

Quantitative and Logical Reasoning
for Primary Schools 1- 6

Teachers' Guide

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PREFACE

Quantitative and logical reasoning skills are essential for pupils to develop as they prepare for higher levels of education. These skills involve the ability to understand and use numerical data, analyse patterns and relationships, and make logical conclusions based on evidence and reasoning.

Quantitative reasoning involves understanding and working with numbers, including basic arithmetic operations such as addition, subtraction, multiplication, and division. Pupils learn to interpret and analyse mathematical information in various formats, such as charts, graphs and tables, to extract useful information and draw meaningful conclusions.

To develop these skills, pupils should be provided with opportunities to engage in hands-on activities and problem-solving tasks that require quantitative and logical reasoning at their level.

Teaching quantitative and logical reasoning skills to primary school pupils is essential to help them succeed in higher education. Here are some strategies that teachers can use to effectively teach these skills:

- I. Use hands-on activities: Provide pupils with hands-on activities, such as math games and puzzles. This will help them to develop quantitative reasoning skills.
- II. Use real-world examples: Use real-world examples to help pupils understand how quantitative and logical reasoning skills are used in everyday life.
- III. Emphasise critical thinking: Emphasise critical thinking skills by encouraging pupils to ask questions, analyse data, and make informed decisions. Encourage them to think outside the box and consider multiple perspectives when solving problems.
- IV. Scaffold learning: Scaffold learning by breaking down complex concepts into smaller, more manageable steps. Provide pupils with examples and guided practice to help them build their understanding of quantitative and logical reasoning.
- V. Provide feedback: Provide regular feedback to students to help them identify areas for improvement and build their confidence. Encourage them to ask questions and seek help when they need it.

Quantitative and Logical Reasoning for Primary Schools 1-6 provides practical examples on how to develop these skills. Teachers are advised to understand these skills and the strategies employed in order to guide the pupils on how to work with the various formats to extract useful information and draw meaningful conclusion.

This Teachers' Guide is an additional step to the Answer Booklet earlier provided. Here, a step-by-step explanation has been provided for the teacher to understand how the answers earlier provided were obtained.

We hope every teacher will find this useful not only in our journey through quantitative and logical reasoning but also in making the journey fun-filled and enjoyable.

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Book 1

Solutions to Quantitative Reasoning Book 1

Unit 1: Identification of Numbers (1 - 100)

This unit involves the identification of numbers from 1 to 100.

Exercise 1a (page 2)

Fill in the blank space.

Example

1, 2, 3, 4, 5

The answer is 3 because 3 is the next number to 2.

Exercise 1b (page 4)

Rearrange the numbers from the lowest to the highest.

Example

12 15 14 11 13
is rearranged as
11 12 13 14 15

Unit 2: Identification of Numbers (101 - 300)

This unit involves identification of numbers from 101 - 300.

Exercise 2a (page 6)

Rearrange the numbers in ascending order, i.e. from the lowest to the highest.

Example

22 18 40 15 25
Since 15 is the lowest number, we have

15 18 22 25 40

Exercise 2b (page 7)

Rearrange in descending order, i.e. from the highest to the lowest.

Example

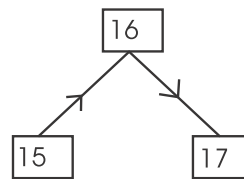
17 20 21 14 18
Since 21 is the highest, we have
21 20 18 17 14

Unit 3: Identification of Numbers (301 - 500)

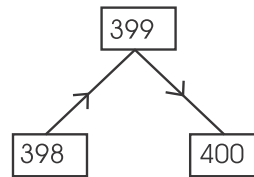
This unit involves the arrangement of numbers using different patterns.

Exercise 3a (page 9)

1.



2.



Numbers are arranged in ascending order from the lower left through the upper path to the lower right.

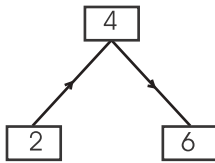
That is:

From (1), we have 15 → 16 → 17

From (2), we have 398 → 399 → 400

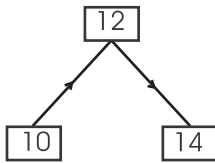
Exercise 3b (page 10)

1.



Difference between 2 and 4 is 2 and the difference between 4 and 6 is also 2. This means that there is a common difference of 2 between consecutive numbers.

2.



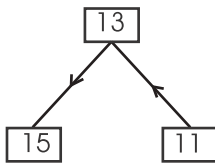
10 → 12 → 14

Exercise 3c (page 12)

Numbers are arranged in descending order with a difference of 2 between consecutive numbers.

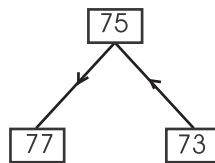
Example

1.



15 ← 13 ← 11

2.



77 ← 75 ← 73

Unit 4: Numbers Comparison

Study each set of numbers to discover the highest or the lowest numbers as required.

Exercise 4a (page 14)

Circle the smallest number.

Example

④ 7 9

4 is circled because it is the lowest number in the group.

Exercise 4b (page 15)

Circle the highest number.

42 72 122 92 ⑩123

123 is the highest number in the group.

Exercise 4c (page 17)

Circle the highest and lowest numbers.

121 ⑩109 148 ⑩159 123

109 is the lowest.

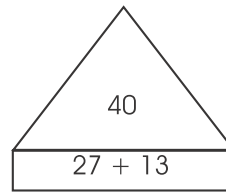
159 is the highest.

Unit 5: Addition of Numbers

Add the numbers at the base of the triangle and write the result in the space provided.

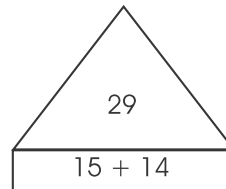
Exercise 5a (page 18)

1.



$27 + 13 = 40$

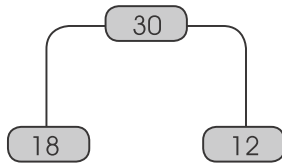
2.



$15 + 14 = 29$

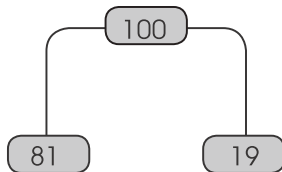
Exercise 5b (page 20)

1.



Add 18 and 12 to get 30.
 $18 + 12 = 30$

2.

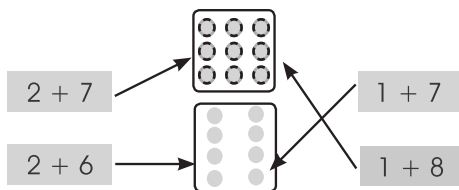


Add 81 and 19 to get 100
 $81 + 19 = 100$

Exercise 5c (page 22)

Match the block in the centre with the equivalent addition problems on both sides.

1.



$2 + 7 = 9 = 1 + 8$
 $2 + 6 = 8 = 1 + 7$

2. Use the information in the given table to answer the questions that follows.

Name	Number of Chocolates
Stella	5
Linda	4
Hannah	3
Victor	2
Ben	3

Example

Who has the highest number of chocolates and how many?

Ans: Stella, 5 chocolates

Unit 6: Subtraction of Numbers

Exercise 6a (page 24)

Solve the problem and tick the correct answer.

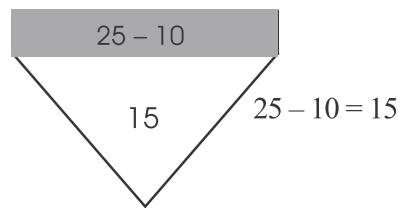
Example

$6 - 5 = ?$ (a) 2 (b) 1 (c) 3
 Since $6 - 5 = 1$, the correct answer is 1.

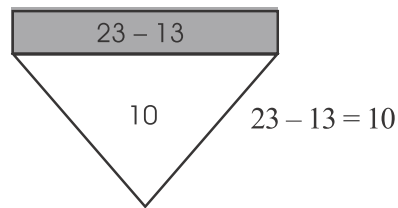
Exercise 6b (page 25)

Subtract the numbers at the top and write the answer in the space provided.

1.

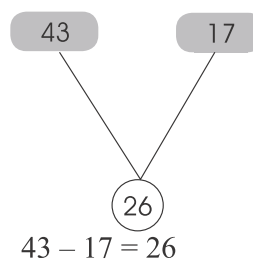


2.

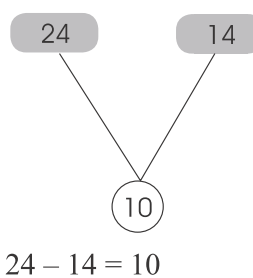


Exercise 6c (page 27)

1.



2.



Unit 7: Writing Numbers in Words
(1 – 30)

Exercise 7a (page 30)

Match the numbers with their names.

Example

Numbers	Number Names
2	Eleven
11	Two

Exercise 7b (page 31)

Fill in the missing letters:

- 7 → Seven
- 14 → Fourteen

Exercise 7c (page 33)

Complete the words in column A and choose the option from column B which represents the number name given in column A.

Example

Column A	Column B
Twelve	<input type="checkbox"/> 13 <input type="checkbox"/> 20 <input checked="" type="checkbox"/> 12
Eighteen	<input checked="" type="checkbox"/> 18 <input type="checkbox"/> 80 <input type="checkbox"/> 8

Unit 8: Number Comparison II
(Greater than (>) and Less than (<))

Exercise 8a (page 34)

Write (<) or (>) to show the less or greater number.

Example

6 < 8
6 is less than 8.

Exercise 8b (page 35)

Write the appropriate sign in the box.

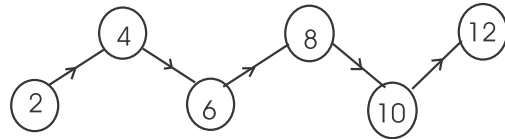
- 3 + 4 5 – 1
Since 3 + 4 = 7 and 5 – 1 = 4
Then, 7 > 4 → 3 + 4 5 – 1

2. $2 + 2 \square 9 - 5$

$2 + 2 = 4, 9 - 5 = 4$

Then, $4 = 4 \rightarrow 2 + \square 2 = 9 - 5$

Unit 9: Multiplication of Numbers
Using Repeated Addition



$2 \times 1 = 2$

$2 \times 2 = 2 + 2 = 4$

$2 \times 3 = 2 + 2 + 2 = 6$

$2 \times 4 = 2 + 2 + 2 + 2 = 8$

Exercise 9a (page 38)

Example

$2 \times 2 = 4$

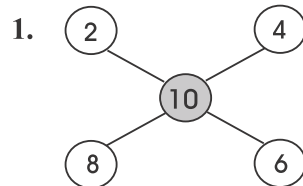
$2 \times 3 = 6$

$2 \times 4 = 8$

$2 \times 5 = 10$

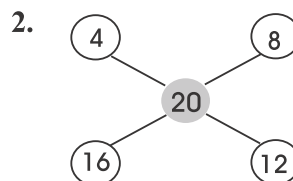
$2 \times 6 = 12$

Exercise 9b (page 39)



$2 \times 2 = 4, 2 \times 3 = 6,$

$2 \times 4 = 8, 2 \times 5 = 10$



$4 \times 2 = 8, 4 \times 3 = 12,$

$4 \times 4 = 16, 4 \times 5 = 20$

Unit 10: Writing Numbers in Words II
(31 - 50)

Exercise 10a (page 42)

Write each of the numbers in words.

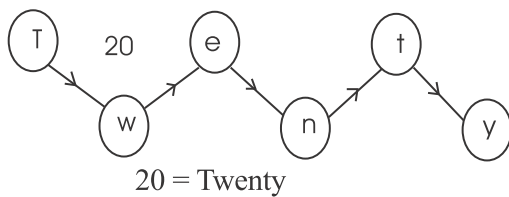
Example

23 = Twenty-four

Exercise 10b (page 43)

Fill in the missing letters

Example



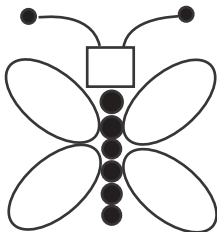
Unit 11: Identification of Shapes

Exercise 11a (page 46)

Write down the number of the required shapes from each diagram.

Example

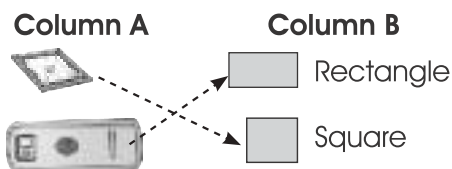
How many circles can you see?



There are 8 circles in the diagram.

Exercise 11b (page 49)

Match the objects in column A with their shapes in column B.



Unit 12: Plane Shapes and Solid Shapes

Exercise 12a (page 50)

Identify the given shapes and write their number in the table below.

Example



Cube	Cuboid	Cone	Cylinder	Sphere
1	2			

From the above example, observe that diagram 1 is a cube while diagram 2 is a cuboid.

Exercise 12b (page 52)

State whether the statements are True (T) or False (F)

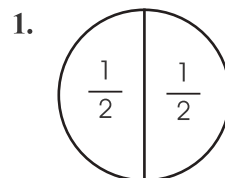
Example

Statement	T/F
The object beside is a cuboid. 	F

The answer is false because the object is not a cuboid.

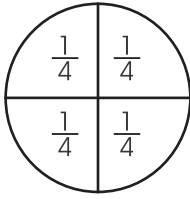
Unit 13: Fraction

Write the value of each fraction in the space provided.



Since the circle is divided into two equal parts, the fraction is $\frac{1}{2}$

2.



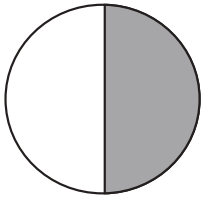
Since the circle is divided into four equal parts, the fraction is $\frac{1}{4}$

Use the above examples for Exercise 13a (page 54) and Exercise 13b (page 55).

Exercise 13c (page 56)

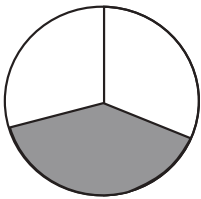
Write out the shaded fraction.

1.



$\frac{1}{2}$ is the shaded fraction

2.



$\frac{1}{3}$ is the shaded fraction

3.



$\frac{1}{4}$ is the shaded fraction

Unit 14: Coding

The act of representing figures with letters of the alphabet is called coding. Changing coded words back to figure is called decoding.

Exercise 14a (page 58)

Example

e	f	g	h	i	n	o	r	s	t	u	v	w	x
1	2	3	4	5	6	7	8	9	10	11	12	13	14

Seven \rightarrow 9 1 12 1 6

S = 9, e = 1, v = 12 and n = 6

Exercise 14b (page 59)

x	w	v	u	t	s	r	o	n	i	h	g	f	e
1	2	3	4	5	6	7	8	9	10	11	12	13	14

5 2 8 \rightarrow t w o

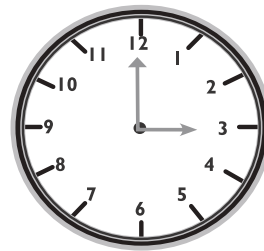
5 = t, 2 = w, and 8 = o

Unit 15: Time and Calendar

Exercise 15a (page 61)

Tick the right option.

Example



The correct time is 3:00

Exercise 15b (page 63)

Fill in the blank

Example

The day before Monday is Sunday.

Revision Exercises

Exercise 1 (page 65)

Arrange in ascending order.

Example

13, 3, 5, 19, 20

Since 3 is the lowest and 20 is the highest, we have:

$3 < 5 < 13 < 19 < 20$

Exercise 2 (page 66)

Arrange in descending order.

Example

3, 23, 15, 9, 2

Since 23 is the highest and 2 is the lowest, we have:

$23 > 15 > 9 > 3 > 2$

Exercise 3 (page 67)

Identify the pattern and fill in the blank.

Example

10, 20, 30, ,

Note that the difference between two consecutive numbers is 10. Thus, we have:

10, 20, 30, 40, 50

Exercise 4 (page 69)

Numbers are arranged in descending order.

- 120, 119, 118, 117, 116
- 11, 10, 9, 8, 7

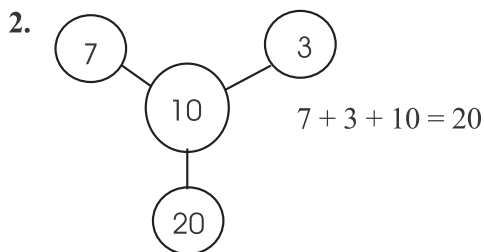
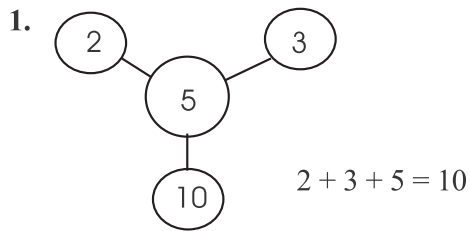
Exercise 5 (page 71)

Add the numbers on the left hand side to obtain the number on the right hand side.

Example

$$5 + \boxed{3} = 8$$

$$15 + 14 = \boxed{29}$$

Exercise 6 (page 72)**Exercise 7 (page 74)**

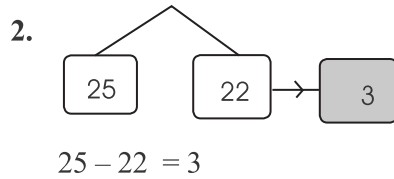
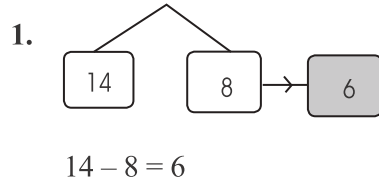
Find the missing numbers by performing the required operations.

1. $65 - 35 = \textcircled{30}$
 i.e. $\begin{array}{r} 65 \\ -35 \\ \hline 30 \end{array}$

2. $23 - 6 = \textcircled{17}$

Exercise 8 (page 75)

Find the difference between the numbers on the left hand side and write the result in the box on right hand side.

Example**Exercise 9 (page 76)**

Complete the missing words.

Example

43 = Forty-three

27 = Twenty-seven

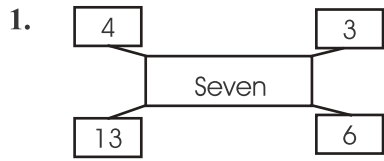
Exercise 10 (page 77)

Perform the operations on the left hand side and write the result in words on the right hand side.

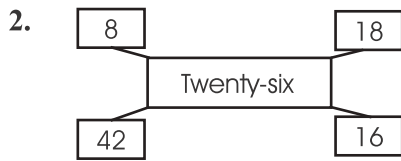
Example

$21 + 23 =$ Forty-four
 $40 - 23 =$ Seventeen

Exercise 11 (page 78)



$$4 + 3 = \boxed{\text{Seven}} = 13 - 6$$



$$8 + 18 = \boxed{\text{Twenty-six}} = 42 - 16$$

Exercise 12 (page 81)

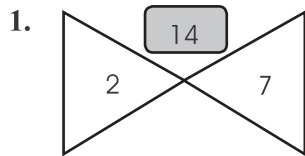
Complete the missing number in the multiplication table.

Example

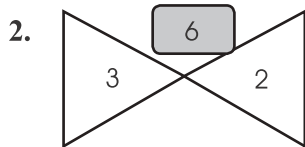
$$2 \times 4 = 8$$

Exercise 13 (page 82)

Complete the missing number.



$$2 \times 7 = 14$$

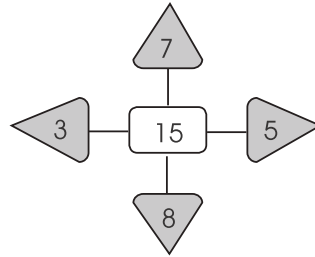


$$3 \times 2 = 6$$

Exercise 14 (page 84)

Multiply horizontally and add vertically to get the number at the centre.

Example



Horizontally:

$$3 \times 5 = 15$$

Vertically:

$$7 + 8 = 15$$

Thus, $3 \times 5 = 15 = 7 + 8$

Exercise 15 (page 86)

Arrange the numbers in each set in ascending order.

Example

323 421 362 121 221

Since 121 is the lowest and 421 is the highest, we have:

121 221 323 361 421

Exercise 16 (page 87)

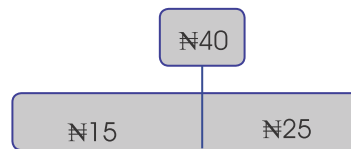
Circle the lowest number and write out the highest number.

Example

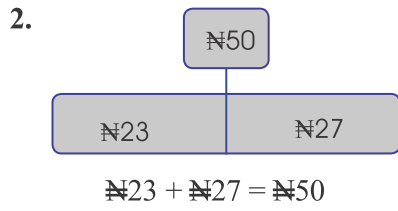
242 (121) 478 198 123: 478

Exercise 17 (page 88)

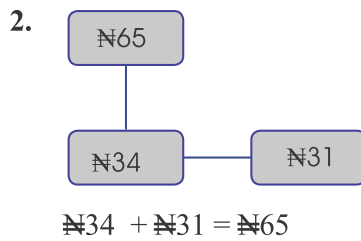
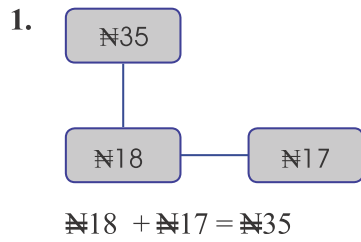
1.



$$\cancel{N}15 + \cancel{N}25 = \cancel{N}40$$

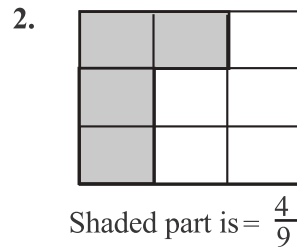
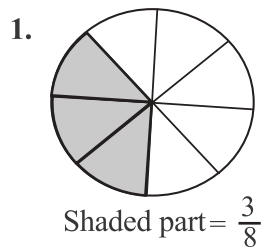


Exercise 18 (page 89)



Exercise 19 (page 91)
Name the shaded part.

Example



Exercise 20 (page 93)

e	f	g	h	i	n	o	r	s	t	u	v	w	x
1	2	3	4	5	6	7	8	9	10	11	12	13	14

Use the table to answer the questions that follows.

1. Five → 2 5 12 1
From the table, F = 2, i = 5, v = 12 and e = 1
2. 10 1 6 → t e n
From the table, 10 = t, 1 = e, 6 = n

Exercise 21 (page 94)

e	i	n	r	s	t	u	v	y
1	2	3	4	5	6	7	8	9

Verse = 8 1 4 5 1

6 2 3 9 = T i n y

Book 2

Solutions to Quantitative Reasoning Book 2

Unit 1: Numbers I (501 -750)

Exercise 1a (page 2)

Arrange the numbers in ascending order from the table given on page 1 of the textbook.

1. (521) (522) (523) (524) (525)
2. (616) (617) (618) (619) (620)
3. (735) (736) (737) (738) (739)

Exercise 1b (page 4)

Arrange the numbers in descending order from the table given on page 1 of the textbook.

1.

700
699
698
697
696
2.

325
324
323
322
321

Exercise 1c (page 6)

Fill in the gap by studying the pattern in which the numbers are arranged, i.e. find the difference between each successive terms.

1. 320 325 330 335 340

In this case, the difference between each successive terms is 5.

i.e. $325 = 320 + 5$, $330 = 325 + 5$,
 $335 = 330 + 5$, $340 = 335 + 5$

2. 401 410 419 428 439
Difference of 9

3. 105 115 125 135 145
Difference of 10

Exercise 1d (page 7)

Arrange the numbers in descending order.

1. 341 142 322 423 124
423 341 322 142 124
2. 442 249 321 521 156
521 442 321 249 156
3. 615 621 619 609 617
621 619 617 615 609

Unit 2: Numbers II (751 -1000)

Exercise 2a (page 10)

Arrange the numbers in either ascending or descending order before picking the required numbers, i.e. circle the highest and underline the lowest.

1.

23	12	15
35	<u>40</u>	

The numbers are

23, 12, 15, 35, 40

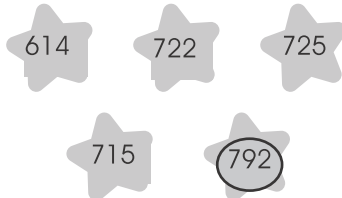
Arrange in ascending order,

12 15 23 35 40

Underline the lowest and circle the highest numbers

12 15 23 35 (40)

2.



614, 722, 725, 715, 792

614 715 722 725 (792)

Exercise 2b (page 13)

Arrange the numbers in either ascending or descending order, then circle the highest number and write out the lowest number.

1. 483 378 654 321 487

Arrange in ascending order, circle the highest number and write the lowest number.

321 378 483 487 (654): 321

2. 576 587 562 559 595

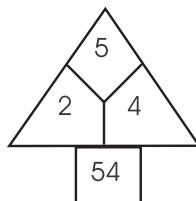
Arrange in ascending order, circle the highest number and write the lowest number.

559 562 576 587 (595): 559

Exercise 2c (page 14)

Form the highest 2-digit number from the given numbers in each triangle.

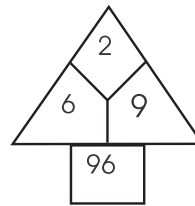
1.



In the triangle, the numbers are 2, 5 and 4.

The highest digit is 5, followed by 4, which gives the required number which is 54.

2.

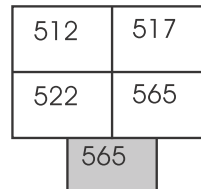


In the triangle, the numbers are 2, 6 and 9. The highest digit is 9, followed by 6. This gives the required number which is 96.

Exercise 2d (page 15)

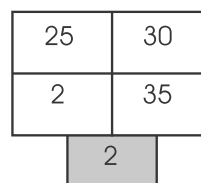
To pick the odd number, study the pattern carefully and see how the numbers are arranged.

1.



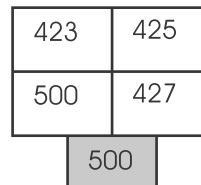
From the diagram, we can see that the difference between other successive numbers apart from 565 is 5, i.e. $517 - 512 = 5$, $522 - 517 = 5$. Therefore, the required number is 565.

2.



We can see from the diagram that apart from 2, the difference between other successive numbers is 5, i.e. $30 - 25 = 5$, $35 - 30 = 5$. Therefore, the required number is 2.

3.

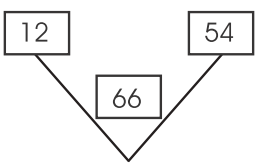


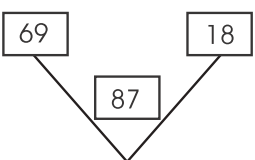
From the diagram, the difference between the other successive numbers is 2 i.e. $427 - 425 = 425 - 423 = 2$. Therefore, the deviant number is 500.

Unit 3: Addition and Subtraction of Numbers

Exercise 3a (page 17)

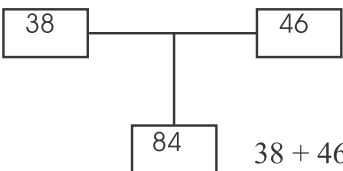
The addition of the two numbers at the top of the diagram results into the middle number.

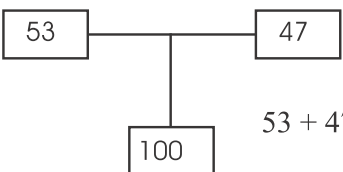
1.  $12 + 54 = 66$

2.  $69 + 18 = 87$

Exercise 3b (page 18)

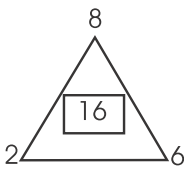
The addition of the two numbers at the top gives the number at the bottom.

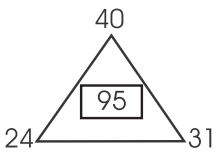
1.  $38 + 46 = 84$

2.  $53 + 47 = 100$

Exercise 3c (page 20)

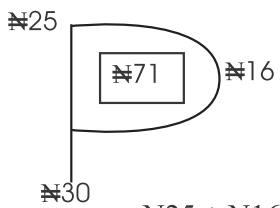
The addition of the three numbers at the edges of the triangle gives the number in the middle of the shape.

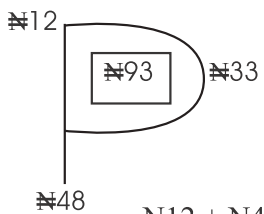
1.  $8 + 2 + 6 = 16$

2.  $40 + 31 + 24 = 95$

Exercise 3d (page 21)

The addition of all the numbers on the outer parts of the shape gives the number inside the shape.

1.  $\cancel{25} + \cancel{16} + \cancel{30} = \cancel{71}$

2.  $\cancel{12} + \cancel{48} + \cancel{33} = \cancel{93}$

Unit 4: Cardinal, Nominal and Ordinal Numbers

A cardinal number is a number that tells us the number of things or objects that we have in a group. It is also a whole number, e.g. 1, 2, 3, 10, 200 and so on.

An ordinal number is a number that shows the position of an object in a group, e.g. first, tenth, fifteenth and so on.

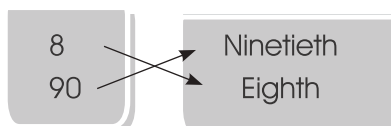
A nominal number is a number that is used to identify an object uniquely, e.g. the Zip code of a place, shirt number of a football player and so on..

Exercise 4a (page 23)

- Abeo stood first in his class.
(a) Cardinal (b) Ordinal (c) Nominal
- The zip code of Tope’s office is 120019.
(a) Cardinal (b) Ordinal (c) Nominal
- We have 6 textbooks on Mathematics to prepare for the forthcoming examinations.
(a) Cardinal (b) Ordinal (c) Nominal

Exercise 4b (page 25)

Match the cardinal numbers with their respective ordinal numbers.



Unit 5: Numbers in Words

Write numbers from 51 to 100 in words.

Exercise 5a (page 28)

Write the following words in figures

- Forty-three = 43
- Seventy-nine = 79
- Eighty-five = 85

Exercise 5b (page 29)

Write the following figures in words

- 28 = Twenty-eight
- 41 = Forty-one
- 80 = Eighty

Exercise 5c (page 30)

Add or subtract the numbers in figures and write the result in words.

- $12 + 15 = 27$
 $27 =$ Twenty-seven
 $12 + 15 =$ Twenty-seven
- $32 - 12 = 20$
 $20 =$ Twenty
 $32 - 12 =$ Twenty

- $39 - \square =$ Thirty-four
 $\text{Thirty-four} = 34$ in figures
 $39 - \square = 34$
 $39 - 34 = \square$
 $5 = \square$
 $\square = 5$ i.e.
 $39 - 5 =$ Thirty-four

a	b	c	d	e	f	g	h	i	j	k	l	m
1	2	3	4	5	6	7	8	9	10	11	12	13
n	o	p	q	r	s	t	u	v	w	x	y	z
14	15	16	17	18	19	20	21	22	23	24	25	26

Use the table above for Exercises 5d, 5e and 5f.

Exercise 5d (page 31)

Code the number written in words using the table above

- Forty-one = 6 15 18, 20, 25, 15, 14, 5
- Seventy-two = 19 5 22 5 14 20 25
20 23 15
- Twelve = 20 23 5 12 22 5

Exercise 5e (page 32)

Decode the numbers to give the word equivalent, using the table given above.

- 20 23 5 14 20 25 = Twenty
- 19 9 24 20 25 15 14 5 = Sixty-one
- 5 12 5 22 5 14 = Eleven

Exercise 5f (page 34)

Convert the letters given to number, add and convert the result to letter using the table given above.

- $a + b = 1 + 2 = 3$
 $3 = c$
 $\therefore a + b = c$
- $g + h = 7 + 8 = 15$
 $15 = o$
 $\therefore g + h = o$

3. $f + k = 6 + 11 = 17 = q$
 $\therefore f + k = q$

4. $b + w = 2 + 23 = 25 = y$
 $\therefore b + w = y$

1	2	3	4	5	6	7	8	9	10	11	12	13
z	y	x	w	v	u	t	s	r	q	p	o	n
14	15	16	17	18	19	20	21	22	23	24	25	26
m	l	k	j	i	h	g	f	e	d	c	b	a

Use the table above for Exercises 5g, 5h and 5i.

Exercise 5g (page 34)

Decode the numbers to give the equivalent words, using the above table.

- 7 4 22 13 7 2 = Twenty
- 8 22 5 22 13 7 2 = Seventy
- 22 18 20 19 72 8 18 3 = Eighty-six

Exercise 5h (page 35)

Convert the words to numbers using the table above.

- Twelve = 7 4 22 15 5 22
- Thirty-six = 7 19 18 9 7 2 8 18 3
- Eight = 22 18 20 19 7

Exercise 5i (page 37)

Convert the letters to the numbers assigned to each letter and perform the mathematical operations required.

- $z + w = 1 + 4 = 5 = v$
 $\therefore z + w = v$
- $a - p = 26 - 11 = 15 = l$
 $\therefore a - p = l$
- $f - z = 21 - 1 = 20 = g$
 $\therefore f - z = g$
- $h + u = 19 + 6 = 25 = b$
 $\therefore h + u = b$

Unit 6: Even Numbers

Even numbers are numbers that can be divided by 2 without remainder, e.g. 2, 4, 6, 8, etc.

Exercise 6a (page 38)

Arrange the even numbers given in ascending order.

- 10 2 8 4 8
2 4 6 8 10
- 44 52 46 50 48
44 46 48 50 52
- 76 68 74 70 72
68 70 72 74 76

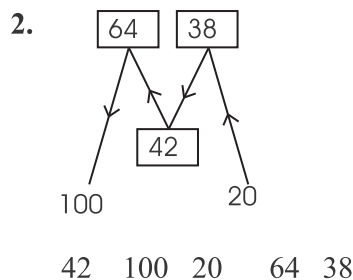
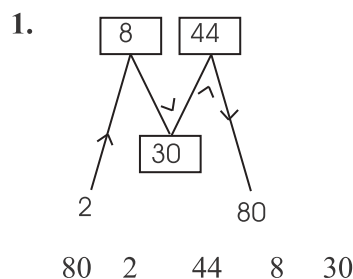
Exercise 6b (page 39)

In the given numbers, write out the number that is not an even number.

- 2 4 (9) 16 8 = 9
- 98 80 76 50 (49) = 49
- (21) 42 60 84 76 = 21

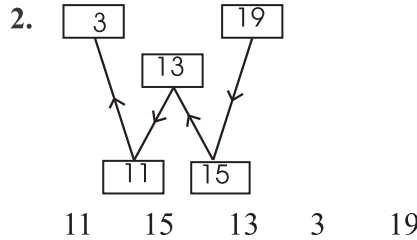
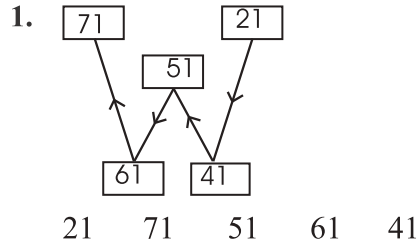
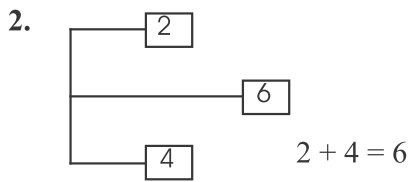
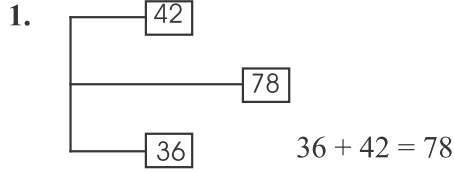
Exercise 6c (page 40)

Arrange the even numbers in ascending or descending order, taking note of the directions of the arrows.



Exercise 6d (page 42)

Add the even numbers on the top and bottom to give the middle number.



Unit 7: Odd Numbers

Odd numbers are numbers that cannot be divided by 2 evenly, i.e. when divided by 2, it gives a remainder, e.g. 1, 3, 5, 7, etc.

Exercise 7a (page 44)

Arrange the odd numbers given in descending order.

1.

1	9	3	5	7
<u>9</u>	<u>7</u>	<u>5</u>	<u>3</u>	<u>1</u>
2.

61	45	77	93	13
<u>93</u>	<u>77</u>	<u>61</u>	<u>45</u>	<u>13</u>
3.

11	25	53	91	41
<u>91</u>	<u>53</u>	<u>41</u>	<u>25</u>	<u>11</u>

Exercise 7b (page 45)

In the given numbers, circle and write out the number that is not an odd number.

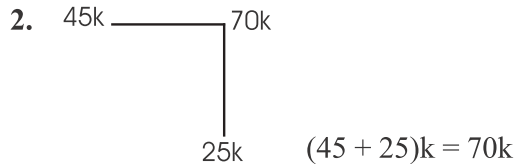
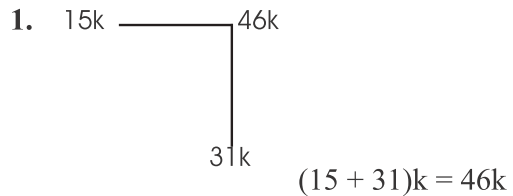
1. 1 60 23 41 67 = 60
2. 45 73 85 2 33 = 2
3. 29 65 40 17 83 = 40

Exercise 7c (page 46)

Arrange the odd numbers in ascending or descending order, taking note of the directions of the arrows.

Exercise 7d (page 48)

The number at the top right position of the shape is the sum of the other numbers.



Note: It can be observed from the examples above that sum of two odd numbers will result to an even number.

Unit 8: Multiplication Table

Use the multiplication table given in pages 50-52 of the textbook to answer Exercises 8a-8d.

Exercise 8a (page 53)

1. $\boxed{3} \times 7 = 21$
2. $\boxed{6} \times 9 = 54$
3. $\boxed{8} \times 5 = 40$

Exercise 8b (page 53)

Circle the number that is not a multiple of the other numbers given.

1. 2 4 6 8 16 **(23)**

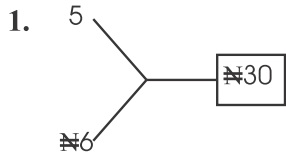
23 is the odd number out because the remaining numbers are multiples of 2.

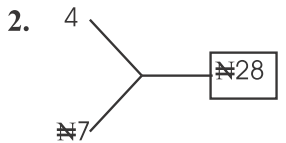
2. 3 **(16)** 9 15 21

16 is the odd number out because the remaining numbers are multiples of 3.

Exercise 8c (page 54)

The product of the two numbers at the top and bottom gives the number at the right side.

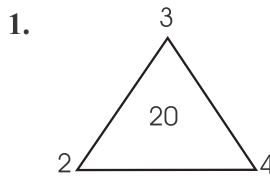
1.  $5 \times 6 = 30$

2.  $4 \times 7 = 28$

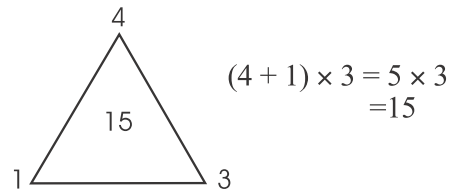
Exercise 8d (page 55)

Use the steps below to solve the questions in this exercise.

- (i) Add the number at the top with the number on the left hand side.
 (ii) Multiply the result of (i) with the number at the right hand side to get the middle number.


1.  $(3 + 2) \times 4 = 5 \times 4 = 20$

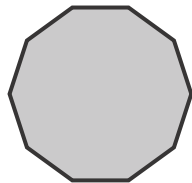
2.

**Unit 9: Shapes**

Identify both plane and solid shapes and also, learn the properties of each of the shapes.

Exercise 9a (page 57)

1.  Cylinder

2.  Decagon

Exercise 9b (page 59)

1. A sphere has zero face **I**
 2. A cube has 6 faces. **I**
 3. A cone has one edge. **I**

Unit 10: Fractions**Exercise 10a (page 61)**

Addition of fractions with the same denominator.

1. $\frac{2}{5} + \frac{1}{5} = \frac{2+1}{5} = \frac{3}{5}$
 2. $\frac{3}{8} + \frac{2}{8} = \frac{3+2}{8} = \frac{5}{8}$

Exercise 10b (page 62)

Subtraction of fractions with the same denominator.

$$1. \quad \frac{7}{9} - \frac{3}{9} = \frac{7-3}{9} = \frac{4}{9}$$

$$2. \quad \frac{4}{5} - \frac{1}{5} = \frac{4-1}{5} = \frac{3}{5}$$

Exercise 10c (page 63)

Addition of fractions with the same denominator using shapes.

$$1. \quad \frac{2}{4} \begin{array}{c} \diagup \\ \square \\ \diagdown \end{array} + \frac{1}{4} \begin{array}{c} \diagup \\ \square \\ \diagdown \end{array} = \begin{array}{c} \diagup \\ \square \\ \diagdown \end{array} \frac{3}{4}$$

$$2. \quad \frac{1}{3} \begin{array}{c} \triangle \\ \square \\ \triangle \end{array} + \frac{1}{3} \begin{array}{c} \triangle \\ \square \\ \triangle \end{array} = \begin{array}{c} \triangle \\ \square \\ \triangle \end{array} \frac{2}{3}$$

Exercise 10d (page 64)

Subtraction of fractions with the same denominator using shapes.

$$1. \quad \frac{3}{6} \begin{array}{c} \circ \\ \square \\ \circ \end{array} - \frac{1}{6} \begin{array}{c} \circ \\ \square \\ \circ \end{array} = \begin{array}{c} \circ \\ \square \\ \circ \end{array} \frac{2}{6}$$

$$2. \quad \frac{3}{4} \begin{array}{c} \square \\ \square \\ \square \end{array} - \frac{1}{4} \begin{array}{c} \square \\ \square \\ \square \end{array} = \begin{array}{c} \square \\ \square \\ \square \end{array} \frac{2}{4}$$

Revision Exercises**Exercise 1 (page 65)**

Study the number pattern and arrangement carefully, and use it to answer the questions below.

- 3, 6, 9, 12, 15, 18
We notice that the difference between successive terms is 3, i.e.
 $6 = 3 + 3$, $9 = 6 + 3$, $12 = 9 + 3$, $15 = 12 + 3$
and $18 = 15 + 3$
- 4, 8, 12, 16, 20, 24
Notice a difference of 4 between successive terms.

Exercise 2 (page 66)

(I) Add the numbers on the left side to get the number on the right side.

- $12 + 13 = 25$
- $14 + 19 = 33$

(II) The sum of the numbers on the left hand side is equal to the sum of the numbers on the right hand side.

- $12 + 11 = 14 + 9$
From the left hand side,
 $12 + 11 = 23$
From the right hand side,
 $14 + 9 = 23$
We can see that the sum of numbers on the left hand side is the same as that of the numbers on the right hand side.

- $8 + 6 = 7 + \underline{\hspace{2cm}}$
From the left hand side
 $8 + 6 = 14$
From the right hand side, to get the missing number,
 $7 + \underline{\hspace{2cm}} = 14$
 $\underline{\hspace{2cm}} = 14 - 7 = 7$
 $\therefore 7 + 7 = 14$, hence the missing number is 7

Exercise 3 (page 68)

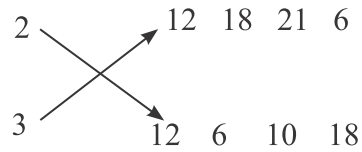
Study the patterns and arrangements carefully, and use them to answer the questions that follow.

$$1. \quad \begin{array}{ccc} 50 & \xrightarrow{+/-10} & 60 & \xrightarrow{+/-10} & 70 \\ .50 & & .40 & & .30 \end{array}$$

The numbers at the top increase with the addition of 10 while the numbers below decrease by 10.

$$2. \quad \begin{array}{ccc} +2 & +3 & +4 \\ \begin{array}{|c|} \hline 4 \\ \hline \end{array} & \begin{array}{|c|} \hline 17 \\ \hline \end{array} & \begin{array}{|c|} \hline 21 \\ \hline \end{array} \\ \downarrow & \downarrow & \downarrow \\ \begin{array}{|c|} \hline 6 \\ \hline \end{array} & \begin{array}{|c|} \hline 14 \\ \hline \end{array} & \begin{array}{|c|} \hline 25 \\ \hline \end{array} \\ \downarrow & \downarrow & \downarrow \\ \begin{array}{|c|} \hline 8 \\ \hline \end{array} & \begin{array}{|c|} \hline 11 \\ \hline \end{array} & \begin{array}{|c|} \hline 29 \\ \hline \end{array} \end{array}$$

The numbers in the first column increase by 2 downwards, while the numbers in the second column decrease by 3 downwards and the numbers in the third column increase by 4 downwards.



We can see from the above that 12, 18, 21, 6 are all multiples of only 3 while 12, 6, 10, 18 are all multiples of 2.

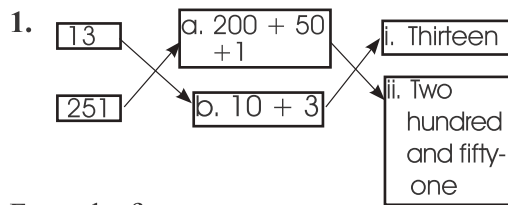
Exercise 4 (page 70)

Complete the blanks with the appropriate numbers.

1. 375, 376, 377, 378, 379, 380
2. 109, 110, 111, 112, 113, 114
3. 224, 225, 226, 227, 228, 229, 230

Exercise 5 (page 71)

Perform the operations required and match the answer with the numbers in words.

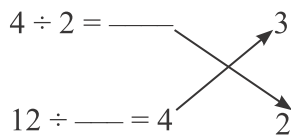


From the first one.
 $200 + 50 + 1 = 251$ which is Two hundred and fifty-one in words.
 Similarly,
 $10 + 3 = 13$ which is thirteen in words.

Exercise 6 (page 72)

Perform the operations required and match the result with the correct number.

1. $4 \div 2 = 2$
2. $12 \div \text{---} = 4$
 $\rightarrow 12 \div 4 = 3$
 Therefore we have



Exercise 7 (page 73)

Match the numbers below with the set of numbers that are exactly divisible by them.

Exercise 8 (page 74)

Help Jimmy reach his school by making a path of even numbers. The starting point is 10, then trace using even numbers only till you get to 100 (end point).

Exercise 9 (page 75)

Help the priest reach the church by making a path of odd numbers. The starting point is 17, then trace using odd numbers only till you get to 75 (end point).

Exercise 10 (page 76)

To pick out the odd number, study the numbers given in each question.

1. 12 14 18 22 (25)
 25 is the odd one out because the remaining numbers are even numbers.
2. 21 23 (22) 17 15
 22 is the odd one out because the remaining numbers are odd numbers.

Exercise 11 (page 77)

Perform the mathematical operations and compare the result with the statement to know if it is true or false.

1. $90 - 24$ is an odd number
 Answer: False
 $90 - 24 = 66$ which is an even number.
2. $13 + 25$ is an even number.
 Answer: True
 $13 + 25 = 38$ which is an even number.

Exercise 12 (page 78)

Tick the option whose sum is not the same as the sum of others.

1. (a) $40 + 60 = 100$ (b) $50 + 50 = 100$
 (c) $20 + 80 = 100$ (d) $10 + 91 = 101$

The addition of the numbers in (a), (b), (c) is 100 while the addition of the numbers in (d) equals 101 which is the odd one.

2. (a) $32 + 64 = 96$
 (b) $90 + 6 = 96$
 (c) $81 + 16 = 97$
 (d) $77 + 19 = 96$

Exercise 13 (page 79)

Addition and subtraction of numbers.

1. $450 - \underline{\quad} = 300$
 $\quad = 450 - 300 = 150$
 $\therefore \underline{\quad} = 150$
2. $\underline{\quad} - 199 = 101$
 $\underline{\quad} = 101 + 199 = 300$
 $\therefore \underline{\quad} = 300$

Exercise 14 (page 81)

Fill in the blanks with the appropriate mathematical symbol.

1. $60 \underline{\quad} 2 = 120$
 It is the product (\times) of 60 and 2 that gives 120, hence the missing symbol is (\times).

2. $16 \underline{\quad} 2 = 8$
 The missing symbol is (\div) because $16 \div 2$ would give 8.

a	b	c	d	e	f	g	h	i	j	k	l	m
1	2	3	4	5	6	7	8	9	10	11	12	13
n	o	p	q	r	s	t	u	v	w	x	y	z
14	15	16	17	18	19	20	21	22	23	24	25	26

Use the above table for Exercises 15 and 16.

Exercise 15 (page 83)


1. One hundred = $\underline{15} \ \underline{14} \ \underline{5} \ \underline{8}$
 $\underline{21} \ \underline{14} \ \underline{4} \ \underline{18} \ \underline{5} \ \underline{4}$
2. Fifteen = $\underline{6} \ \underline{9} \ \underline{6} \ \underline{20} \ \underline{5} \ \underline{5} \ \underline{14}$
3. $19 \ 5 \ 22 \ 5 \ 14 = \underline{s} \ \underline{e} \ \underline{v} \ \underline{e} \ \underline{n}$

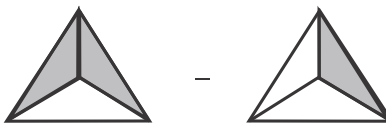
Exercise 16 (page 84)

1. $da + p = 41 + 16 = 57$
2. $ib - fh = \underline{92} - \underline{68} = 24$
3. $g \times y = 7 \times 25 = 175$
4. $hg \div c = 87 \div 3 = 29$

Exercise 17 (page 85)

Addition and subtraction of fractions with the same denominator using shapes.

1. 
 $\frac{2}{4} + \frac{1}{4} = \frac{3}{4}$

2. 
 $\frac{2}{3} - \frac{1}{3} = \frac{2-1}{3} = \frac{1}{3}$

Exercise 18 (page 87)

Add or subtract the fractions and check if the result given is true or false.

1. $\frac{1}{3} + \frac{2}{3} = \frac{1+2}{3} = \frac{3}{3} = 1$
 which is true (i.e. $\frac{1}{3} + \frac{2}{3} = 1$)

2. $\frac{4}{7} + \frac{2}{7} = \frac{1}{7}$
 $\frac{4}{7} + \frac{2}{7} = \frac{4+2}{7} = \frac{6}{7} \neq \frac{1}{7}$
 Hence, it is false.

Book 3

Solutions to Quantitative Reasoning Book 3

Unit 1: Numbers

This unit involves the arrangement of numbers, with each group of numbers having its own set rules.

Exercise 1a (page 1)

1. 410 415 420 425
430 435 440

Note that there is a common difference of 5 between each consecutive set of numbers.

2. 1000 900 800 700
600 500 400

Note that there is a common difference of 100 between each consecutive set of numbers.

Exercise 1b (page 2)

Arrange each number in a given set in ascending order, i.e. from the lowest to the highest.

Example

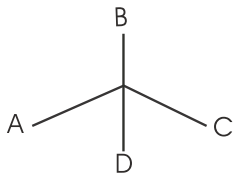
341 123 321 231 121

We start with 121 because it is the lowest number in the set.

$121 < 123 < 231 < 321 < 341$.

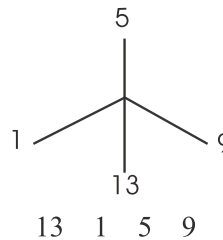
Exercise 1c (page 3)

Arrange the numbers in ascending order from A to D.

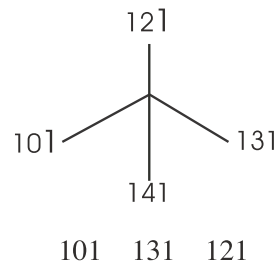


Example

1.



2.



Unit 2: Addition and Subtraction of Numbers

This unit involves addition and subtraction of numbers.

Exercise 2a (page 5)

Find the sum of the numbers on the left hand side to obtain the number on the right hand side.

1. $121 + 223 = 344$
2. $624 + 319 = 943$

Exercise 2b (page 6)

Perform the operations on both sides of the given expression, then write the appropriate sign in the space provided.

Example

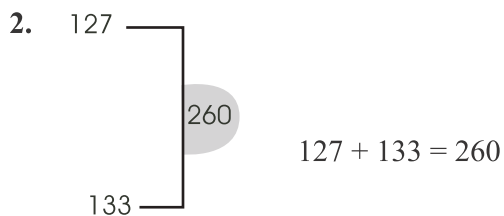
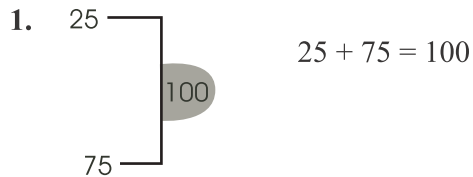
$70 + 30 \square 120 - 5$
 $70 + 30 = 100$ and
 $120 - 5 = 115$

Since 100 is less than 115, we write the less than sign ($<$) in the box.

Exercise 2c (page 7)

The sum of the numbers on the left hand side of the diagram is the same as the number on the right hand side.

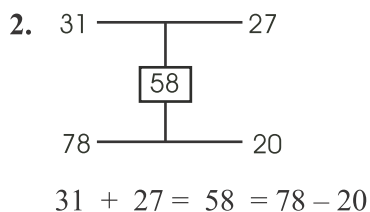
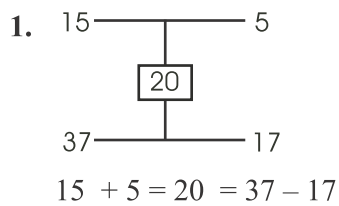
Example



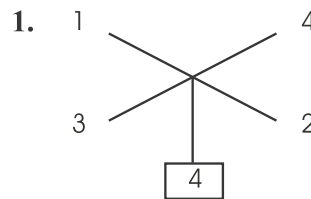
Exercise 2d (page 9)

The sum of the two numbers at the top is the same as the difference between the two numbers at the bottom and also the same as the numbers at the centre.

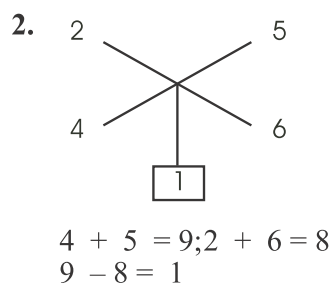
Example



Exercise 2e (page 11)



Add 1 to 2, that is, $2 + 1 = 3$
 Add 3 to 4, that is, $4 + 3 = 7$
 Find the difference between 7 and 3,
 That is, $7 - 3 = 4$



Unit 3: Multiplication and Division of Numbers

This unit involves the multiplication and division of numbers.

Exercise 3a (page 13)

1. Complete the table

\times	2	3	5	7	11
2	4				
3		9			
5			25		
7				49	
11					121

Complete the table by multiplying the numbers in each row by the numbers in the corresponding column.

$2 \times 2 = 4; 3 \times 3 = 9; 5 \times 5 = 25$
 $7 \times 7 = 49; 11 \times 11 = 121$

2. Complete the table below

÷	30	60	120	240	480
2				120	
3			40		
5		12			96
6	5				

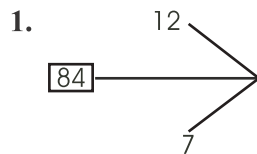
Complete the table by dividing row by column. That is,

$$\frac{240}{2} = 120$$

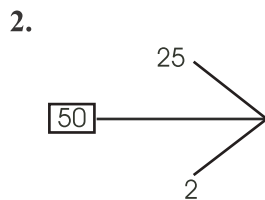
$$\frac{60}{5} = 12$$

$$\frac{480}{5} = 96$$

Exercise 3b (page 14)

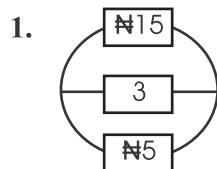


To get 84, multiply 12 by 7
i.e. $12 \times 7 = 84$

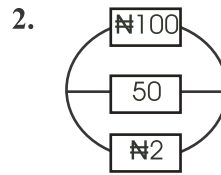


To get 50, multiply 25 by 2.
That is, $25 \times 2 = 50$

Exercise 3c (page 15)

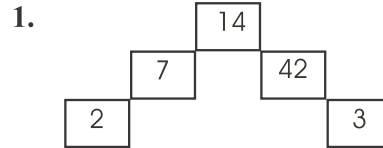


Multiply ₦5 by 3 to get ₦15
i.e. $3 \times ₦5 = ₦15$



To get ₦100, Multiply by ₦2 by 50
i.e. $50 \times ₦2 = ₦100$

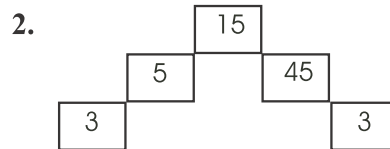
Exercise 3d (page 16)



Multiply 2 by 7 to get 14.
Also, divide 42 by 3 to get 14.

i.e. $2 \times 7 = 14$

$$\frac{42}{3} = 14$$

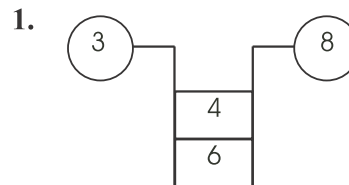


Multiply 3 by 5 to get 15
Also, divide 45 by 3 to get 15.

i.e. $3 \times 5 = 15$

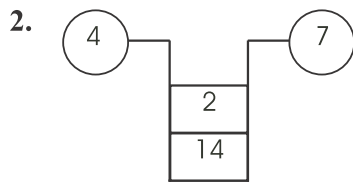
$$\frac{45}{3} = 15$$

Exercise 3e (page 17)



The product of the numbers in the circles is the same as the product of the numbers in the boxes.

That is, $3 \times 8 = 4 \times 6 = 24$



$$4 \times 7 = 2 \times 14 = 28$$

Unit 4: Odd, Even and Prime Numbers

In this unit, we define prime, odd and even numbers and show their differences and relationships.

Definition

Prime numbers are numbers that can only be divisible by 1 and itself, e.g. 2, 3, 5, 7, ...

Even numbers are numbers that are divisible by 2, e.g. 2, 4, 6, 8, 10, ...

Odd numbers are numbers that cannot be divisible by 2, e.g. 1, 3, 5, 7, ...

Exercise 4a (page 19)

Circle the prime number(s) in each group.

Examples

1. $\textcircled{41}$ 50 91 2 $\textcircled{8}$
2 and 41 are the prime numbers

2. 111 63 533 $\textcircled{97}$ 15
97 is the prime number.

Exercise 4b (page 20)

Find the sum or difference between the even and prime numbers in each set.

Examples

1. 18 9 15 11 21
 $\boxed{18} - \boxed{11} = 7$

Since 18 is an even number and 11 is a prime number.

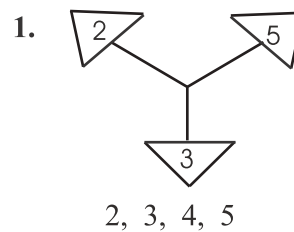
2. 49 64 51 59 27
 $\boxed{64} - \boxed{59} = 5$

3. 19 27 34 25 33
 $\boxed{34} + \boxed{19} = 53$

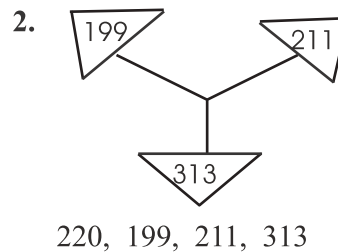
Exercise 4c (page 20)

In each set of numbers, neglect the number that is not of the same type with the other numbers and arrange the other numbers in the triangular boxes.

Examples



2, 3 and 5 are prime numbers while 4 is an even number, so we neglect 4.



199, 211 and 313 are prime numbers while 220 is an even number.

Exercise 4d (page 24)

Study each group of numbers carefully and tick out the odd one.

Example

- a. $3\checkmark$ b. 6 c. 8 d. 15

3 is the odd one because it is a prime number and can only be divisible by itself and 1 but other numbers in the group are not prime numbers.

Exercise 4e (page 26)

State whether the expression is either true or false.

Example

$60 - 18$ is a prime number.

Solution

The expression is false since $60 - 18 = 42$ which is an even number.

Unit 5: Coding and Decoding

In this unit, letters are used to represent numbers.

Exercise 5a (page 28)**Example**

M A T H E M A T I C S
6 1 8 4 3 6 1 8 5 2 7

- HAT = 418
Since H = 4, A = 1 and T = 8
- AIM = 156
Since A = 1, I = 5 and M = 6

Exercise 5b (page 29)**Example**

H I S T O R Y
1 2 5 6 3 4 7

- TOY - OY = $637 - 37$
= 600
Since T = 6, O = 3 and Y = 7
- TOY + OY = $637 + 37$
= 674
Since T = 6, O = 3 and Y = 7

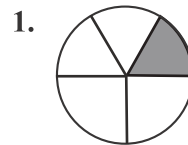
Exercise 5c (page 30)

S	C	I	E	N	C	E
5	6	7	2	3	6	2

Example

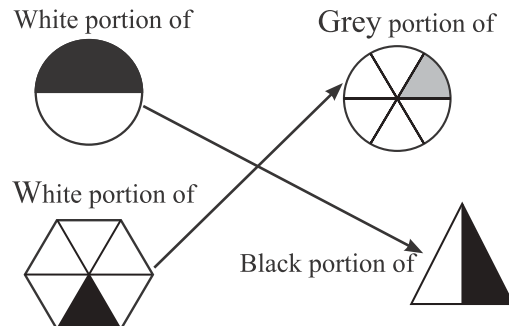
SEE

From the table above, S = 5, E = 2. Thus, SEE = 522

Unit 6 : Fractions**Exercise 6a (page 31)****Example**

Since the shaded part is 1 out of 5 parts, the correct answer is $\frac{1}{5}$

- Match the figures in column A with those showing the same fraction in column B.

Example**Exercise 6b (page 34)**

- Compare the fractions and insert $<$, $>$ or $=$ in the blank space.

Example

$\frac{3}{6}$ is the same as $\frac{1}{2}$, so we have

$$\frac{3}{6} = \frac{1}{2}$$

- Arrange the fractions in order, from the lowest to the highest.

Example

$$\frac{1}{2}, \frac{1}{4}, \frac{1}{5}$$

The correct order is,

$$\frac{1}{2} < \frac{1}{4} < \frac{1}{5}$$

Where '<' means less than.

Unit 7: Equivalent Fractions

This unit compares fractions that have the same value.

Exercise 7a (page 36)

1. Match each fraction with its lowest form.

Example

$$\frac{2}{4} = \frac{1}{2}$$

2. Match equal fractions.

Example

$$\frac{2}{4} = \frac{3}{6}$$

Since $\frac{2}{4} = \frac{3}{6}$ and $\frac{3}{6} = \frac{1}{2}$

Exercise 7b (page 38)**Example**

1. $\frac{3}{5} = \frac{21}{35}$

Note that the same number (7) that multiplied 3 to get 21 also multiplied 5 to get 35.

That is $\frac{3 \times 7}{5 \times 7} = \frac{21}{35}$

2. $\frac{4}{9} = \frac{12}{27}$

Note that the same number (3) that multiplied 4 to get 12 also multiplied 9 to get 27.

Revision Exercises**Exercise 1 (page 39)**

Fill in the blank with the appropriate symbol.

Example

$$70 + 30 < 120 - 5$$

$$70 + 30 = 100$$

$$120 - 5 = 115 \implies 100 < 115$$

Thus, $70 + 30 < 120 - 5$

Exercise 2 (page 40)

Study the relationship between each set of numbers and use it to find the missing numbers.

Example

$$2 \quad 4 \quad 8 \quad 16 \quad 32 \quad 64 \quad 128$$

Note that:

$$2 \times 2 = 4$$

$$4 \times 2 = 8$$

$$8 \times 2 = 16$$

$$16 \times 2 = 32$$

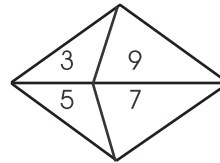
$$32 \times 2 = 64$$

$$64 \times 2 = 128$$

Thus, each number is multiplied by 2 to get the next number in the group.

Exercise 3 (page 41)

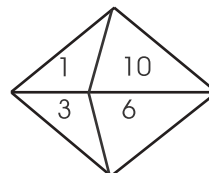
1.



Since $3 + 2 = 5$; $5 + 2 = 7$ and $7 + 2 = 9$

Therefore, the difference between each successive terms is 2.

2.



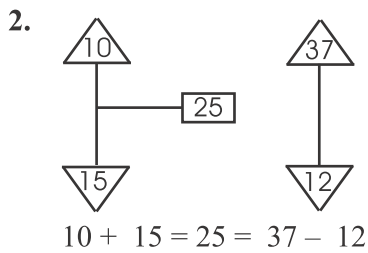
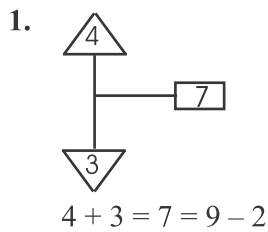
1, 3, 6, 10

The difference between 1 and 3 is 2.
 The difference between 3 and 6 = 3.
 The difference between 6 and 10 = 4.

Exercise 4 (page 43)

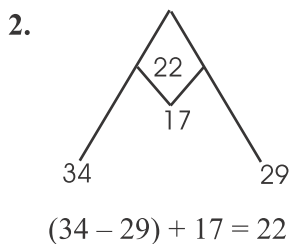
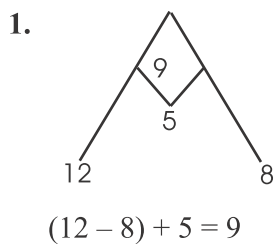
The sum of the numbers on the left hand side equals the positive difference between the numbers on the right hand side which is the same as the number in the centre.

Examples



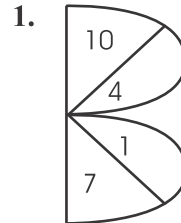
Exercise 5 (page 45)

Examples

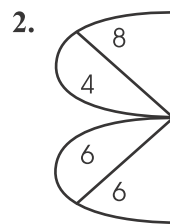


Exercise 6 (page 47)

Examples



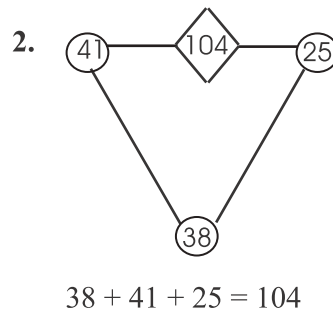
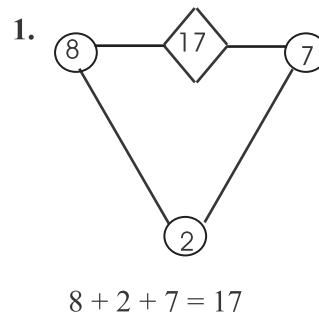
Note the direction of the diagram.
 This means that $10 - 4 = 7 - 1 = 6$



Note the direction of the diagram. This means that $8 + 4 = 6 + 6 = 12$

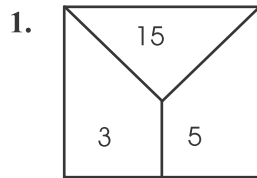
Exercise 7 (page 49)

Examples

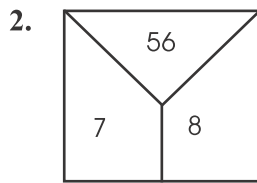


Exercise 8 (page 51)

Examples



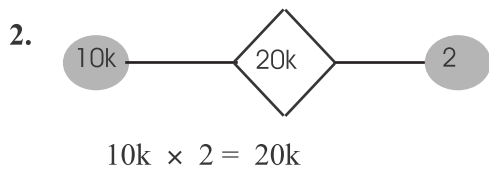
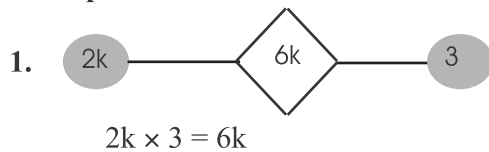
The product of 3 and 5 gives 15, i.e. $3 \times 5 = 15$



$7 \times 8 = 56$

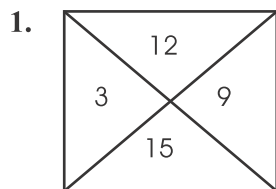
Exercise 9 (page 53)

Examples



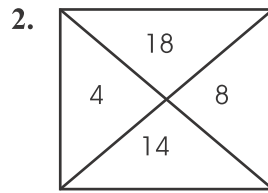
Exercise 10 (page 54)

Examples



The product of 3 and 9 is the same as the sum of 12 and 15.

That is, $3 \times 9 = 12 + 15 = 27$

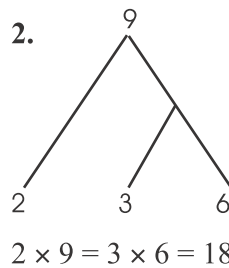
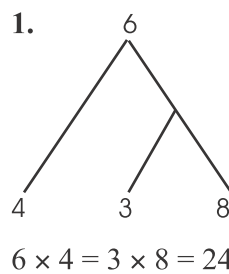


The product of 4 and 8 is the same as the sum of 14 and 18.

That is, $4 \times 8 = 14 + 18 = 32$

Exercise 11 (page 56)

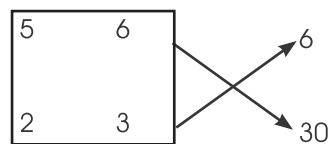
Examples



Exercise 12 (page 58)

Multiply the numbers on the left hand side and match it with the result on the right hand side.

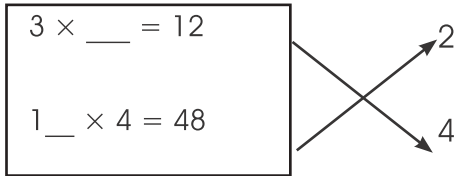
Example



$5 \times 6 = 30$, so we match 5 and 6 with 30
Also, $2 \times 3 = 6$

Exercise 13 (page 59)

Match the number on the left hand side with the missing number on the right hand side.

Example

$3 \times \text{---} = 12$ was matched with 4 because $3 \times 4 = 12$

Also, $12 \times 4 = 48$, therefore 2 is the missing number.

Exercise 14 (page 60)

- From the given table, trace out the multiples of three (3) to form a path, i.e. $3 \rightarrow 15 \rightarrow 6 \rightarrow$ till you get to 69.
- From the given table, trace out the multiples of 5, to form a path. That is, $200 \rightarrow 155 \rightarrow 185 \rightarrow$ till you get to 985.

Exercise 15 (page 62)

Write Yes (Y) or No (N) in the boxes as per the divisibility. For example,

120 is divisible by 2, 3, 4 and 5, that is why we have Y all through.

Exercise 16 (page 63)

The codes for some digits are given, decode the given words by changing the words to numbers, then perform the required operation.

Example

If The - he = 200 and women - men = 34000, then find twin - in.

Solution

If the - he = 200, then $t = 2$.

Also, if women - men = 34 000, then $w = 34$ which means $w = 3, o = 4$.

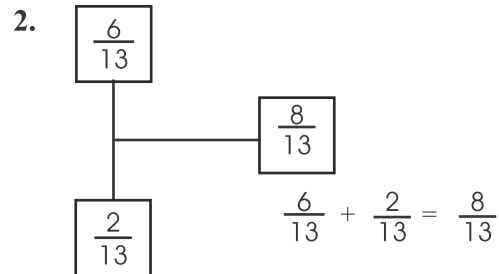
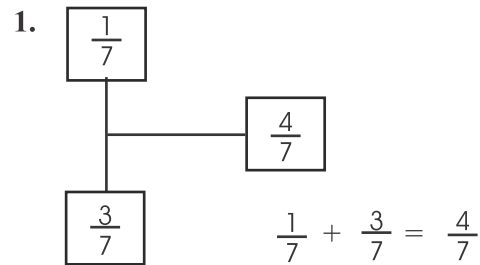
This implies that

Twin = 23in, since we do not have any expression for in.

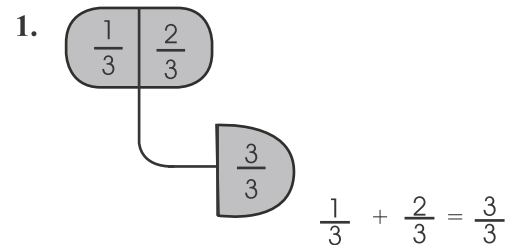
Therefore, twin - in = $23in - in = 2300$

Exercise 17 (page 64)

This involves addition and subtraction of fractions.

Example**Exercise 18 (page 66)**

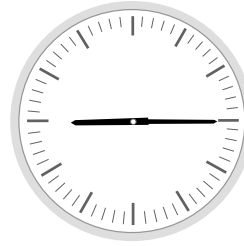
This involves addition and subtraction of fractions.



2.

$$\frac{4}{10} + \frac{1}{10} = \frac{5}{10}$$

Example



The time is 9:15

Exercise 19 (page 68)

This involves the reduction of a fraction to its lowest form.

1.

$$\frac{1}{2} \text{ is the lowest form of } \frac{2}{4}$$

2.

$$\frac{3}{5} \text{ is the lowest form of } \frac{6}{10}$$

Exercise 20 (page 70)

Match the clock diagram on the left with the correct time on the right.

Exercise 21 (page 71)

Read the time on the left hand side and match the clock with the correct time reading on the right hand side.

Example

9:15 is read as quarter past nine.

Exercise 22 (page 72)

1.

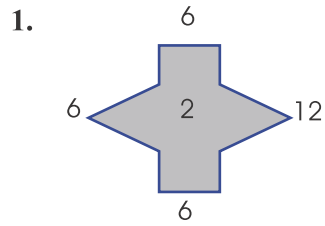
The difference between 27 and 18 is the same as the product of 3 and 3. That is,
 $27 - 18 = 3 \times 3 = 9$

2.

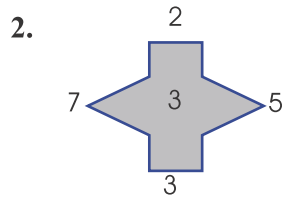
$$7 \times 4 = 64 - 36 = 28$$

Exercise 23 (page 73)

- (i) Find the product of the left hand side and the right hand side numbers.
- (ii) Raise the top and bottom numbers by the power of the middle number, then find the sum.
- (iii) Observe that i = ii

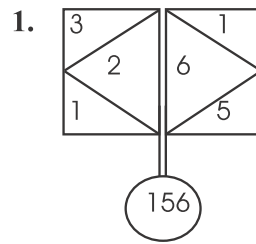


Observe that $6 \times 12 = 72$
 Also, $6^2 + 6^2 = 36 + 36 = 72$

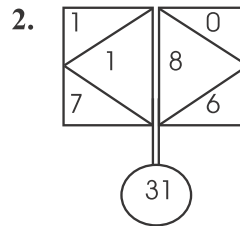


$7 \times 5 = 45$
 $2^3 + 3^3 = 8 + 27 = 35$

Exercise 24 (page 74)



This implies $321 - 165 = 156$



This implies $117 - 086 = 31$

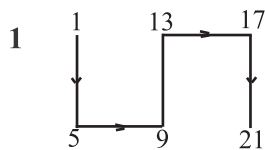
Book 4

Solutions to Quantitative Reasoning Book 4

Unit 1: Arrangement of Numbers

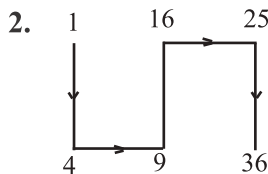
Exercise 1a (page 1)

This unit deals with the arrangement of numbers, each having its own pattern depending on the mathematical operation performed on it.



In this example, the difference between each number is 4, i.e.

$$1 + 4 = 5, 5 + 4 = 9, 9 + 4 = 13, \\ 13 + 4 = 17 \text{ and } 17 + 4 = 21$$



Observe that each of the numbers in this example are perfect squares. That is, each can be written as a square of another number. For example, $1 = 1^2$, $4 = 2^2$, $9 = 3^2$, $16 = 4^2$, $25 = 5^2$ and $36 = 6^2$

This implies that the operation performed here is the square of consecutive numbers.

Exercise 1b (page 3)

The pattern in this case is the addition of a constant number 105 column-wise or vertically to get the next number.

710	615	1 050
815	720	1 155
920	825	1 260

1. $815 = 710 + 105,$
 $920 = 815 + 105$

Also,

$$720 = 615 + 105 \\ 825 = 720 + 105$$

Similarly,

$$1155 = 1050 + 105 \\ 1260 = 1155 + 105$$

Exercise 1c (page 4)

This deals with ordering of numbers from ascending to descending order and vice versa. We also do conversion from minutes to seconds and vice versa, where s = seconds, m = minutes.

1. 500s 4m 25s 370s 600s 7m.

We first convert the minutes to seconds before doing the ordering.

We know that

$$60s = 1m$$

$$500s = 500s$$

$$4m 25s = (4 \times 60) + 25 \\ = 240 + 25 = 265s$$

$$370s = 370s$$

$$600s = 600s$$

$$7m = (7 \times 60)s = 420s$$

So we now arrange in ascending order using the conversion above:

$$265s < 370s < 420s < 500s < 600s \\ = 4m 25s < 370s < 7m < 500s < 600s$$

2. 200s 420s 6m 40s 5m 20s 500s

$$200s = 200s$$

$$420s = 420s$$

$$6m 40s = (6 \times 60) + 40 = 360 + 40 = 400s$$

$$5m 20s = (5 \times 60) + 20 = 300 + 20 = 320s \\ 550s$$

We arrange in descending order, using the conversion above.

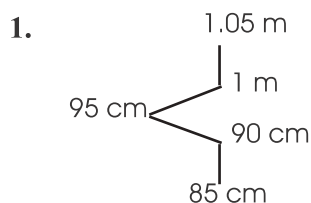
$$550s > 420s > 400s > 320s > 200s \\ = 550s > 420s > 6m 40s > 5m 20s > 200s.$$

Exercise 1d (page 6)

In this exercise, we find the average of numbers and also convert from one unit to another. For example, in order to convert from centimetre to metre and vice versa, we know that

1 metre (m) = 100 centimetre (cm)

We add all the numbers on the right side and divide by 4, then we convert if needed to arrive at the number on the left side.



We first convert all the numbers from metres to centimetres.

$$1.05 = (100 \times 1.05)\text{cm}$$

$$= 105 \text{ cm}$$

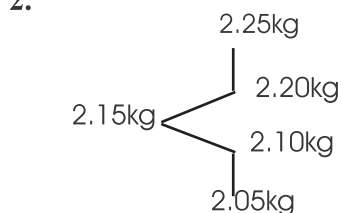
$$1 \text{ m} = 100 \text{ cm}$$

So that we have

$$\frac{85 \text{ cm} + 90 \text{ cm} + 100 \text{ cm} + 105 \text{ cm}}{4}$$

$$= \frac{380 \text{ cm}}{4} = 95 \text{ cm}$$

2.



=

$$\frac{(2.25 + 2.20 + 2.10 + 2.05) \text{ kg}}{4}$$

$$= \frac{8.60 \text{ kg}}{4} = 2.15 \text{ kg}$$

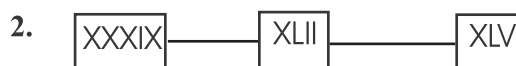
Exercise 1e (page 7)

This involves the arrangement of roman numerals in ascending order.



$$\text{XIII} = 13 \quad \text{XIV} = 14 \quad \text{and} \quad \text{XV} = 15$$

That is, the numbers are arranged in ascending order with a difference of 1 as 13, 14, 15.



$$\text{XXXIX} = 39, \quad \text{XLII} = 42 \quad \text{and} \quad \text{XLV} = 45$$

The numbers are arranged in ascending order with a difference of 3.

Exercise 1f (page 9)

Arrangement of numbers according to a set rule or pattern.

1. 1 3 5 7 9 11

The rule here is the addition of 2 to successive terms, i.e.

$$3 = 1 + 2,$$

$$5 = 3 + 2,$$

$$7 = 5 + 2,$$

$$9 = 7 + 2,$$

$$11 = 9 + 2$$

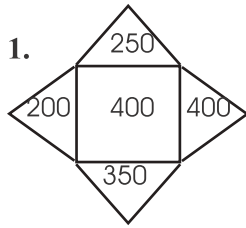
2. 2, 3, 5, 7, 8, 11

The rule in this case is that all the numbers are prime numbers except 8 which is the odd one out.

Arrangement of numbers or patterns does not have a unique formula.

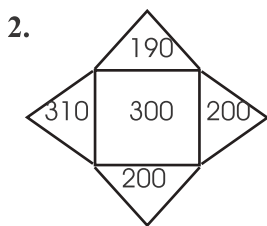
Unit 2: Addition and Subtraction of Numbers**Exercise 2a (page 10)**

In this case, add all the numbers and divide the result by 3 to get the middle number.



$$\frac{(200 + 250 + 400 + 350)}{3}$$

$$= \frac{1200}{3} = 400$$

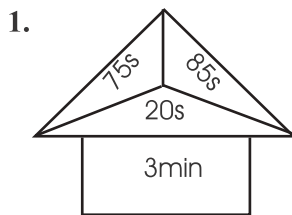


$$\frac{(310 + 190 + 200 + 200)}{3}$$

$$= \frac{900}{3} = 300$$

Exercise 2b (page 11)

Add the three (3) numbers in the triangle and convert the answer to either minutes or metres as indicated.



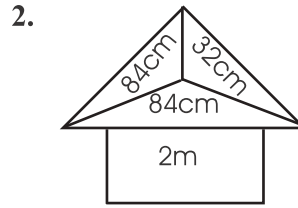
$$75s + 85s + 20s = 180s$$

But recall that

$$60 \text{ s} = 1 \text{ min}$$

$$\text{then, } 180s = \frac{180}{60} = 3 \text{ mins}$$

$$7s + 85s + 20s = 3 \text{ mins}$$



$$84 \text{ cm} + 32 \text{ cm} + 84 \text{ cm} = 200 \text{ cm}$$

But recall that

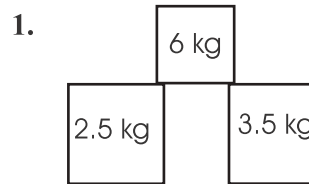
$$100 \text{ cm} = 1 \text{ m,}$$

$$\text{then, } 200 \text{ cm} = \frac{200}{100} = 2 \text{ m}$$

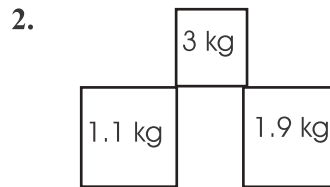
$$84 \text{ cm} + 32 \text{ cm} + 84 \text{ cm} = 2 \text{ m}$$

Exercise 2c (page 12)

Add the two numbers at the bottom to get the number at the top.



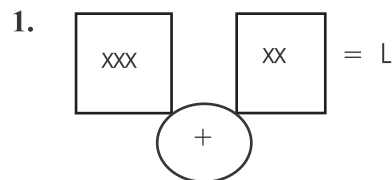
$$2.5 \text{ kg} + 3.5 \text{ kg} = 6 \text{ kg}$$



$$1.1 \text{ kg} + 1.9 \text{ kg} = 3 \text{ kg}$$

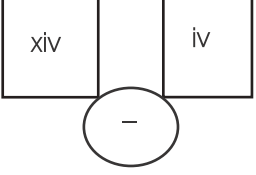
Exercise 2d (page 13)

This involves the addition and subtraction of numbers in roman numerals.



$$\text{XXX} = 30, \text{ XX} = 20$$

$$30 + 20 = 50 = \text{L}$$

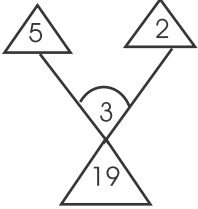
2.  = x

XIV = 14, IV = 4
 $14 - 4 = 10 = X$

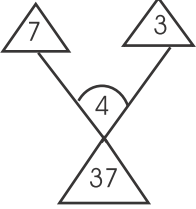
Unit 3: Multiplication and Division of Numbers

Exercise 3a (page 15)

The number at the bottom is obtained by adding the squares of the remaining three (3) numbers at the top and middle, and dividing the result by 2.

1. 

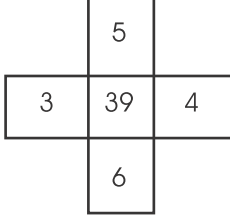
$$\begin{aligned} &(5^2 + 2^2 + 3^2) \div 2 \\ &= (25 + 4 + 9) \div 2 \\ &= 38 \div 2 = 19 \end{aligned}$$

2. 

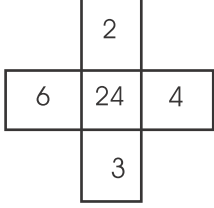
$$\begin{aligned} &(7^2 + 3^2 + 4^2) \div 2 \\ &= (49 + 9 + 16) \div 2 \\ &= 74 \div 2 = 37 \end{aligned}$$

Exercise 3b (page 17)

The middle number is obtained by finding the product of numbers on the left and top and adding it to the product of the numbers on the right and bottom of the shape.

1. 

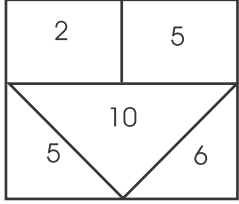
$$\begin{aligned} &(3 \times 5) + (6 \times 4) \\ &= 15 + 24 \\ &= 39 \end{aligned}$$

2. 

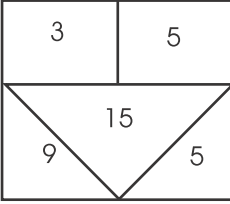
$$\begin{aligned} &(6 \times 2) + (4 \times 3) \\ &= 12 + 12 \\ &= 24 \end{aligned}$$

Exercise 3c (page 18)

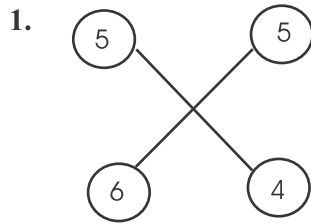
The middle number is obtained by finding the products of the two (2) numbers at the top. Also, the product of the two numbers at the bottom divided by 3 gives the middle number.

1. 

$$\begin{aligned} &2 \times 5 = 10 \\ &(5 \times 6) \div 3 \\ &= 30 \div 3 \\ &= 10 \end{aligned}$$

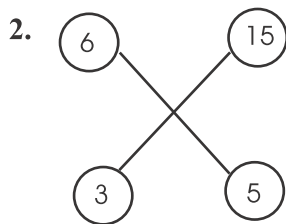
2. 

$$\begin{aligned} &3 \times 5 = 15 \\ &(9 \times 5) \div 3 \\ &= 45 \div 3 \\ &= 15 \end{aligned}$$

Exercise 3d (page 20)

$$\frac{5 \times 4}{2} = \frac{6 \times 5}{3}$$

$$= 10 = 10$$



$$\frac{6 \times 5}{2} = \frac{15 \times 3}{3}$$

$$= 15 = 15$$

The products of the numbers above are equal when divided by 2 and 3 respectively.

Unit 4: Fractions**Exercise 4a (page 22)**

This deals with the ordering of fractions in ascending order. To do this, find the lowest common multiple (LCM) of all the fractions, determine their equivalent fractions, arrange the numerators in ascending order and rewrite the fractions back to their original form given.

Example

$$\frac{5}{7}, \frac{17}{19}, \frac{23}{24}, \frac{1}{2}, \frac{5}{4}, \frac{3}{4}$$

The LCM is 3192. So that

$$\frac{5}{7} = \frac{2\,280}{3\,192}, \frac{17}{19} = \frac{2\,856}{3\,192}$$

$$\frac{23}{24} = \frac{3\,059}{3\,192}, \frac{1}{2} = \frac{1\,596}{3\,192}$$

$$\frac{5}{4} = \frac{3\,865}{3\,192}, \frac{3}{4} = \frac{2\,394}{3\,192}$$

Now, arrange the equivalent fractions in ascending order.

$$\frac{1\,596}{3\,192}, \frac{2\,280}{3\,192}, \frac{2\,394}{3\,192}, \frac{2\,856}{3\,192}, \frac{3\,059}{3\,192}, \frac{3\,865}{3\,192}$$

$$= \frac{1}{2}, \frac{5}{7}, \frac{3}{4}, \frac{17}{19}, \frac{23}{24}, \frac{5}{4}$$

Exercise 4b (page 23)

Match the addition of fractions with their sum.

Example

1. $\frac{1}{2} + \frac{1}{2} = \frac{1+1}{2} = \frac{2}{2}$
 $= 1$

2. $\frac{1}{3} + \frac{1}{3} = \frac{1+1}{3} = \frac{2}{3}$

Exercise 4c (page 24)

Match the subtraction of fractions with their difference.

Example

1. $\frac{1}{2} - \frac{1}{2} = \frac{1-1}{2} = \frac{0}{2} = 0$

2. $\frac{2}{3} - \frac{1}{3} = \frac{2-1}{3} = \frac{1}{3}$

Exercise 4d (page 25)

Perform the operation on the left hand side and also on the right hand side and put the appropriate symbol.

$$1. \quad \frac{1}{8} + \frac{3}{8} \quad \frac{5-3}{8} - \frac{3}{8}$$

Solution

$$1. \quad \frac{1}{8} + \frac{3}{8} = \frac{1+3}{8} = \frac{4}{8}$$

$$\frac{5}{8} - \frac{3}{8} = \frac{5-3}{8} = \frac{2}{8}$$

Therefore,

$$\frac{1}{8} + \frac{3}{8} > \frac{5}{8} - \frac{3}{8}$$

since $\frac{4}{8} > \frac{2}{8}$

$$2. \quad \frac{16}{13} - \frac{3}{13} \quad \frac{3+1}{4} - \frac{1}{4}$$

Solution

$$\frac{16}{13} - \frac{3}{13} = \frac{16-3}{13} = \frac{13}{13} = 1$$

$$\frac{3}{4} + \frac{1}{4} = \frac{4}{4} = 1$$

Therefore,

$$\frac{16}{13} - \frac{3}{13} = \frac{3}{4} + \frac{1}{4}$$

since $1 = 1$

Unit 5: Decimals**Exercise 5a (page 26)**

Fill in the blanks with decimals in words or numbers.

- Write 4.02 in words.

Solution

4.02 in word is four and two hundredths

- Write one and thirty-eight hundredths as a decimal.

Solution

One and thirty-eight hundredths as a decimal is 1.38, i.e. 1 is the whole number, 8 is in the hundredths place.

Exercise 5b (page 27)

In this case, arrange the numbers in ascending or descending order, then circle or underline the highest.

- 0.01, 0.14, 0.90, 0.89, 0.15

Solution

Arrange the numbers in ascending order and underline the highest.

0.01, 0.14, 0.15, 0.89, 0.90

The highest number is 0.90, so we have,

0.01, 0.14, 0.90, 0.89, 0.15

- 1.23, 1.98, 1.78, 1.81, 1.99

Solution

Arrange the numbers in ascending order to have

1.23, 1.78, 1.81, 1.98, 1.99

The highest number is 1.99, so we have,

1.23, 1.98, 1.78, 1.81, 1.99

Exercise 5c (page 28)

Here, we deal with the ordering of numbers by arranging them in ascending and descending order as indicated in each question.

- 109.88 km > 108.88 km > 108.78 km > 107.98 km

Arranging the numbers in descending order, we have

109.88 km, 108.88 km, 108.78 km, 107.98 km
 putting the inequality sign, we have that
 $109.88 \text{ km} > 108.88 \text{ km} > 108.78 \text{ km} > 107.98 \text{ km}$ which is True (T).

2. $105.91 > 106.92 > 104.84 > 103.12$
 Arranging the numbers in descending order, we have
 $106.92 > 105.91 > 104.84 > 103.12$
 which is different from the question, hence
 $105.91 > 106.92 > 104.84 > 103.12$ is False.

3. $\frac{1}{8} > \frac{11}{4} > \frac{1}{3} > \frac{1}{2} > 1$
 We first convert the numbers to decimals and then arrange in descending order, i.e.
 $\frac{1}{8} = 0.125$, $\frac{11}{4} = 2.750$
 $\frac{1}{3} = 0.333$, $\frac{1}{2} = 0.500$
 $1 = 1.000$
 $2.750 > 1.000 > 0.500 > 0.333 > 0.125$
 which is same as
 $\frac{11}{4} > 1 > \frac{1}{2} > \frac{1}{3} > \frac{1}{8}$
 which is different from the question, hence
 $\frac{1}{8} > \frac{11}{4} > \frac{1}{3} > \frac{1}{2} > 1$ is False.

Exercise 5d (page 29)
 This is conversion of numbers from metres to centimetres and millimetres.
 Note that
 $10 \text{ mm} = 1 \text{ cm}$
 $10 \text{ cm} = 1 \text{ dm}$
 $10 \text{ dm} = 1 \text{ m}$
 $1000 \text{ mm} = 1 \text{ m}$
 $100 \text{ cm} = 1 \text{ m}$

1. 3.123 m to mm
 We know that $1000 \text{ mm} = 1 \text{ m}$
 $3.123 \text{ m} = (1000 \times 3.123) \text{ mm}$
 $3.123 \text{ m} = 3123 \text{ mm}$

2. 31.23 cm to m
 Recall that $100 \text{ cm} = 1 \text{ m}$
 $31.23 \text{ cm} = \left(\frac{31.23}{100}\right) \text{ m}$
 $31.23 \text{ cm} = 0.3123 \text{ m}$

Unit 6: Coding
 In coding, we represent letters with numbers and vice versa. This is done to make pupils think smart and fast.

Exercise 6a (page 30)
 The word FOUNDATION is coded as:

F	O	U	N	D	A	T	I	O	N
3	0	2	5	7	4	9	6	0	5

Code or decode the following:
 1. NOUN = 5025
 2. 3257 = Fund

Exercise 6b (page 31)
 The word AIRPLANE is coded as:

A	I	R	P	L	A	N	E
1	3	5	7	9	1	2	4

Code or decode the following:
 1. Plain – Lain
 $= 79132 - 9132$
 $= 70,000$

2. $3489 + 5635 = 9124 = \text{Lane}$

Exercise 6c (page 32)
 The word JUSTICE is coded as:

J	U	S	T	I	C	E
4	7	5	6	3	1	2

Code the following:
 1. ICE = 312
 2. USE = 752

$$\begin{aligned}
 3. \text{ SITE} + \text{JUST} \\
 = 5362 + 4756 \\
 = 10\ 118
 \end{aligned}$$

Exercise 6d (page 33)

The word AUDITORY is coded as:

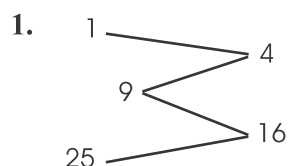
A	U	D	I	T	O	R	Y
1	2	3	4	5	6	7	8

Evaluate the following:

- $D - A = 3 - 1 = 2$
- $\frac{Y}{U} = \frac{8}{2} = 4$
- $T \times D = 5 \times 3 = 15$

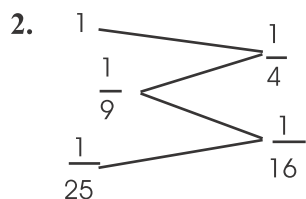
Unit 7: Number Pattern

Exercise 7a (page 34)



The numbers are the squares of the first five numbers, i.e.

$$1^2 = 1, 2^2 = 4, 3^2 = 9, 4^2 = 16 \text{ and } 5^2 = 25.$$



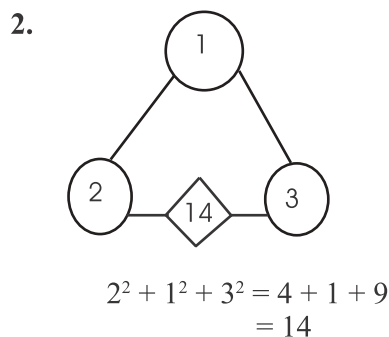
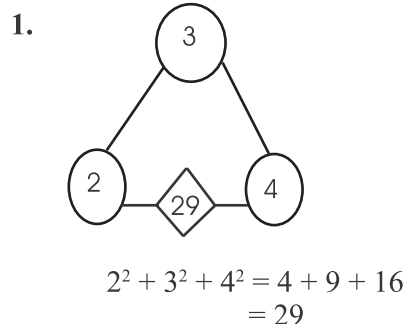
The numbers are the squares of the inverse of the first five numbers, i.e.

$$1^2 = 1 \left(\frac{1}{2}\right)^2 = \frac{1}{4}, \left(\frac{1}{3}\right)^2 = \frac{1}{9}$$

$$\left(\frac{1}{4}\right)^2 = \frac{1}{16} \text{ and } \left(\frac{1}{5}\right)^2 = \frac{1}{25}$$

Exercise 7b (page 36)

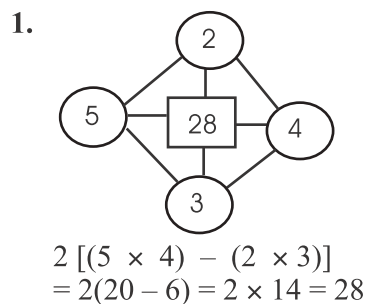
Add the squares of the three numbers to arrive at the number in the middle.



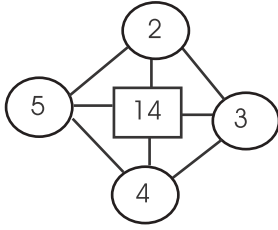
Exercise 7c (page 37)

To solve this, follow the steps below.

- Find the product of the top and the bottom numbers.
- Find the product of the left and right hand side numbers
- Subtract (i) from (ii) and multiply the result by 2.
- The result gives the middle number.



2.

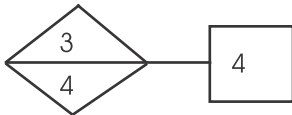


$$2 [(5 \times 3) - (2 \times 4)] \\ = 2(15 - 8) = 2(7) = 14$$

Exercise 7d (page 39)

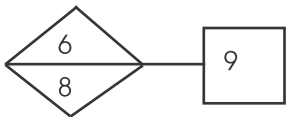
Find the sum of the squares of the two numbers on the left, find the square root of the result and subtract 1 from it. This results into the number on the right.

1.



$$(\sqrt{3^2 + 4^2}) - 1 = (\sqrt{9 + 16}) - 1 \\ = (\sqrt{25}) - 1 = 5 - 1 = 4$$

2.

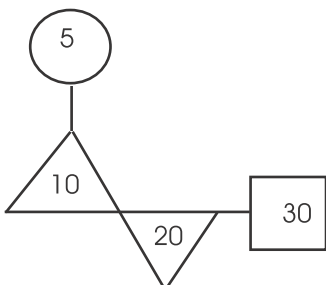


$$(\sqrt{6^2 + 8^2}) - 1 = (\sqrt{36 + 64}) - 1 \\ = (\sqrt{100}) - 1 = 10 - 1 = 9$$

Revision Exercises

Exercise 1 (page 40)

1.



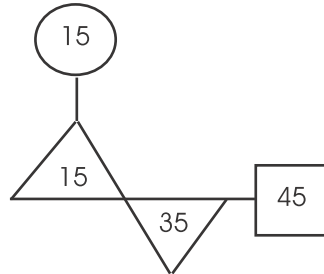
Add a constant number (5) to the sum of 5 and 10.

i.e. $(5 + 10) + 5 = 20$

Add a constant number (10) to 20 to get

$10 + 20 = 30$

2.



Add a constant number (5) to the sum of 15 and 15.

i.e. $(15 + 15) + 5 = 30 + 5 = 35$

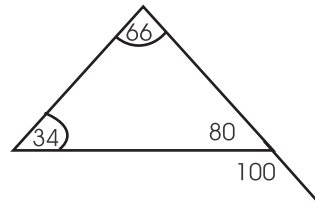
Also, add a constant number (10) to 35 to get

$35 + 15 = 45$

Exercise 2 (page 42)

In this case, we deal with the sum of the angles in a triangle which is 180° and also the sum of the angles on a straight line, which is 180° .

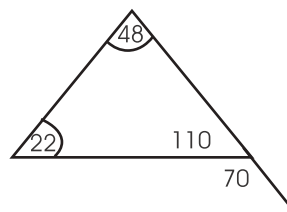
1.



$66^\circ + 34^\circ + 80^\circ = 180^\circ$ (Sum of angles in a triangle)

$80^\circ + 100^\circ = 180^\circ$ (Sum of angles on a straight line)

2.



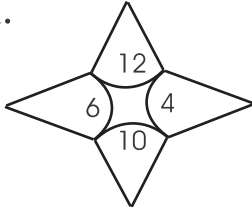
$48^\circ + 22^\circ + 110^\circ = 180^\circ$ (Sum of angles in a triangle)

$110^\circ + 70^\circ = 180^\circ$ (Sum of angles on a straight line)

Exercise 3 (page 44)

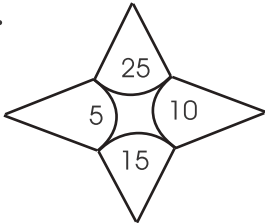
Add the numbers on the left and right sides to get the number at the bottom. Also, multiply the numbers on the left and right sides and divide the result by 2 to get the number at the top.

1.



$$\begin{aligned} 6 + 4 &= 10 \\ (6 \times 4) \div 2 \\ &= 24 \div 2 = 12 \end{aligned}$$

2.

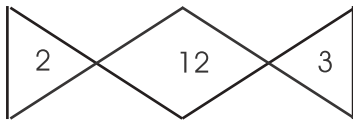


$$\begin{aligned} 5 + 10 &= 15 \\ (5 \times 10) \div 2 \\ &= 50 \div 2 = 25 \end{aligned}$$

Exercise 4 (page 46)

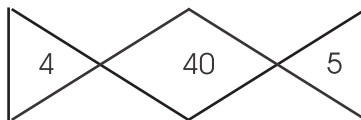
Add the squares of the numbers on the left and right side and subtract 1 from the result to get the middle number.

1.



$$\begin{aligned} (2^2 + 3^2) - 1 &= (4 + 9) - 1 \\ &= 13 - 1 = 12 \end{aligned}$$

2.



$$\begin{aligned} (4^2 + 5^2) - 1 &= (16 + 25) - 1 \\ &= 41 - 1 = 40 \end{aligned}$$

Exercise 5 (page 47)

Solve the fractions given and match with the appropriate values.

$$\begin{aligned} 1. \quad \frac{1}{2} \text{ of } 4^2 &= \frac{1}{2} \times 4^2 \\ &= \frac{1}{2} \times 16 = 8 \end{aligned}$$

$$\begin{aligned} 2. \quad \frac{1}{3} \text{ of } 9^2 &= \frac{1}{3} \times 9^2 \\ &= \frac{1}{3} \times 81 = 27 \end{aligned}$$

Exercise 6 (page 48)

Solve the fractions and simplify to the lowest form, then match with the appropriate values.

$$\begin{aligned} 1. \quad \frac{1}{6} + \frac{3}{6} &= \frac{1+3}{6} \\ &= \frac{4}{6} = \frac{2}{3} \end{aligned}$$

$$\begin{aligned} 2. \quad \frac{5}{2} + \frac{1}{2} &= \frac{5+1}{2} \\ &= \frac{6}{2} = 3 \end{aligned}$$

Exercise 7 (page 49)

Solve the fractions to find the missing number or fraction.

$$\begin{aligned} 1. \quad 1 - \frac{5}{10} &= \frac{1}{1} - \frac{5}{10} = \frac{10-5}{10} \\ &= \frac{5}{10} = \frac{1}{2} \end{aligned}$$

$$2. \quad \frac{1}{7} - \frac{2}{\square} = \frac{1}{21}$$

Collect the like terms:

$$\frac{1}{7} - \frac{1}{21} = \frac{2}{\square}$$

$$\frac{3-1}{21} = \frac{2}{\square}$$

$$\frac{2}{21} = \frac{2}{\square}$$

Comparing the left side and the right side, we can see that

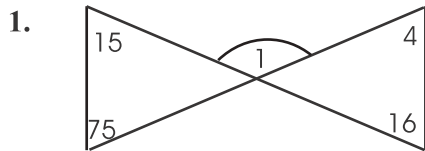
$$2 = 2, \text{ then } 21 = \square$$

i.e. \square which is the missing number is 21.

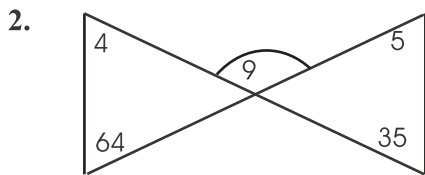
Exercise 8 (page 50)

Use the steps below to solve this exercise.

- (i) Divide the bottom left number by the top of the left number.
- (ii) Divide the bottom right number by the top right number
- (iii) Subtract the result of (ii) from the result of (i) to get the number in the middle.



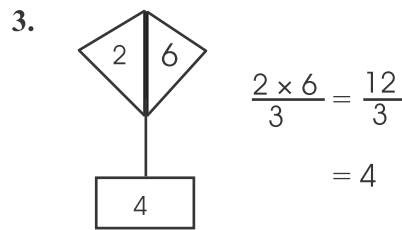
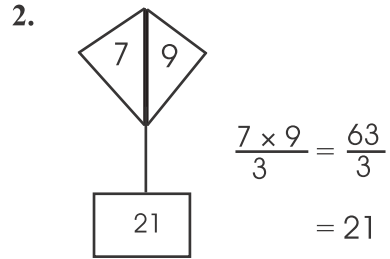
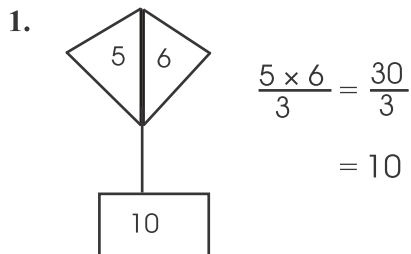
$$\left(\frac{75}{15} - \frac{16}{4}\right) = 5 - 4 = 1$$



$$\left(\frac{64}{4} - \frac{35}{5}\right) = 16 - 7 = 9$$

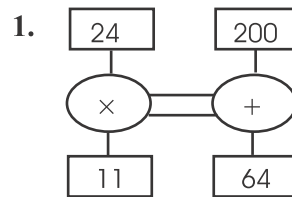
Exercise 9 (page 51)

Divide the product of the two numbers at the top by a constant number 3 to get the number at the bottom.



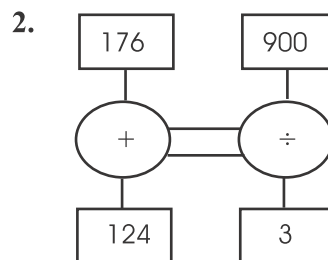
Exercise 10 (page 53)

Fill in the blanks with the appropriate mathematical symbols.



From the diagram, it can be seen that
 $(24 \times 11) = (200 + 64)$
 $264 = 264$

i.e. the left hand side is the same as the right hand side.



From the above diagram, it can be seen that
 $(176 + 124) = (900 \div 3)$
 $300 = 300$

Exercise 11 (page 56)

Convert the mixed numbers to improper fraction and match with the correct answer.

$$1. \quad 1 \frac{2}{3} = 1 + \frac{2}{3} = \frac{1}{1} + \frac{2}{3} = \frac{3+2}{3} = \frac{5}{3}$$

$$2. \quad 1 \frac{7}{8} = 1 + \frac{7}{8} = \frac{1}{1} + \frac{7}{8} = \frac{8+7}{8} = \frac{15}{8}$$

Exercise 12 (page 57)

Convert the improper fractions to mixed numbers and match with the correct answer.

$$1. \quad \frac{16}{3} = \frac{15+1}{3} = \frac{15}{3} + \frac{1}{3} \\ = 5 + \frac{1}{3} = 5 \frac{1}{3}$$

$$2. \quad \frac{15}{4} = \frac{12+3}{4} = \frac{12}{4} + \frac{3}{4} \\ = 3 + \frac{3}{4} = 3 \frac{3}{4}$$

Exercise 13 (page 58)

Use the steps below to solve the questions in this exercise.

- (i) Multiply the number at the top right position with the number at the bottom left position.
- (ii) Multiply the number at the top left position with the number at the bottom right position.
- (iii) Subtract (ii) from (i).
- (iv) Divide the result in (iii) by 2 to get the middle number.

$$1. \quad \begin{array}{ccc} \boxed{5} & & \boxed{8} \\ & \diagdown & / \\ & \boxed{19} & \\ & / & \diagdown \\ \boxed{6} & & \boxed{2} \end{array}$$

$$\frac{(8 \times 6) - (5 \times 2)}{2}$$

$$= \frac{48 - 10}{2} = \frac{38}{2} = 19$$

$$2. \quad \begin{array}{ccc} \boxed{3} & & \boxed{5} \\ & \diagdown & / \\ & \boxed{13} & \\ & / & \diagdown \\ \boxed{7} & & \boxed{3} \end{array}$$

$$\frac{(7 \times 5) - (3 \times 3)}{2}$$

$$= \frac{35 - 9}{2} = \frac{26}{2} = 13$$

Exercise 14 (page 60)

Use the steps below to solve the questions in this exercise.

- (i) Find the product of the top and bottom numbers.
- (ii) Add the left side and the right side numbers.
- (iii) Subtract (ii) from (i) to get the middle number.

$$1. \quad \begin{array}{ccc} & 6 & \\ & / \quad \backslash & \\ 9 & \boxed{7} & 2 \\ & \backslash \quad / & \\ & 3 & \end{array}$$

$$(6 \times 3) - (9 + 2)$$

$$= 18 - 11 = 7$$

$$2. \quad \begin{array}{ccc} & 4 & \\ & / \quad \backslash & \\ 3 & \boxed{27} & 2 \\ & \backslash \quad / & \\ & 8 & \end{array}$$

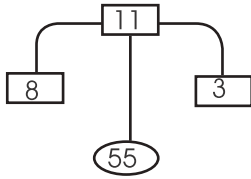
$$(8 \times 4) - (3 + 2)$$

$$= 32 - 5 = 27$$

Exercise 15 (page 61)

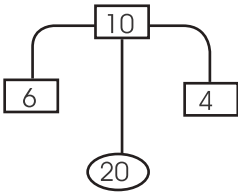
The sum of the left and right side numbers gives the number at the top while the number at the bottom is obtained by multiplying the sum of the left and right side numbers by their positive difference.

1.



$$\begin{aligned} 8 + 3 &= 11 \\ (8 + 3) \times (8 - 3) \\ &= 11 \times 5 = 55 \end{aligned}$$

2.

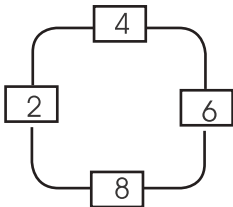


$$\begin{aligned} 6 + 4 &= 10 \\ (6 + 4) \times (6 - 4) \\ &= 10 \times 2 = 20 \end{aligned}$$

Exercise 16 (page 63)

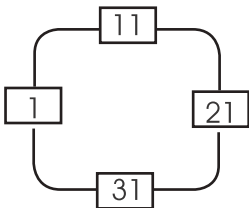
This exercise deals with the arrangement of numbers with each having its own pattern, depending on the mathematical operation(s) performed on it.

1.



Addition of 2, i.e.
 $2, 4 = 2 + 2, 6 = 4 + 2, 8 = 6 + 2$

2.



Addition of 10
 i.e. $1, 11 = 10 + 1, 21 = 11 + 10,$
 $31 = 21 + 10$

Exercise 17 (page 64)

In this exercise, two numbers are picked from the six numbers on the right hand side, their sum must give the number on the left hand side.

1. $\frac{21}{3} = \frac{14}{3} \text{ and } \frac{7}{3}$

i.e. $\frac{21}{3} = \frac{14}{3} + \frac{7}{3}$

$$\frac{21}{3} = \frac{21}{3}$$

2. $\frac{11}{6} = 1\frac{3}{6} \text{ and } \frac{2}{6}$

i.e. $\frac{11}{6} = 1\frac{3}{6} + \frac{2}{6}$

$$\frac{11}{6} = \frac{9}{6} + \frac{2}{6}$$

$$\frac{11}{6} = \frac{11}{6}$$

Exercise 18 (page 65)

In this exercise, two numbers are picked from the six numbers on the right hand side, their positive difference will give the number on the left hand side.

1. $\frac{12}{9} = \frac{22}{9} - \frac{10}{9}$
 $= \frac{22 - 10}{9}$

$$\frac{12}{9} = \frac{12}{9}$$

2. $\frac{11}{3} = 4\frac{1}{3} - \frac{2}{3}$
 $= \frac{13 - 2}{3}$

$$\frac{11}{3} = \frac{11}{3}$$

Exercise 19 (page 66)

Match the equivalent conversion given below.

Note that

$$1 \text{ kg} = 1000 \text{ g}$$

$$1 \text{ g} = 0.001 \text{ kg}$$

Similarly,

$$1 \text{ l} = 1000 \text{ ml}$$

$$1 \text{ ml} = 0.001 \text{ l}$$

$$1. \quad 2 \text{ kg} = (2 \times 1000) \text{ g} \\ = 2000 \text{ g}$$

$$2. \quad 0.075 \text{ l} = (0.075 \times 1000) \text{ ml} \\ = 75 \text{ ml}$$

$$\frac{13}{3} - \frac{2}{3}$$

Exercise 20 (page 67)

Use the steps below to solve the questions in this exercise.

- Multiply the numbers on the middle left and bottom right sides.
- Multiply the numbers on the middle right and bottom left sides.
- Subtract (ii) from (i) and square the result.
- The result obtained in (iii) is the number at the top.

$$1. \quad \begin{array}{|c|} \hline 25 \\ \hline \end{array} \quad \begin{array}{|c|} \hline 5 \\ \hline \end{array} \quad \begin{array}{|c|} \hline 15 \\ \hline \end{array} \\ \begin{array}{|c|} \hline 3 \\ \hline \end{array} \quad \begin{array}{|c|} \hline 10 \\ \hline \end{array} \quad \begin{array}{l} [(10 \times 5) - (15 \times 3)]^2 \\ = (50 - 45)^2 \\ = (5)^2 = 25 \end{array}$$

$$2. \quad \begin{array}{|c|} \hline 81 \\ \hline \end{array} \quad \begin{array}{|c|} \hline 15 \\ \hline \end{array} \quad \begin{array}{|c|} \hline 3 \\ \hline \end{array} \\ \begin{array}{|c|} \hline 17 \\ \hline \end{array} \quad \begin{array}{|c|} \hline 4 \\ \hline \end{array} \quad \begin{array}{l} [(15 \times 4) - (17 \times 3)]^2 \\ = (60 - 51)^2 \\ = (9)^2 = 81 \end{array}$$

$$3. \quad \begin{array}{|c|} \hline 4 \\ \hline \end{array} \quad \begin{array}{|c|} \hline 4 \\ \hline \end{array} \quad \begin{array}{|c|} \hline 5 \\ \hline \end{array} \\ \begin{array}{|c|} \hline 2 \\ \hline \end{array} \quad \begin{array}{|c|} \hline 3 \\ \hline \end{array} \quad \begin{array}{l} [(4 \times 3) - (5 \times 2)]^2 \\ = (12 - 10)^2 \\ = (2)^2 = 4 \end{array}$$

Exercise 21 (page 69)

Use the steps below to solve the questions in this exercise.

- Find the sum of the three numbers at the edges of the triangle.
- Raise the number on the horizontal line to the power of the number at the centre of triangle.
- The result of (i) must be equal to the result of (ii)

$$1. \quad \begin{array}{c} 8 \\ \triangle \\ 9 \quad 8 \\ \hline 5 \end{array} \quad \begin{array}{l} (9 + 8 + 8) = 5^2 \\ = 25 = 25 \end{array}$$

$$2. \quad \begin{array}{c} 0 \\ \triangle \\ 4 \quad 3 \\ \hline 7 \end{array} \quad \begin{array}{l} (4 + 0 + 3) = 7^1 \\ = 7 = 7 \end{array}$$

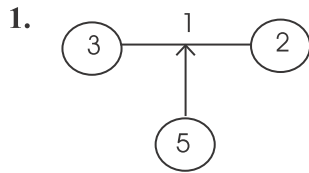
Book 5

Solutions to Quantitative Reasoning Book 5

Unit 1: Operations on Numbers I

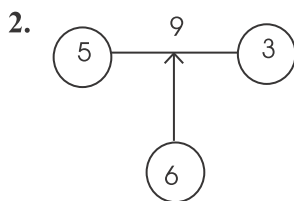
Exercise 1a (page 1)

We add the numbers on the vertical line while we multiply horizontally to arrive at the same answer.



$$3 \times 2 = 6 \quad (\text{Horizontally})$$

$$5 + 1 = 6 \quad (\text{Vertically})$$

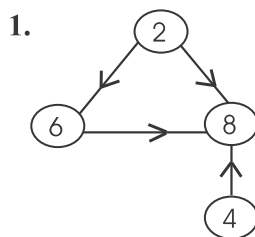


$$5 \times 3 = 15 \quad (\text{Horizontally})$$

$$9 + 6 = 15 \quad (\text{Vertically})$$

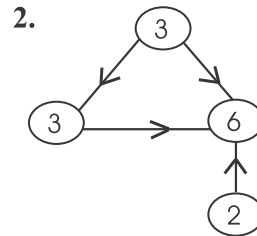
Exercise 1b (page 3)

We add the left number to the number at the top to get the number on the right. We multiply the number at the top with the number at the bottom to get the number at the right.



$$2 + 6 = 8$$

$$2 \times 4 = 8$$

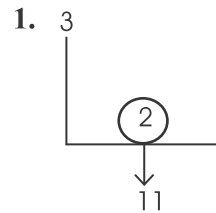


$$3 + 3 = 6$$

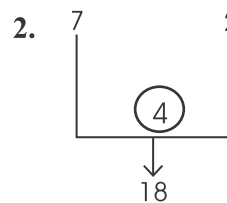
$$3 \times 2 = 6$$

Exercise 1c (page 5)

We multiply the first 2 numbers at the top, then add the number at the centre to arrive at the final answer at the bottom.



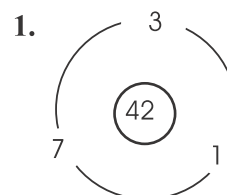
$$(3 \times 3) + 2 = 9 + 2 = 11$$



$$(7 \times 2) + 4 = 14 + 4 = 18$$

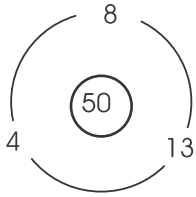
Exercise 1d (page 7)

We add the three numbers on the outer circle, then multiply the result by 2 to arrive at the number in the middle.



$$(3 + 7 + 11) \times 2 = 21 \times 2 = 42$$

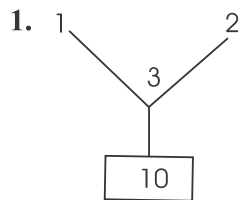
2.



$$(8 + 4 + 13) \times 2 = 25 \times 2 = 50$$

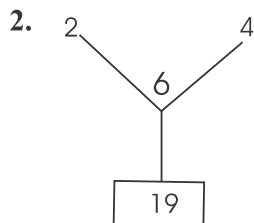
Exercise 1e (page 8)

In this case, there is an invisible number which is the next number to the number at the centre, which is added to the first three numbers to arrive at the bottom number.



Here, the middle number is 3 and 4 is the next after it, then we have:

$$(1 + 2 + 3) + 4 = 6 + 4 = 10$$



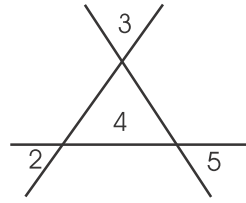
Here, the middle number is 6 and 7 is the next after it, then we have:

$$(2 + 4 + 6) + 7 = 12 + 7 = 19$$

Exercise 1f (page 9)

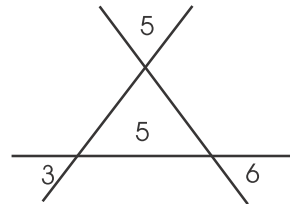
In this case, we have an invisible number 2 which is multiplied by the number from left and then subtracted from the sum of the number at the top and the number at the right to get the middle number.

1.



$$(5 + 3) - (2 \times 2) = 8 - 4 = 4$$

2.

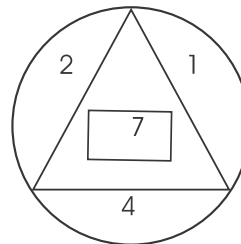


$$(5 + 6) - (2 \times 3) = 11 - 6 = 5$$

Exercise 1g (page 11)

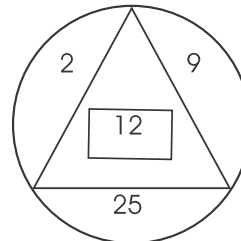
In this case, we take the square of the number on the left, then add it to the square roots of the numbers on the right and bottom respectively, to arrive at the middle number.

1.



$$2^2 + \sqrt{1} + \sqrt{4} = 4 + 1 + 2 = 8$$

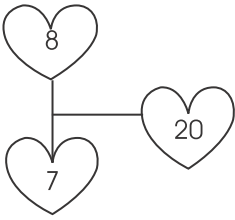
2.

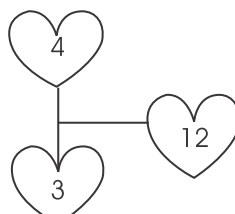


$$2^2 + \sqrt{9} + \sqrt{25} = 4 + 3 + 5 = 12$$

Exercise 1h (page 12)

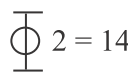
Here, we have an invisible number 5 which is then added to the sum of the two numbers on the left side to give the number on the right side.

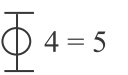
1. 
 $(8 + 7) + 5 = 15 + 5 = 20$

2. 
 $(4 + 3) + 5 = 7 + 5 = 12$

Unit 2: Operations on Numbers II**Exercise 2a (page 14)**

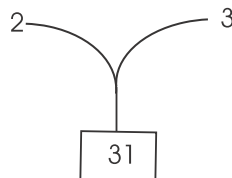
In this case, we square the first number and take away the second number from it to arrive at the number on the right hand side.

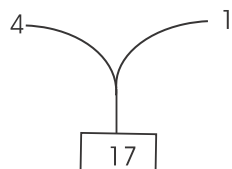
1.  $= 14$
 $4^2 - 2 = 16 - 2 = 14$

2.  $= 5$
 $3^2 - 4 = 9 - 4 = 5$

Exercise 2b (page 15)


Here, we add the square of the number on the left to the cube of the number on the right to arrive at the number at the bottom.


1. 
 $2^2 + 3^3 = 4 + 27 = 31$

2. 
 $4^2 + 1^3 = 16 + 1 = 17$

Exercise 2c (page 16)

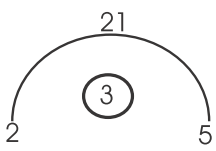
In this case, we add the product and the difference of the numbers on the left hand side to get the result on the right hand side.

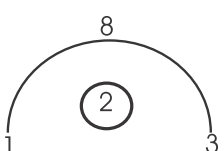
1.  $= 7$
 $(3 \times 2) + (3 - 2) = 6 + 1 = 7$

2.  $= 36$
 $(8 \times 4) + (8 - 4) = 32 + 4 = 36$

Exercise 2d (page 17)

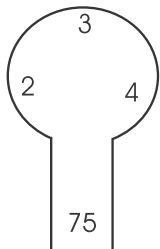
Here, we add the two numbers at the bottom, we then multiply the result with the middle number to get the answer at the top.

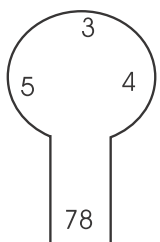
1. 
 $(2 + 5) \times 3 = 7 \times 3 = 21$

2. 
 $(1 + 3) \times 2 = 4 \times 2 = 8$

Exercise 2e (page 18)

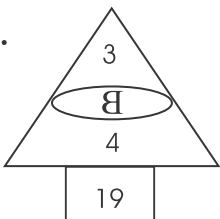
In this case, we add the first number with the square of the second number and the cube of the third number, to get the number at the bottom.

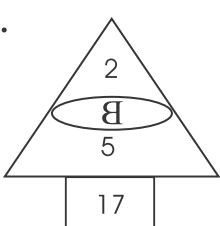
1. 
$$\begin{aligned} 2 + 3^2 + 4^3 \\ = 2 + 9 + 64 \\ = 75 \end{aligned}$$

2. 
$$\begin{aligned} 5 + 3^2 + 4^3 \\ = 5 + 9 + 64 \\ = 78 \end{aligned}$$

Exercise 2f (page 20)

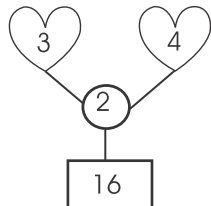
Here, we add the product and sum of the two numbers in the triangle to get the number at the bottom.

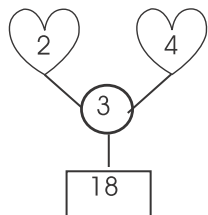
1. 
$$\begin{aligned} (3 \times 4) + (3 + 4) \\ = 12 + 7 = 19 \end{aligned}$$

2. 
$$\begin{aligned} (2 \times 5) + (2 + 5) \\ = 10 + 7 = 17 \end{aligned}$$

Exercise 2g (page 21)

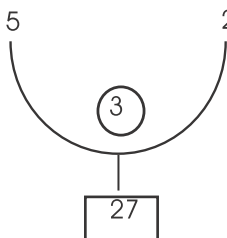
Here, we take the middle number, raise it to the power of the number at the top left and multiply it with the number at the top right. Then we divide the result by 2 to arrive at the bottom number.

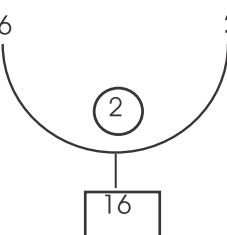
1. 
$$\begin{aligned} (2^3 \times 4) \div 2 \\ = (8 \times 4) \div 2 \\ = 32 \div 2 = 16 \end{aligned}$$

2. 
$$\begin{aligned} (3^2 \times 4) \div 2 \\ = (9 \times 4) \div 2 \\ = 36 \div 2 = 18 \end{aligned}$$

Exercise 2h (page 22)

In this case, we find the difference between the numbers at the top, then we raise the result to the power of the number in the middle to get the result (i.e. number at the bottom).

1. 
$$\begin{aligned} (5 - 2)^3 \\ = 3^3 = 27 \end{aligned}$$

2. 
$$\begin{aligned} (6 - 2)^2 \\ = 4^2 = 16 \end{aligned}$$

Unit 3: Fractions

Exercise 3a (page 24)

R stands for addition

U stands for subtraction

$$1. \frac{1}{2} \mathbf{R} \frac{1}{4} = \frac{1}{2} + \frac{1}{4} = \frac{2+1}{4} = \frac{3}{4}$$

$$2. \frac{5}{4} \mathbf{U} \frac{3}{4} = \frac{5}{4} - \frac{3}{4} = \frac{5-3}{4} = \frac{2}{4} = \frac{1}{2}$$

Exercise 3b (page 25)

 stands for division

 stands for multiplication

$$1. \frac{1}{2} \triangle \frac{1}{3} = \frac{1}{2} \div \frac{1}{3} = \frac{1}{2} \times \frac{3}{1} = \frac{3}{2}$$

$$2. \frac{7}{9} \nabla \frac{3}{4} = \frac{7}{9} \times \frac{3}{4} = \frac{7}{12}$$

Exercise 3c (page 25)

 stands for subtraction

 stands for addition

In this case, we take the square of both numbers before performing the required operation.

$$1. \left[\frac{1}{2} \right] \text{---} \nabla \text{---} \left[\frac{1}{4} \right] = \left(\frac{1}{2} \right)^2 - \left(\frac{1}{4} \right)^2 = \frac{1}{4} - \frac{1}{16} = \frac{4-1}{16} = \frac{3}{16}$$

$$2. \left[\frac{1}{3} \right] \text{---} \triangle \text{---} \left[\frac{1}{9} \right] = \left(\frac{1}{3} \right)^2 + \left(\frac{1}{9} \right)^2 = \frac{1}{9} + \frac{1}{81} = \frac{9+1}{81} = \frac{10}{81}$$

Exercise 3d (page 27)

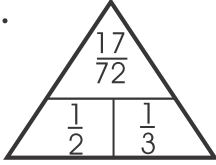
Here, we multiply the positive differences between the numbers on the left side and centre to get the desired result on the right side.

$$1. \begin{array}{c|c} \frac{2}{3} & \frac{3}{4} \\ \hline \frac{1}{3} & \frac{1}{4} \end{array} \rightarrow \left[\frac{1}{6} \right] = \left(\frac{2}{3} - \frac{1}{3} \right) \times \left(\frac{3}{4} - \frac{1}{4} \right) = \frac{1}{3} \times \frac{2}{4} = \frac{2}{12} = \frac{1}{6}$$

$$2. \begin{array}{c|c} \frac{1}{2} & \frac{2}{3} \\ \hline \frac{1}{3} & \frac{1}{3} \end{array} \rightarrow \left[\frac{1}{18} \right] = \left(\frac{1}{2} - \frac{1}{3} \right) \times \left(\frac{2}{3} - \frac{1}{3} \right) = \frac{1}{6} \times \frac{1}{3} = \frac{1}{18}$$

Exercise 3e (page 28)

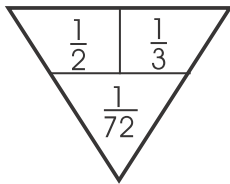
1.



In this example, we add the cube of $\frac{1}{3}$ to the square of $\frac{1}{2}$ to arrive at $\frac{17}{72}$ i.e.

$$\left(\frac{1}{2}\right)^3 + \left(\frac{1}{3}\right)^2 = \frac{1}{8} + \frac{1}{9} = \frac{9+8}{72} = \frac{17}{72}$$

2.



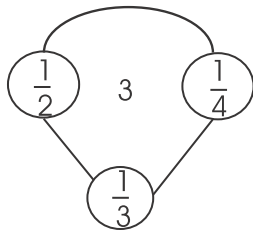
In this case, we find the difference between the cube of $\frac{1}{2}$ and the square of $\frac{1}{3}$ to get the result $\frac{17}{72}$ i.e.

$$\begin{aligned} \left(\frac{1}{2}\right)^3 - \left(\frac{1}{3}\right)^2 &= \frac{1}{8} - \frac{1}{9} = \frac{9-8}{72} \\ &= \frac{1}{72} \end{aligned}$$

Exercise 3f (page 29)

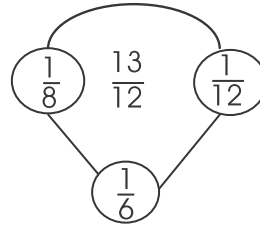
In this case, we multiply the number on the left by 2, the bottom number by 3 and the number on the right by 4, then we sum all to get the middle number.

1.



$$\begin{aligned} &= \left(\frac{1}{2} \times 2\right) + \left(\frac{1}{3} \times 3\right) + \left(\frac{1}{4} \times 4\right) \\ &= 1 + 1 + 1 = 3 \end{aligned}$$

2.

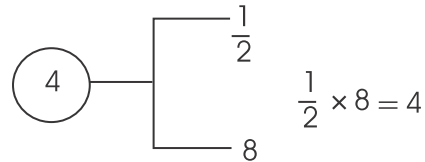


$$\begin{aligned} &= \left(\frac{1}{8} \times 2\right) + \left(\frac{1}{6} \times 3\right) + \left(\frac{1}{12} \times 4\right) \\ &= \frac{1}{4} + \frac{1}{2} + \frac{1}{3} = \frac{3+6+4}{12} \\ &= \frac{13}{12} \end{aligned}$$

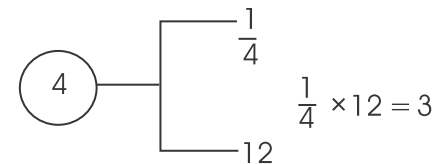
Exercise 3g (page 30)

We multiply the two numbers on the right side to get the number on the left side.

1.



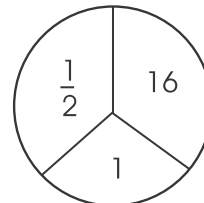
2.



Exercise 3h (page 31)

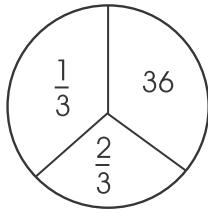
Here, we multiply the square of the number on the left side with the square root of the number on the right side to get the answer at the bottom.

1.



$$\begin{aligned} &\left(\frac{1}{2}\right)^2 \times \sqrt{16} \\ &= \frac{1}{4} \times 4 = 1 \end{aligned}$$

2.



$$\begin{aligned} & \left(\frac{1}{3}\right)^2 \times \sqrt{36} \\ &= \frac{1}{9} \times 6 \\ &= \frac{6}{9} = \frac{2}{3} \end{aligned}$$

Unit 4: Decimals

Exercise 4a (page 33)

 stands for addition

 stands for subtraction

1. $0.02 \begin{array}{c} \uparrow \\ \uparrow \end{array} 0.31 = 0.33$

2. $0.58 \begin{array}{c} \downarrow \\ \downarrow \end{array} 0.17 = 0.41$

Exercise 4b (page 34)

In this case, we add or subtract the numbers in the same shape on the left hand side to get the answer on the right hand side.

1. $\boxed{2.3} + \textcircled{1.8} + \boxed{14.1} + \textcircled{8.3}$

Collect like terms (the same shape):

$$= \boxed{2.3} + \boxed{14.1} + \textcircled{1.8} + \textcircled{8.3}$$

$$= \boxed{16.4} + \textcircled{10.1}$$

2. $\boxed{167.5} + \textcircled{2.54} - \boxed{37.18} - \textcircled{0.35}$

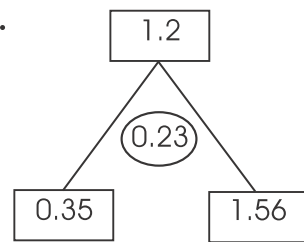
Collect like terms:

$$\begin{aligned} &= \boxed{167.5} - \boxed{37.18} + \textcircled{2.54} - \textcircled{0.35} \\ &= \boxed{130.32} + \textcircled{2.19} \end{aligned}$$

Exercise 4c (page 35)

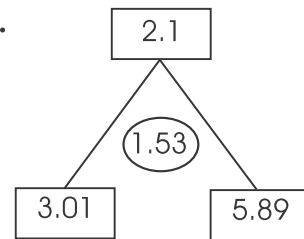
In this case, we subtract the numbers on the bottom left from the bottom right, then subtract the result from the square of the number at the top, to give us the result (the middle number).

1.



$$\begin{aligned} & (1.2)^2 - (1.56 - 0.35) \\ &= (1.2)^2 - (1.21) \\ &= 1.44 - 1.21 = 0.23 \end{aligned}$$

2.

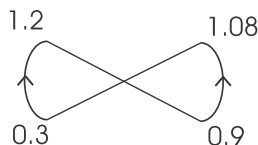


$$\begin{aligned} & (2.1)^2 - (5.89 - 3.01) \\ &= 4.41 - 2.88 \\ &= 1.53 \end{aligned}$$

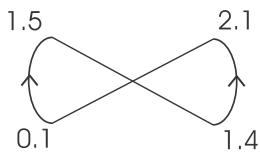
Exercise 4d (page 36)

Here, we multiply the numbers at the top left and bottom right, to get the number at the top right and also find the difference between the two numbers to get the number at the bottom left.

1.



$$\begin{aligned} & 1.2 \times 0.9 = 1.08 \\ & 1.2 - 0.9 = 0.3 \end{aligned}$$

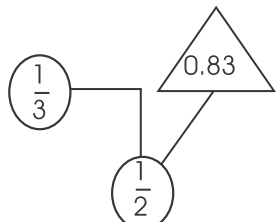
2. 

$$1.5 \times 1.4 = 2.1$$

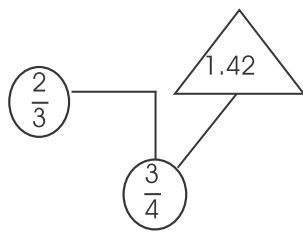
$$1.5 - 1.4 = 0.1$$

Exercise 4e (page 38)

Here, we add the two numbers in the circle and convert the result to decimal.

1. 

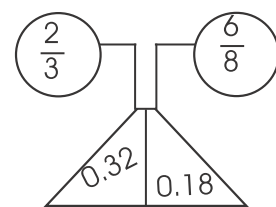
$$\frac{1}{3} + \frac{1}{2} = \frac{2+3}{6} = \frac{5}{6} = 0.83$$

2. 

$$\frac{2}{3} + \frac{3}{4} = \frac{8+9}{12} = \frac{17}{12} = 1.42$$

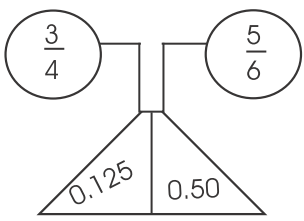
Exercise 4f (page 39)

In this case, the product of the fractions at the top is equal to the sum of the decimals at the bottom.

1. 

$$\frac{2}{3} \times \frac{6}{8} = \frac{12}{24} = \frac{1}{2} = 0.50$$

$$0.32 + 0.18 = 0.50$$


2. 

$$\frac{3}{4} \times \frac{5}{6} = \frac{15}{24} = \frac{5}{8} = 0.625$$

$$0.125 + 0.50 = 0.625$$


Exercise 4g (page 41)

The first number on the left and the first number on the right when added must be equal to the difference of the second number on the left and right side respectively.

1. 

$$0.5 + 0.2 = 0.7$$

$$0.85 - 0.15 = 0.7$$

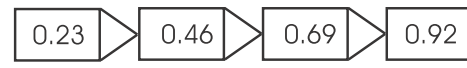
2. 

$$0.35 + 0.15 = 0.50$$

$$1.75 - 1.25 = 0.50$$

Exercise 4h (page 42)

This is clearly an arrangement of numbers and each question has its own pattern.


1. 

$$0.23 \times 1 = 0.23$$

$$0.23 \times 2 = 0.46$$

$$0.23 \times 3 = 0.69$$

$$0.23 \times 4 = 0.92$$

2. 

$$24.8 \div 2 = 12.4 \div 2 = 6.2 \div 2 = 3.1$$

Unit 5: Coding

In coding, we represent letters with numbers and vice versa in order to make pupils reason smart and fast.

Exercise 5a (page 43)

U N I V E R S A L
8 5 3 9 2 6 7 1 4

1. VERSE = 9 2 6 7 2
2. 7214 = S E A L

Exercise 5b (page 44)

E A I U M L T S
0 1 2 3 4 5 6 7

1. AT + SIM = 16 + 724
= 740
2. ALE - EMU = 150 - 043
= 107

Exercise 5c (page 46)

F L A B B E R G A S T E D
5 7 1 2 2 4 8 6 1 9 0 4 3

In this case, we convert the letters to number, perform the operation, find the square root of the result and convert back to the letters.

1. B E D + A F L
= 243 + 157 = $\sqrt{400} = 20$
20 = B T
2. B A T - G G
= 210 - 66 = $\sqrt{144} = 12 = A B$

Exercise 5d (page 47)

F L A B B E R G A S T E D
5 7 1 2 2 4 8 6 1 9 0 4 3

Convert the letters to numbers, perform the operation and convert the result back to letters.

1. B A G \div D G
= 216 \div 36 = 6 = G
2. B B \times F
22 \times 5 = 110 = AAT

Exercise 5e (page 48)

E L A B O R A T E
2 5 9 1 0 6 9 4 2

Convert the letters given to numbers and find the square root.

1. T O O = $\sqrt{400} = 20$
2. A R B = $\sqrt{961} = 31$

Exercise 5f (page 49)

S T R A W B E R R Y
5 6 4 1 7 2 3 4 4 8

Here, we convert the letters to numbers, find their respective square roots and perform the required operations on the result. The answer is then converted to letters.

1. A T + R
 $\sqrt{16} + \sqrt{4} = 4 + 2 = 6 = T$
2. T R + B S
 $\sqrt{64} + \sqrt{25} = 8 + 5 = 13 = A E$

Unit 6: Introduction to Sets and Venn Diagrams (pages 51-54)

Set is a collection of well-defined objects. For example, the numbers of pupils in a class, the number of states in Nigeria, etc.

Examples

1. If X is the set of prime numbers between 20 and 50, then X is _____?

Solution

The prime numbers between 20 and 50 are as follows:
23, 29, 31, 37, 41, 43 and 47

Then

$$X = \{23, 29, 31, 37, 41, 43, 47\}$$

2. If $X = \{2, 4, 6, 8, 10, 12, 14\}$
 $Y = \{3, 6, 9, 12, 15\}$. Find

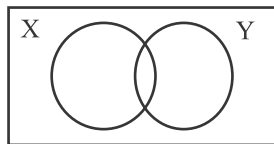
- (a) $X \cup Y$ (b) $X \cap Y$ (c) $X - Y$

Solution

- (a) $X \cup Y =$ Numbers in X and Y
 so that
 $X \cup Y = \{2, 3, 4, 6, 8, 9, 10, 12, 14, 15\}$
- (b) $X \cap Y =$ Numbers common to both
 X and Y.
 $X \cap Y = \{6, 12\}$
- (c) $X - Y =$ Numbers in X but not in Y.
 $X - Y = \{2, 4, 8, 10, 14\}$

Venn Diagram

A venn diagram is used to show the relationship between two or more sets. It is usually in pictorial form which makes use of circles and rectangle.

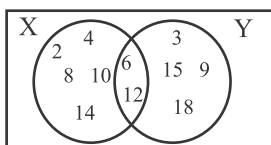


Venn diagram

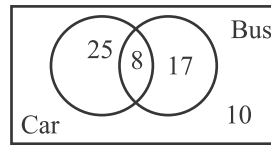
Examples

1. Represent $X = \{2, 4, 6, 8, 10, 12, 14\}$
 and $Y = \{3, 6, 9, 12, 15, 18\}$ in a venn diagram.

Solution



2. Use the venn diagram to answer the questions below.



The diagram above shows the transportation of travellers from one state to another.

- (a) How many travellers used a car?
 (b) How many travellers used a bus only?
 (c) How many travellers used both bus and car?
 (d) How many travellers used neither bus nor car?
 (e) How many travellers were considered?

Solution

- (a) The number of travellers that used car are $25 + 8 = 33$
- (b) The number of travellers that used bus only are those that did not use car which are 17.
- (c) The number of travellers that used bus and car equals 8 (which comprise car and bus in the Venn diagram).
- (d) The number of travellers that used neither bus nor car equals 10 (from the Venn diagram, 10 is not inside any of the circles).
- (e) The total number of travellers
 $= 25 + 8 + 17 + 10 = 60$

Revision Exercises

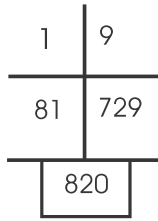
Exercise 1 (page 55)

This is the addition of all the numbers in the first and second row to get the number at the bottom.

1.

8	32	$8 + 32 + 48 + 64 = 152$
48	64	
152		

2.

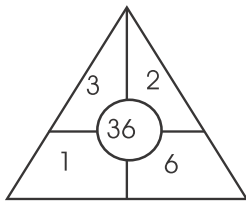


$$1 + 9 + 81 + 729 = 820$$

Exercise 2 (page 57)

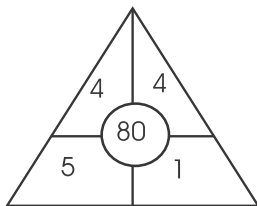
Multiply all the numbers in the triangle to get the number in the middle.

1.



$$1 \times 3 \times 2 \times 6 = 36$$

2.

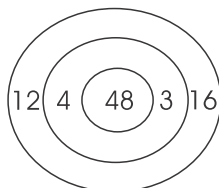


$$5 \times 4 \times 4 \times 1 = 80$$

Exercise 3 (page 58)

In this case, the product of the numbers on the left side must be equal to the product of the numbers on the right side, which is then equal to the number in the middle.

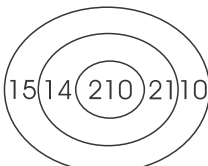
1.



$$12 \times 4 = 48$$

$$3 \times 16 = 48$$

2.



$$15 \times 14 = 210$$

$$21 \times 10 = 210$$

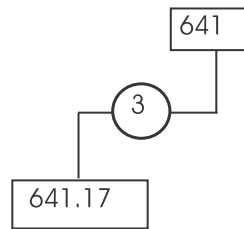
Exercise 4 (page 60)

In this case, approximation of number is being used.

⊗ implies approximation to a significant figure, x stands for the number to be approximated to.

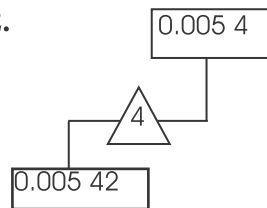
△ implies approximation to decimal places, x stands for the number to be approximated to.

1.



Approximate 641.17 to 3 significant figures which is 641.

2.

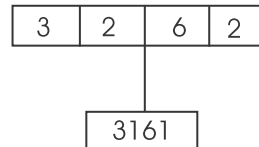


Approximate 0.0054 to 4 significant figures which is 0.0054.

Exercise 5 (page 61)

Arrange the numbers from the highest to the lowest to form one number and then divide by 2 to give the number at the bottom.

1.



$$= \frac{6322}{2}$$

$$= 3161$$

2.

3	4	2
---	---	---

|

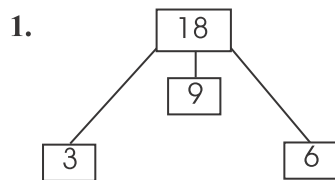
216

$$= \frac{432}{2}$$

$$= 216$$

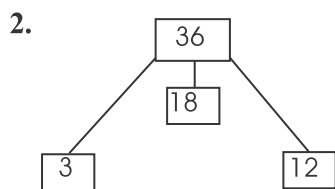
Exercise 6 (page 62)

In this case, we multiply the two numbers at the bottom to get the number at the top, then divide the number at the top by 2 to get the middle number.



$$3 \times 6 = 18$$

$$18 \div 2 = 9$$

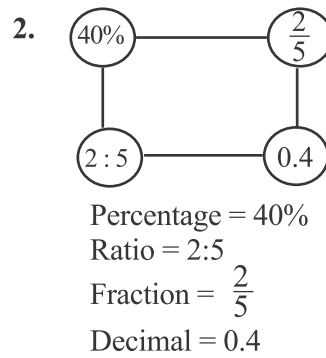
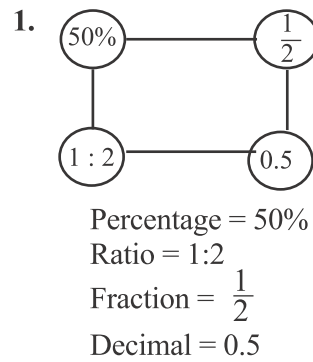
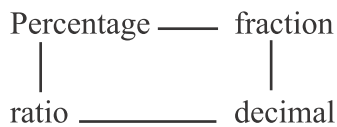


$$3 \times 12 = 36$$

$$36 \div 2 = 18$$

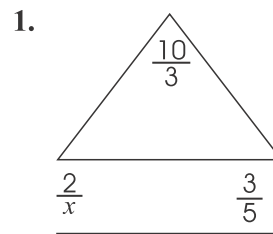
Exercise 7 (page 63)

Here, all the numbers are the same but they are written in this order:



Exercise 8 (page 64)

We equate the two fractions at the bottom to find the unknown letter, which then gives the result on the top of the triangle.



$$\frac{2}{x} = \frac{3}{5}$$

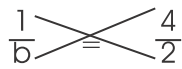
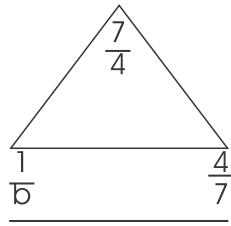
cross multiply

$$3 \times x = 2 \times 5$$

$$\frac{3x}{3} = \frac{10}{3}$$

$$x = \frac{10}{3}$$

2.



cross multiply

$$4 \times b = 7 \times 1$$

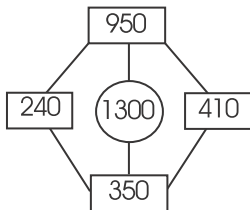
$$\frac{4b}{4} = \frac{7}{4}$$

$$b = \frac{7}{4}$$

Exercise 9 (page 65)

Here, we add the two numbers on the left and right side and multiply by 2 to get the middle number. Also, we add the numbers at the top and bottom to get the middle number.

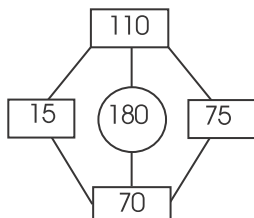
1.



$$\begin{aligned} (240 + 410) \times 2 \\ = 650 \times 2 \\ = 1300 \end{aligned}$$

Also,
 $950 + 350$
 $= 1300$

2.



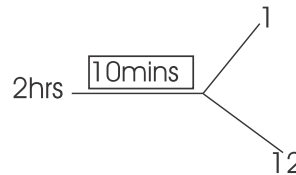
$$\begin{aligned} (15 + 75) \times 2 \\ = 90 \times 2 \\ = 180 \end{aligned}$$

Also,
 $110 + 70$
 $= 180$

Exercise 10 (page 67)

This involves the conversion of units.

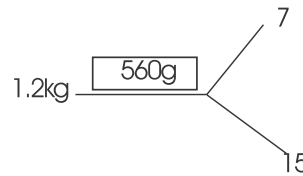
1.



$$\begin{aligned} \frac{1}{12} \times 2 \text{ hrs} &= \frac{1}{12} \times 2 \times 60 \text{ mins} \\ &\text{(since 1 hr = 60 mins)} \end{aligned}$$

$$\frac{1}{12} \times 120 = 10 \text{ mins}$$

2.

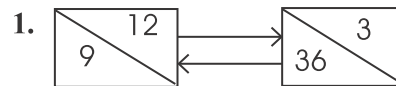


$$\begin{aligned} \frac{7}{15} \times 1.2 \text{ kg} &= \frac{7}{15} \times 1.2 \times 1000 \text{ g} \\ &\text{(since 1 kg = 1000 g)} \end{aligned}$$

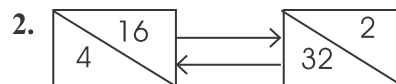
$$\begin{aligned} \frac{7}{15} \times 1200 \text{ g} &= 7 \times 80 \text{ g} \\ &= 560 \text{ g} \end{aligned}$$

Exercise 11 (page 68)

In this case, the product of the numbers on the left side is equal to the product of the numbers on the right side.



$$9 \times 12 = 108; 36 \times 3 = 108$$

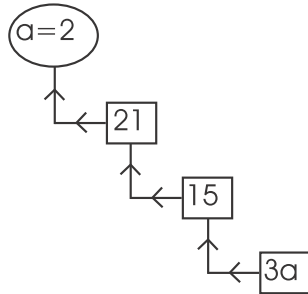


$$4 \times 16 = 64; 32 \times 2 = 64$$

Exercise 12 (page 69)

This involves substitution and then addition of numbers.

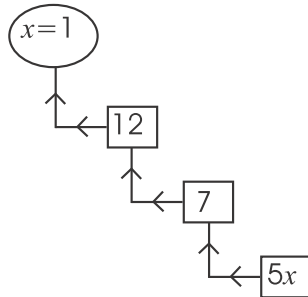
1.



$$3a + 15, a = 2$$

$$3(2) + 15 = 6 + 15 = 21$$

2.



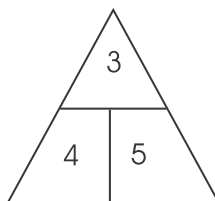
$$5x + 7, x = 1$$

$$5(1) + 7 = 5 + 7 = 12$$

Exercise 13 (page 71)

In this case, we apply the Pythagorean triples.

1.

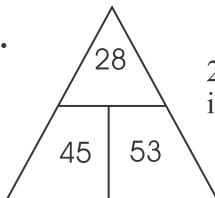


$$3^2 + 4^2 = 5^2$$

i.e. $9 + 16 = 25$

$$25 = 25$$

2.

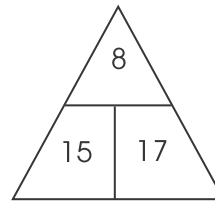


$$28^2 + 45^2 = 53^2$$

i.e. $784 + 2025 = 2809$

$$2809 = 2809$$

3.



$$8^2 + 15^2 = 17^2$$

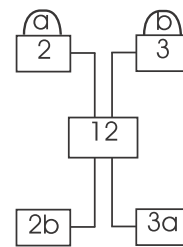
i.e. $64 + 225 = 289$

$$289 = 289$$

Exercise 14 (page 72)

This involves substitution and addition of numbers.

1.

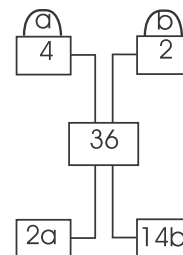


$$2b + 3a, a = 2, b = 3$$

$$= 2(3) + 3(2)$$

$$= 6 + 6 = 12$$

2.



$$2a + 14b, a = 4, b = 2$$

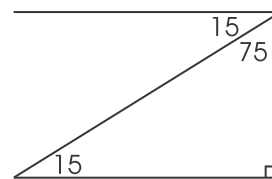
$$= 2(4) + 14(2)$$

$$= 8 + 28 = 36$$

Exercise 15 (page 74)

Here, we deal with right-angled triangles and also alternate angles.

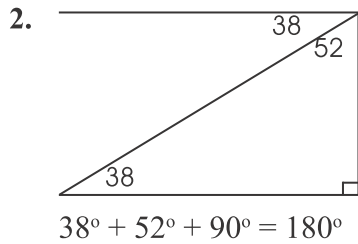
1.



In a right-angled triangle, the sum of the remaining two angles is equal to 90° , since the third side is 90° .

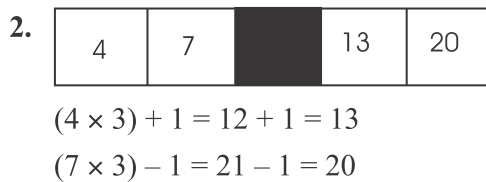
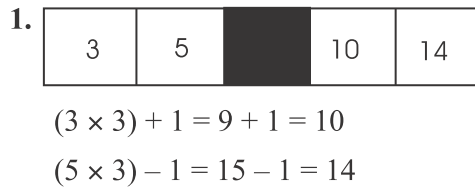
$$\text{So that } 75^\circ + 15^\circ + 90^\circ = 180^\circ$$

Also, $15^\circ = 15^\circ$ (alternate angles are equal in a triangle)



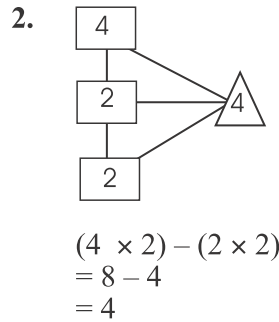
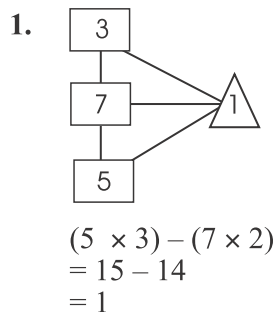
Exercise 16 (page 75)

Multiply the first number on the left hand side by 3 and add 1 to the result to get the first number on the right hand side. Similarly, multiply the second number on the left hand side by 3 and subtract 1 from the result to get the second number on the right hand side.



Exercise 17 (page 77)

The product of the middle number on the left with a constant number 2 is subtracted from the product of the top and bottom numbers on the left to result into the number on the right side.



Exercise 18 (page 78)

Probability is the likelihood of an event occurring. For example when a pregnant woman gives birth, it is either a boy or girl, when students write an examination, they either pass or fail, etc.

Examples

1. If a die is thrown once.
- What is the probability of getting 3?
 - What is the probability of getting a prime number?

Solution

Total outcome when a die is thrown is 6.

- (a) Probability of getting 3

$$= \frac{\text{no. of times 3 appears}}{\text{Total outcome}}$$

$$= \frac{1}{6}$$

- (b) Prime numbers from 1–6 are 2, 3, 5 = 3
Probability of getting a prime number

$$= \frac{3}{6} = \frac{1}{2}$$

2. In a class of 20 pupils, there are 12 girls and the rest are boys. If a pupil is picked at random to answer a question in class, what is the probability that a boy is picked?

Solution

Number of pupils = 20

Number of girls = 12

Number of boys = 20 – 12 = 8

$$\begin{aligned} \text{Probability of boy} &= \frac{\text{number of boys}}{\text{number of pupils}} \\ &= \frac{8}{20} = \frac{2}{5} \end{aligned}$$

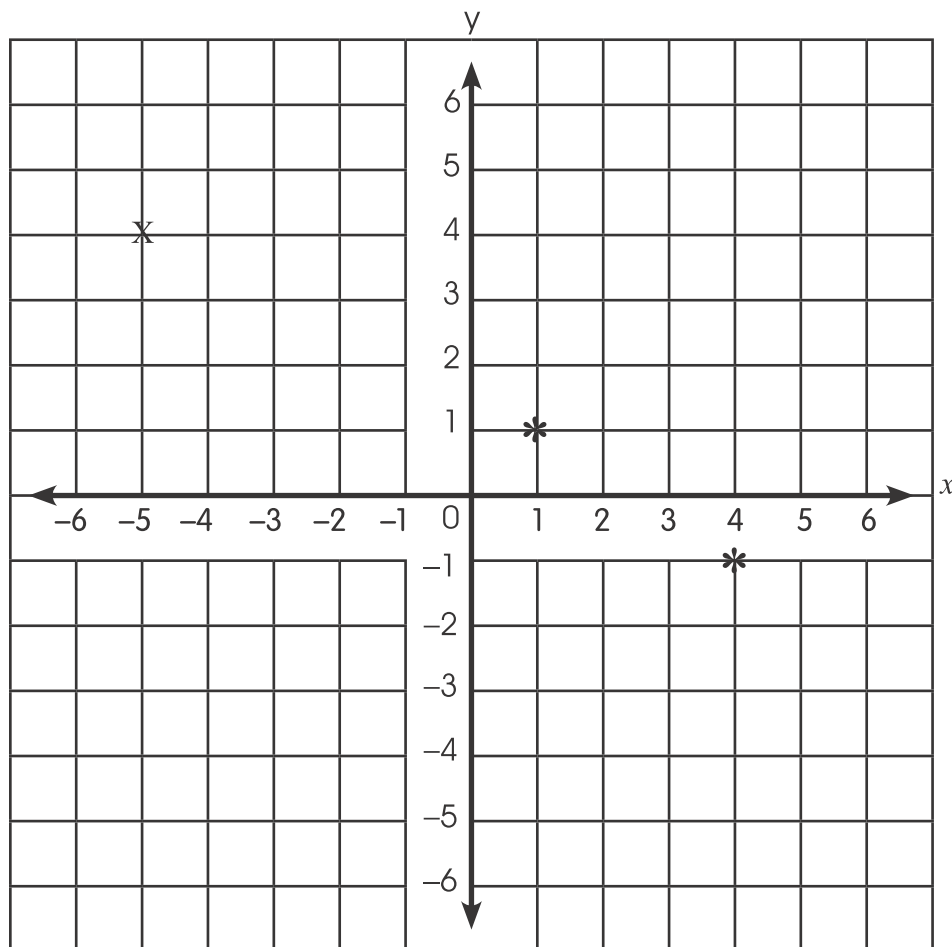
and coordinates) where we are required to locate positions on Cartesian graphs.

Example

Locate and identify the following ordered pairs on the plane.

Exercise 19 and 20 (pages 80 and 81)

Both exercises are combined because they are under the same topic (Cartesian plane)



1. (1, 1) (2) X (3) (4, -1)

2. The point X from the graph is at -5 and 4 and can be written (-5, 4).

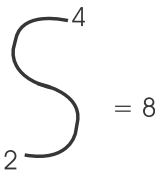
Solution

1. To locate the pair (1,1) from the graph, from the starting point (i.e. 0), move 1 grid line to the right and 1 grid line upward as indicated in the graph with (*).

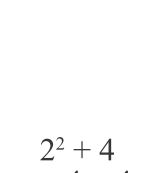
3. To locate the pair (4, -1) from the graph, from the starting, move 4 grid lines to the right and 1 grid line downwards as indicated in the graph with (*).

Exercise 21 (page 82)

Take the square of the number at the bottom and add to the number at the top to arrive at the answer.

1.  = 8

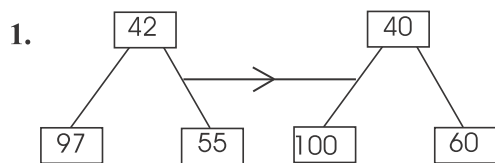
$$2^2 + 4 = 4 + 4 = 8$$

2.  = 38

$$5^2 + 13 = 25 + 13 = 38$$

Exercise 22 (page 83)

Approximate the numbers on the left hand side to the nearest tens. Also, subtraction of the numbers at the bottom gives the number at the top.



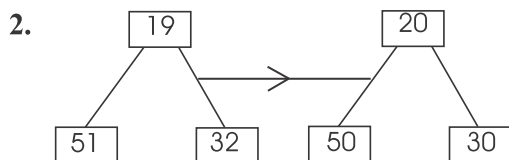
$$97 - 55 = 42; \quad 100 - 60 = 40$$

Also,

$$97 = 100 \text{ (nearest tens)}$$

$$55 = 60 \text{ (nearest tens)}$$

$$42 = 40 \text{ (nearest tens)}$$



$$51 - 32 = 19; \quad 50 - 30 = 20$$

Also,

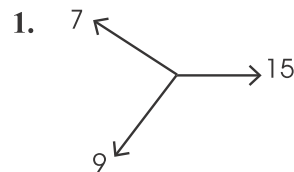
$$51 = 50 \text{ (nearest tens)}$$

$$32 = 30 \text{ (nearest tens)}$$

$$19 = 20 \text{ (nearest tens)}$$

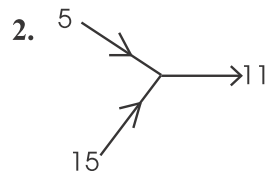
Exercise 23 (page 85)

Same example as given in Exercise 18 above.

Exercise 24 (pages 87)

The numbers on the left hand side are added and a constant number 1 is subtracted from the result to arrive at the number on the right side.

$$(9 + 7) - 1 = 16 - 1 = 15$$

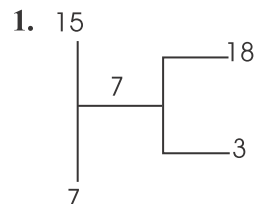


$$(15 - 5) + 1 = 10 + 1 = 11$$

The number at the right side is obtained by adding 1 to the positive difference between the numbers on the left side of the diagram.

Exercise 25 (page 88)

The middle number is obtained by finding the difference between the sum of the numbers on the left and positive difference of the numbers on the right side.



$$(15 + 7) - (18 - 3) = 22 - 15 = 7$$

2. $(24 + 5) - (27 - 9)$
 $= 29 - 18 = 11$

3.

$$(2^2 + 1)^3 = (4 + 1)^3$$

$$= 5^3 = 125$$

Exercise 26 (page 90)

In this case, we find the square of the number at the top, add a constant number 1 to it. After which we raise the result to the power of the middle number to arrive at the number on the right side.

1. $(3^2 + 1)^2 = (9 + 1)^2$
 $= 10^2 = 100$

2. $(2^2 + 1)^2 = (4 + 1)^2$
 $= 5^2 = 25$

Exercise 27 (page 91)

We find the square of the sum of the two numbers at the top to get the middle number; we also multiply the product of the two numbers at the top by a constant number 2 to get the number at the bottom.

1. $(2 + 3)^2 = 5^2$
 $= 25$

$$2 \times (2 \times 3) = 2 \times 6$$

$$= 12$$

2. $(8 + 5)^2 = 13^2$
 $= 169$

$$2 \times (8 \times 5) = 2 \times 40$$

$$= 80$$

Book 6

Solutions to Quantitative Reasoning Book 6

Revision Tests

Exercise 1 (page 1)

- \triangle implies addition
 ∇ implies subtraction

In each case, we add or subtract the numbers term by term (i.e. position by position).

1. $(5,8) \triangle (4,2) \rightarrow (9,10)$

Solution

$(5, 8) \nabla (4, 2) \rightarrow (9, 10)$

We add as follows:

$(5 + 4, 8 + 2) = (9, 10)$

2. $(14,10) \nabla (9,9) \triangle (4,1) \rightarrow (9,2)$

Here, to arrive at $(9, 2)$, we first subtract then add as follows:

$(14, 10) \nabla (9, 9)$ implies
 $(14 - 9, 10 - 9) = (5, 1)$

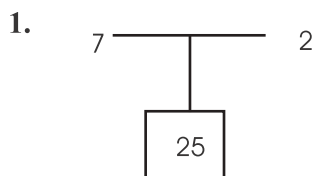
We then have

$(5, 1) \triangle (4, 1) = (5 + 4, 1 + 1)$
 $= (9, 2)$

Exercise 2 (page 2)

To arrive at the number at the bottom, we find the square of the difference between the numbers at the top.

Example



Solution

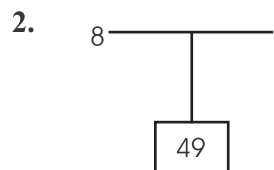
The difference between 7 and 2 equals

$7 - 2 = 5$

The square of 5 = $5^2 = 25$

Thus, we have

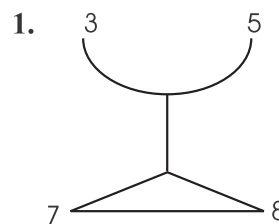
$(7 - 2)^2 = 5^2$
 $= 25$



Solution

$(8 - 1)^2 = 7^2$
 $= 49$

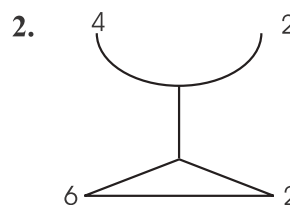
Exercise 3 (page 3)



When we multiply the two numbers at the top (i.e. 3 and 5), the result must be the same as adding the bottom numbers (i.e. 7 and 8).

Therefore:

$3 \times 5 = 7 + 8 = 15$



$4 \times 2 = 6 + 2 = 8$

Exercise 4 (page 5)

$$2! = 2 \times 1 = 2$$

$$3! = 3 \times 2 \times 1 = 6$$

$$4! = 4 \times 3 \times 2 \times 1 = 24$$

$$5! = 5 \times 4 \times 3 \times 2 \times 1 = 120$$

Exercise 5 (page 6)

Add the numbers vertically. The result of adding the numbers on the left hand side must be equal to that of adding the numbers on the right hand side.

1.

2.5	7
3.25	7
11.25	3

$$2.5 + 3.25 + 11.25 = 17$$

$$7 + 7 + 3 = 17$$

2.

3	3
2	5
9	6

$$3 + 2 + 9 = 3 + 5 + 6 = 14$$

Exercise 6 (page 7)

$$6p2 \implies 6^2 \div 2 = \frac{36}{2} = 18$$

$$8p4 \implies 8^2 \div 4 = \frac{64}{4} = 16$$

$$3r2 \implies 3^2 - 1 = 9 - 1 = 8$$

$$4r3 \implies 4^3 - 1 = 64 - 1 = 63$$

Exercise 7 (page 8)

Subtract the sum of the numbers at the top from their product to arrive at the bottom number.

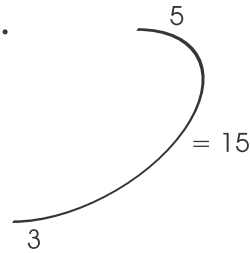
Example

$$1. \quad (3 \times 2) - (3 + 2) = 6 - 5 = 1$$

$$2. \quad (5 \times 7) - (5 + 7) = 35 - 12 = 23$$

Exercise 8 (page 9)

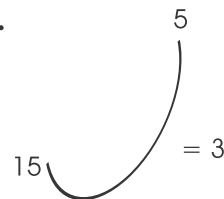
1.



In this case, we multiply 3 by 5 to arrive at 15.

$$\text{i.e. } 3 \times 5 = 15$$

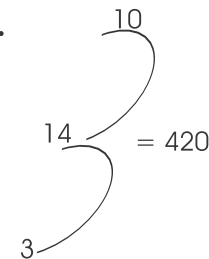
2.



Note that this is an inverted form of the image in example 1 above. Thus, we divide 15 by 5 to arrive at 3.

$$\text{That is } 15 \div 5 = 3$$

3.



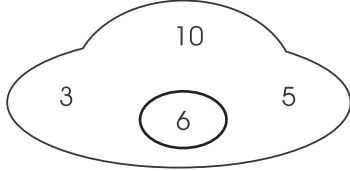
Since the two images here represent multiplication, we multiply the three numbers to arrive at 420

$$\text{That is, } 3 \times 14 \times 10 = 420$$

Exercise 9 (page 11)

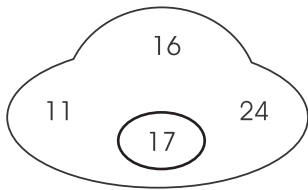
The number at the centre is the mean of the other numbers.

1.



$$\frac{3 + 5 + 10}{3} = \frac{18}{3} = 6$$

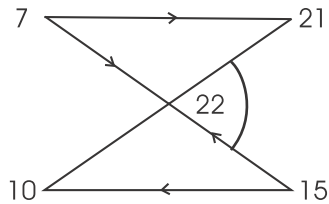
2.



$$\frac{11 + 16 + 24}{3} = \frac{51}{3} = 17$$

Exercise 10 (page 12)

1.

**Solution**

Multiply 7 by 3 to get 21

i.e. $7 \times 3 = 21$

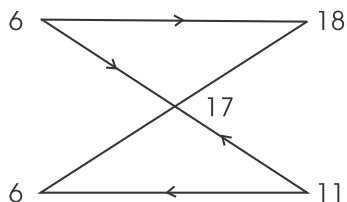
Add 7 to 15 to get 22

i.e. $7 + 15 = 22$

Subtract 5 from 15 to get 10

i.e. $15 - 5 = 10$

2.

**Solution**

Multiply 6 by 3 to get 18

i.e. $6 \times 3 = 18$

Add 6 to 11 to get 17

i.e. $6 + 11 = 17$

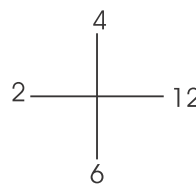
Subtract 5 from 11 to get 6

i.e. $11 - 5 = 6$

Exercise 11 (page 14)

The result of multiplying the numbers on the vertical line must be equal to the result of multiplying the numbers on the horizontal line.

1.

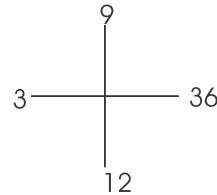


Vertically: $4 \times 6 = 24$

Horizontally: $2 \times 12 = 24$

Thus, $4 \times 6 = 2 \times 12 = 24$

2.



Horizontally: $3 \times 36 = 108$

Vertically: $9 \times 12 = 108$

Thus, $3 \times 36 = 9 \times 12 = 108$

Exercise 12 (page 15)

$$1. \begin{array}{|c} 16 \\ \hline \end{array} \text{ implies } \frac{16 \times 15}{2} = \frac{240}{2}$$

$$2. \begin{array}{|c} 7 \\ \hline \triangle \end{array} \text{ implies } 7 + 6 = 13$$

$$3. \begin{array}{|c} 11 \\ \hline \end{array} \times \begin{array}{|c} 6 \\ \hline \triangle \end{array} = \frac{(11 \times 10)}{2} \times (6 \times 5) \\ = 55 \times 11 \\ = 605$$

Preparatory Exercise 1

Section A (page 17)

1. $6 \oslash 2 = 10$, implies that

$$\begin{aligned} 6 + 2^2 &= 6 + 4 \\ &= 10 \end{aligned}$$

2. $3 \oslash 7 = 52$, implies that

$$\begin{aligned} 3 + 7^2 &= 3 + 49 \\ &= 52 \end{aligned}$$

3. $36 \beta 3 = 2$ implies that

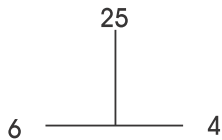
$$\begin{aligned} \sqrt{36} \div 3 &= 6 \div 3 \\ &= 2 \end{aligned}$$

4. $144 \beta 4 = 3$ implies that

$$\begin{aligned} \sqrt{144} \div 4 &= 12 \div 4 \\ &= 3 \end{aligned}$$

Section B (page 17)

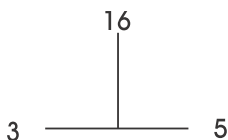
1.



To arrive at 25, divide the sum of 6 and 4 by 2, then square the result.

$$\begin{aligned} \text{That is, } \left(\frac{6+4}{2}\right)^2 &= 5^2 \\ &= 25 \end{aligned}$$

2.



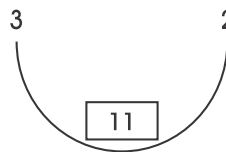
Solution

$$\left(\frac{3+5}{2}\right)^2 = 4^2 = 16$$

Section C (page 19)

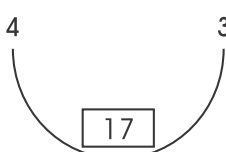
Add 5 to the product of the numbers at the top to arrive at the number at the bottom.

1.



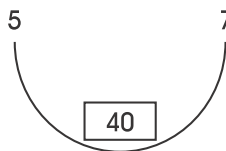
$$\begin{aligned} (3 \times 2) + 5 &= 6 + 5 \\ &= 11 \end{aligned}$$

2.



$$\begin{aligned} (4 \times 3) + 5 &= 12 + 5 \\ &= 17 \end{aligned}$$

3.



$$\begin{aligned} (5 \times 7) + 5 &= 35 + 5 \\ &= 40 \end{aligned}$$

Section D (page 20)

This section involves the arrangement of numbers. Each group of numbers should be studied carefully to determine the operation that is performed in each case. For example,

5, 11, 17, 23, 29

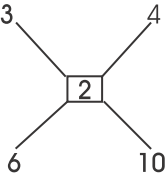
Notice that a constant number, '6' is added to each number across the group.

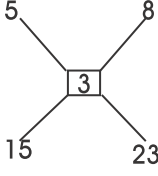
$$\begin{aligned} 5 + 6 &= 11 \\ 11 + 6 &= 17 \\ 17 + 6 &= 23 \\ 23 + 6 &= 29 \end{aligned}$$

Hence, we have

5, 11, 17, 23, 29

Section E (page 20)

1.  Multiply 3 by 2 to get 6,
then add 6 to 4 to get 10
i.e. $3 \times 2 = 6$
 $6 + 4 = 10$

2.  Multiply 5 by 3 to get 15,
then add 15 to 8 to get
23, i.e. $5 \times 3 = 15$
 $15 + 8 = 23$

Section F (page 22)

In this section, numbers are used to represent letters and vice versa.

PUBLISHING
7 9 1 5 4 8 3 4 6 2

1. B L I N G

Let us consider

B represent 1
L represent 5
I represent 4
N represent 6
G represent 2

Therefore, BLING = 15462

2. Consider PLUG – NIB

PLUG = 7592

NIB = 641

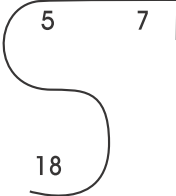
PLUG – NIB = 7592 – 641
= 6951

Section G (page 23)

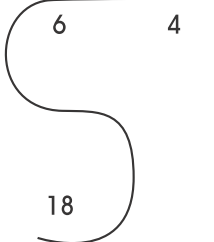
In this section, we write the numbers at the top as a 2-digit number, then interchange the position of each number

to form another 2-digit number, then find their difference to obtain the number at the bottom.

For example,

1. 

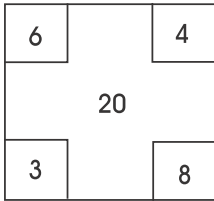
We can write 5 and 7 as 57 and 75
Difference = $75 - 57$
= 18

2. 

We can write 6 and 4 as 64 and 46
Difference = $64 - 46$
= 18

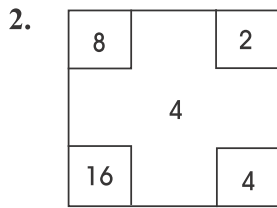
Section H (page 25)

Examples

1. 

Multiply 6 by 8, divide the result by 3 and add 4 to it to get 20.

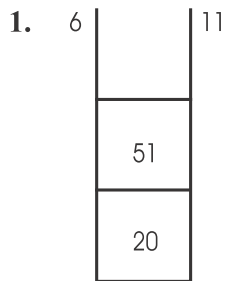
That is, $\frac{6 \times 8}{3} + 4 = \frac{48}{3} + 4$
= $16 + 4$
= 20



Using the same approach, we have

$$\begin{aligned} \frac{8 \times 4}{16} + 2 &= \frac{32}{16} + 2 \\ &= 2 + 2 \\ &= 4 \end{aligned}$$

Section I (page 31)



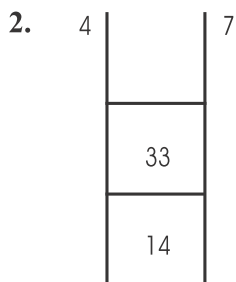
In this example, the determining factors are 6 and 11.

Add 6 to 11, then add 3 to the result to obtain 20.

Also, add 6 to 11, then multiply the result by 3 to obtain 51.

That is,

$$\begin{aligned} (6 + 11) + 3 &= 17 + 3 = 20 \\ (6 + 11) \times 3 &= 17 \times 3 = 51 \end{aligned}$$



$$\begin{aligned} (4 + 7) + 3 &= 11 + 3 = 14 \\ (4 + 7) \times 3 &= 11 \times 3 = 33 \end{aligned}$$

Preparatory Exercise 2

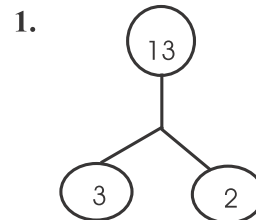
Section A (page 28)

Multiply the number on the left hand side by 3.

Multiply the number on the right hand side by 2.

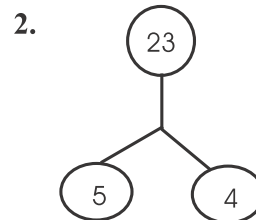
Add the results to obtain the number at the top.

Examples



To arrive at 13, multiply 3 by 3 and 2 by 2, then add the results.

$$\begin{aligned} 3 \times 3 &= 9, 2 \times 2 = 4 \\ 9 + 4 &= 13 \end{aligned}$$



$$\begin{aligned} 5 \times 3 &= 15, 4 \times 2 = 8 \\ 15 + 8 &= 23 \end{aligned}$$

Section B (page 29)

In this section, we have to study each set of numbers and discover the operations between them.

For the first example,

$$(5:10) \quad (7:14) \quad (9:18)$$

Note that in each box, the number on the right hand side is the second multiple of the number on the left hand side.

That is, $10 = 5 \times 2$
 $14 = 7 \times 2$
 $18 = 9 \times 2$

Also, for the second example,

$(169:13)$ $(144:12)$ $(100:10)$

Note that in each box, the number on the left hand side is the square of the number on the right hand side.

That is, $169 = 13^2 = 13 \times 13$
 $144 = 12^2 = 12 \times 12$
 $100 = 10^2 = 10 \times 10$

Section C (page 29)

In this section, the result of multiplying the number in the top left box by the number in the bottom right box must be the same as the result of multiplying the number in the top right box by the number in the bottom left box.

1.

3	4
6	8

$3 \times 8 = 24$
 $6 \times 4 = 24$
Thus, $3 \times 8 = 6 \times 4 = 24$

2.

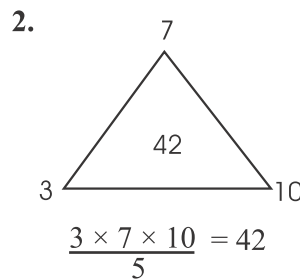
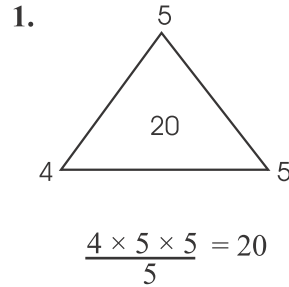
5	7
25	35

$5 \times 35 = 175$
 $7 \times 25 = 175$
Thus, $5 \times 35 = 7 \times 25 = 175$

Section D (page 30)

Find the product of the numbers at the edges of the triangle and divide the result by 5.

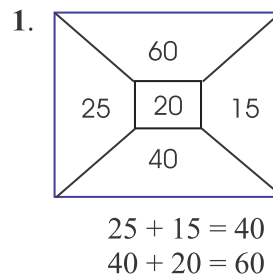
Examples

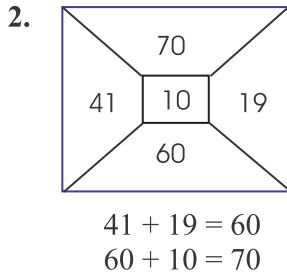


Section E (page 31)

Add the number on the left hand side to the number on the right hand side to obtain the number at the bottom, then add the number at the bottom to the number at the centre to arrive at the number at the top.

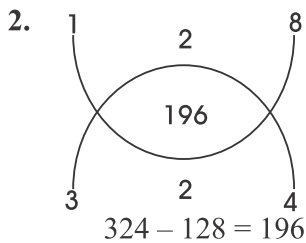
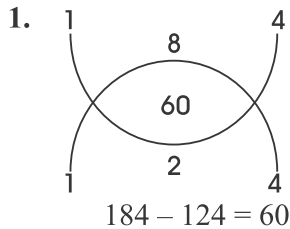
Examples





Section F (page 32)

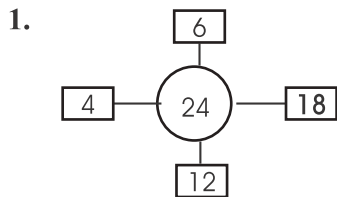
Put the three digits at the top together to form one number. Also, put the three digits at the bottom together to form one number. Find the difference between these two newly formed numbers. The result is the number at the centre.



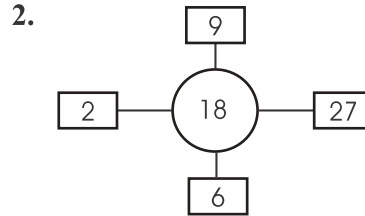
Section G (page 33)

The product of the left and right hand side numbers must be equal to the product of the top and bottom numbers. This product is then divided by 3 to get the middle number.

Examples

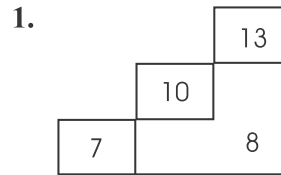


Horizontally: $4 \times 18 = 72$
 Vertically: $6 \times 12 = 72$
 Therefore, $6 \times 12 = 4 \times 18 = 72$
 $\frac{72}{3} = 24$



Horizontally: $2 \times 27 = 54$
 Vertically: $9 \times 6 = 54$
 Therefore, $9 \times 6 = 2 \times 27 = 54$
 $\frac{54}{3} = 18$

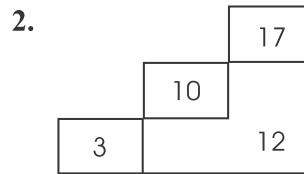
Section H (page 34)



7, 10 and 13 have a common difference of 3. That is $7 + 3 = 10$, and $10 + 3 = 13$.

Now, to get 8, divide the middle number (10) by 2 and subtract the result from 13. That is,

$$13 - \left(\frac{10}{2}\right) = 13 - 5 = 8$$

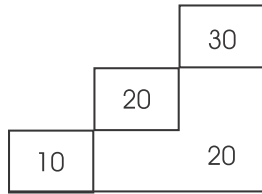


The common difference is 7. $3 + 7 = 10$, and $10 + 7 = 17$

Now, to get 12,

$$17 - \left(\frac{10}{2}\right) = 17 - 5 = 12$$

3.

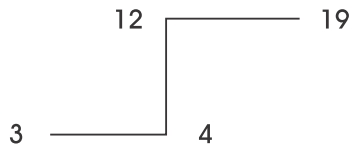


The common difference is 10.
 $10 + 10 = 20$, $20 + 10 = 30$
 Now, to get 20.

$$30 - \left(\frac{20}{2}\right) = 30 - 10 = 20$$

Section I (page 35)

1.



Here, we multiply 3 by 4 to get 12, then add 3, 4 and 12 to get 19.

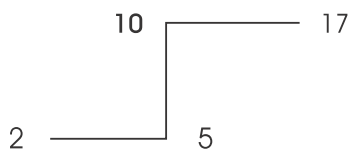
That is,

$$3 \times 4 = 12$$

Then,

$$3 + 4 + 12 = 19$$

2.



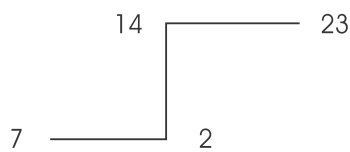
Using the same approach, we have

$$2 \times 5 = 10$$

Then,

$$2 + 5 + 10 = 17$$

3.



$$7 \times 2 = 14,$$

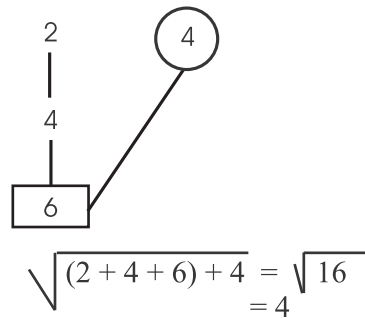
$$7 + 2 + 14 = 23$$

Preparatory Exercise 3

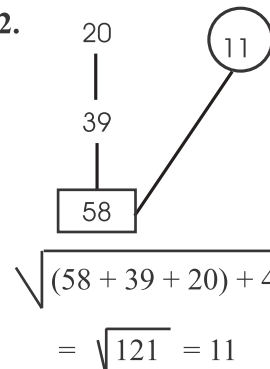
Section A (page 37)

In this section, to get the value of the circled number, we add a constant number (4) to the sum of the other numbers and find the square root of the result.

1.

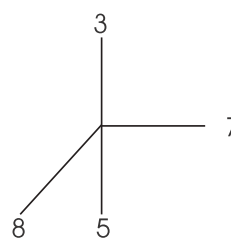


2.



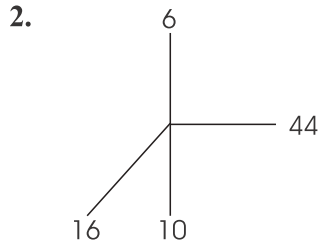
Section B (page 38)

1.



The result of adding 8 to 7 is the same as the result of multiplying 3 by 5.

$$3 \times 5 = 8 + 7 = 15$$



The result of adding 16 to 44 is the same as the result of multiplying 6 and 10.
 $6 \times 10 = 16 + 44 = 60$

Section C (page 39)

In this section, we first substitute the value of the given letters, then solve the expression.

Given that $m = 6$, $n = 5$, $p = 4$

1. $m + n$

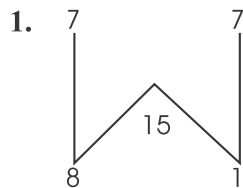
To get the value of $m + n$, we substitute $m = 6$ and $n = 5$ in the expression.

$$m + n = 6 + 5 = 11$$

2. $p + n = 4 + 5$
 $= 9$

3. $m + n - p = 6 + 5 - 4$
 $= 11 - 4$
 $= 7$

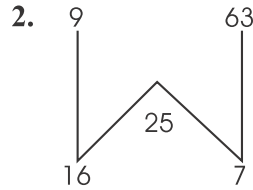
Section D (page 40)



Steps

Add 7 to 8 to get 15
 Multiply 7 by 1 to get 7

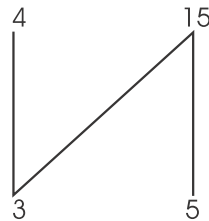
That is,
 $7 + 8 = 15$ and $7 \times 1 = 7$



Add 9 to 16 to get 25
 Multiply 9 by 7 to get 63

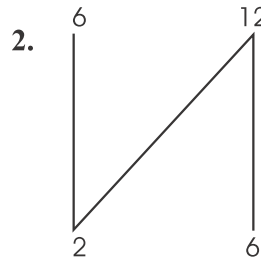
That is,
 $9 + 16 = 25$
 $9 \times 7 = 63$

Section E (page 41)



Multiply 3 by 5 to get 15, then subtract 3 from 5 and add 2 to the result to get 4.

That is,
 $3 \times 5 = 15$
 $(5 - 3) + 2 = 2 + 2 = 4$



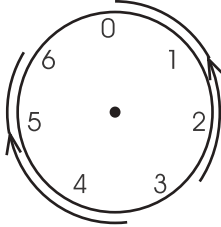
Multiply 2 by 6 to get 12, then subtract 2 from 6 and add 2 to the result to get 6.

That is,
 $2 \times 6 = 12$
 $(6 - 2) + 2 = 6$

Section F (page 42)

R \rightarrow clockwise direction

S \rightarrow anticlockwise direction



1. $4 \textcircled{R} 4$

To solve this question, using the diagram above, we start counting in the clockwise direction from 4 to the next four numbers. That is,

$$4 \textcircled{R} 4 = 1$$

2. $2 \textcircled{S} 5$

To solve this question, using the diagram above, we start counting from 2 in anticlockwise direction to the next 5 numbers. That is,

$$2 \textcircled{S} 5 = 4$$

3. $3 \textcircled{R} 1 \textcircled{S} 6$

We solve this by taking two at a time.

That is

$$3 \textcircled{R} 1 = 6$$

Then, $6 \textcircled{S} 6 = 5$

Therefore, $3 \textcircled{R} 1 \textcircled{S} 6 = 5$

Section G (page 43)

In this section, the following operations are carried out:

- i. Find the square of the difference between the two numbers at the top to get the bottom right number.
- ii. Multiply the top right number by 2 to get the middle number.
- iii. Find the square of the top right number to get the bottom left number.

Examples

1.
$$(10 - 9)^2 = 1^2 = 1$$

$$10 \times 2 = 20$$

$$10^2 = 100$$

2.
$$(6 - 4)^2 = 2^2 = 4$$

$$4 \times 2 = 8$$

$$4^2 = 16$$

Section H (page 44)

Δ implies last number out.

∇ implies first number out.

1. $2 \Delta 7 = 2$

We have the result as 2 because Δ means that we should delete the last number.

2. $6 \Delta 12 = 6$

3. $8 \nabla 4 = 4$

4. $20 \nabla 1 = 1$

5. $3 \Delta 6 \nabla 9$

To solve this, we will first solve the first two numbers, then use the result with the third number.

$3 \Delta 6$ means delete 6

That is $3 \Delta 6 = 3$

Then we have $3 \nabla 9$ which means delete 3

Then, $3 \nabla 9 = 9$

Therefore, $3 \Delta 6 \nabla 9 = 9$

Preparatory Exercise 4

Section A (page 45)

$$1. \begin{array}{|c|} \hline 2 \qquad 3 \\ \hline 4 \qquad 9 \\ \hline \end{array} = (7, 18)$$

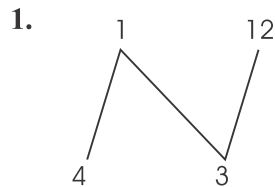
To arrive at (7, 18), we add 4 and 3 to get 7, then multiply 2 by 9 to get 18.

That is, $(4 + 3, 2 \times 9) = (7, 18)$

$$2. \begin{array}{|c|} \hline 3 \qquad 5 \\ \hline 4 \qquad 6 \\ \hline \end{array} = (9, 18)$$

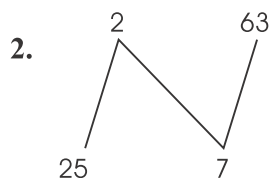
This implies that,
 $(4 + 5, 3 \times 6) = (9, 18)$

Section B (page 46)



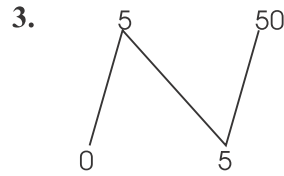
In this example, to arrive at 12, we first find the square root of 4, then add two times of 1 to it. The result is then multiplied by 3.

That is, $(\sqrt{4} + (2 \times 1)) \times 3 = (2 + 2) \times 3 = 12$



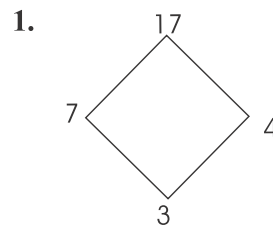
Using the same approach as in example 1, to get 63, we have,

$$\begin{aligned} & (\sqrt{25} + (2 \times 2)) \times 7 \\ & = (5 + 4) \times 7 \\ & = 9 \times 7 = 63 \end{aligned}$$



$$\begin{aligned} & (\sqrt{0} + (2 \times 5)) \times 5 \\ & = (0 + 10) \times 5 \\ & = 10 \times 5 = 50 \end{aligned}$$

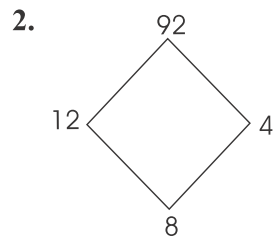
Section C (page 47)



In this example, multiply 7 by 3, then subtract 4 from the result to get 17.

That is,

$$\begin{aligned} & (7 \times 3) - 4 \\ & = 21 - 4 \\ & = 17 \end{aligned}$$

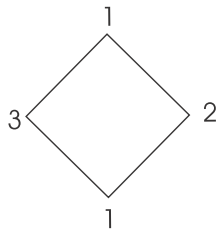


Multiply 12 by 8, then subtract 4 from the result.

That is,

$$\begin{aligned} & (12 \times 8) - 4 \\ & = 96 - 4 \\ & = 92 \end{aligned}$$

3.



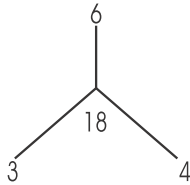
Multiply 3 by 1, then subtract 2 from the result.

That is,

$$\begin{aligned} (3 \times 1) - 2 \\ = 3 - 2 \\ = 1 \end{aligned}$$

Section D (page 48)

1.

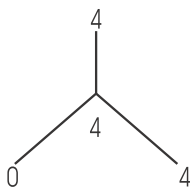


Multiply 3 by 4 and add 6 to the result to get 18.

That is,

$$\begin{aligned} (3 \times 4) + 6 = 12 + 6 \\ = 18 \end{aligned}$$

2.

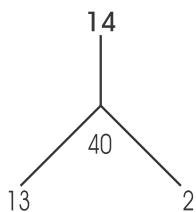


Multiply 0 by 4 and add 4 to the result.

That is,

$$(0 \times 4) + 4 = 4$$

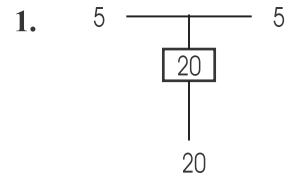
3.



Multiply 13 by 2 and add 14 to the result.

$$\begin{aligned} (13 \times 2) + 14 \\ = 26 + 14 \\ = 40 \end{aligned}$$

Section E (page 49)



In this example, there are two constants and two variables. The two top numbers are the constant and with some operations performed, we will get the other number as follows.

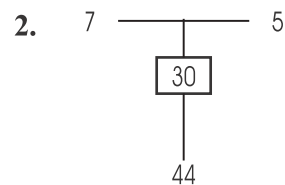
Firstly, find the square of 5 and subtract 5 from it to get 20.

$$5^2 - 5 = 25 - 5 = 20$$

Also,

Subtract 1 from 5, then multiply it by 5 to get 20. That is,

$$\begin{aligned} (5 - 1) \times 5 = 4 \times 5 \\ = 20 \end{aligned}$$



Step 1: Find the square of 7, then subtract 5 from it.

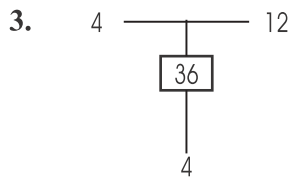
That is,

$$\begin{aligned} 7^2 - 5 = 49 - 5 \\ = 44 \end{aligned}$$

Step 2: Subtract 1 from 7, then multiply the result by 5.

That is,

$$\begin{aligned} (7 - 1) \times 5 = 6 \times 5 \\ = 30 \end{aligned}$$



Step 1: $4^2 - 12 = 16 - 12 = 4$

Step 2: $(4 - 1) \times 12 = 3 \times 12 = 36$

Section F (page 50)

This section involves representing numbers with letters.

For example, if 214 represent the word 'SAW', what number represents the word 'WAS'.

Solution

214 represents SAW
 implies that $2 \rightarrow S$
 $1 \rightarrow A$
 $4 \rightarrow W$

Thus, WAS = 412.

Section G (page 51)

This section involves addition of numbers. The numbers in the first box are added to the numbers in the second box position by position.

Examples

1.
$$\begin{bmatrix} 2 & 1 \\ 3 & 2 \end{bmatrix} + \begin{bmatrix} 4 & 2 \\ 1 & 2 \end{bmatrix} = \begin{bmatrix} 2+4 & 2+1 \\ 3+1 & 2+2 \end{bmatrix}$$

$$= \begin{bmatrix} 6 & 3 \\ 4 & 4 \end{bmatrix}$$

2.
$$\begin{bmatrix} 2 & 1 \\ 1 & 0 \end{bmatrix} + \begin{bmatrix} 2 & 2 \\ 2 & 2 \end{bmatrix} = \begin{bmatrix} 2+2 & 1+2 \\ 1+2 & 0+2 \end{bmatrix}$$

$$= \begin{bmatrix} 4 & 3 \\ 3 & 2 \end{bmatrix}$$

Section H (page 52)

This section involves the arrangement of numbers in different forms.

Example

(3, 15); (8, 18); (13, 21); (x, 24) are number pairs. What does x stand for.

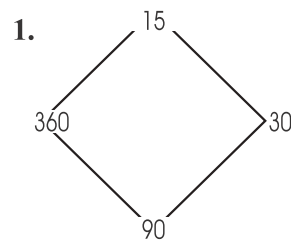
Solution

Notice the difference between the numbers in the first position in each pair.

3, 8, 13, x.
 $3 + 5 = 8$; $8 + 5 = 13$,
 Definitely, $x = 13 + 5 = 18$

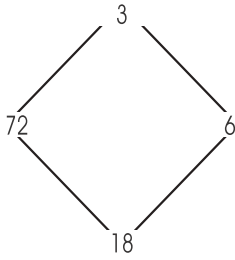
Preparatory Exercise 5

Section A (page 53)



Note that 30, 90 and 360 are multiples of 15. That is,
 $15 \times 2 = 30$
 $15 \times 6 = 90$
 $15 \times 24 = 360$

2.



6, 18 and 72 are multiples of 3.

$$3 \times 2 = 6$$

$$3 \times 6 = 18$$

$$3 \times 24 = 72$$

Section B (page 54)

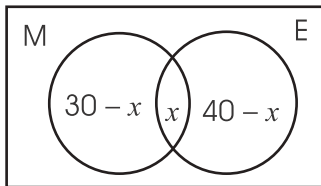
This section uses a Venn diagram to represent the number of boys in a class and their favourite sports.

A Venn diagram is a diagram used to represent the relationship between two or more sets. For example:

In a school, there are 50 boys in JSS 1, if 30 boys like Mathematics and 40 boys like English, how many boys like both Mathematics and English.

Solution

We represent the information on a Venn diagram as follows.



Let the number of boys that like both Mathematics and English be x .

Let the number of boys that like only Mathematics = $30 - x$

Number of boys that like only English = $40 - x$.

Total number of students = 50

This implies that,

$$(30 - x) + (40 - x) + x = 50$$

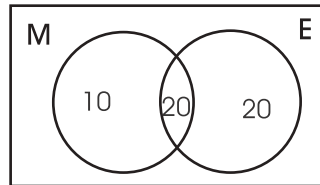
$$30 + 40 - 2x + x = 50$$

$$70 - 50 = x$$

$$x = 20$$

The number of students that like both Mathematics and English = 20

Thus, we have



Section C (page 55)

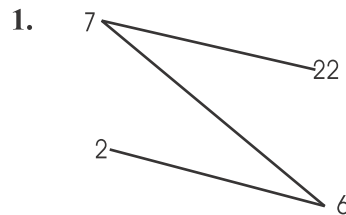
Square the second number on the left hand side and subtract the first number from the result to get the number on the right hand side.

$$1. \quad 7A4 \rightarrow 4^2 - 7 \\ = 16 - 7 = 9$$

$$2. \quad 6A6 \rightarrow 6^2 - 6 \\ = 36 - 6 = 30$$

$$3. \quad 8A3 \rightarrow 3^2 - 8 \\ = 9 - 8 = 1$$

Section D (page 55)

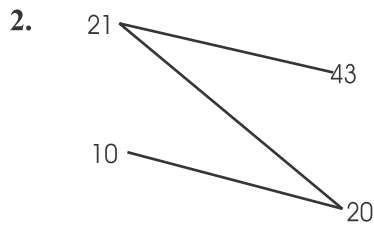


Subtract 1 from 22, then multiply the result by 2 to get the product of 6 and 7.

That is,

$$((22 - 1) \times 2) = 7 \times 6$$

$$21 \times 2 = 7 \times 6 = 42$$



$$\begin{aligned} ((43 - 1) \times 10) &= 21 \times 20 \\ 42 \times 10 &= 21 \times 20 = 420 \end{aligned}$$

Section E (page 55)

We use letters to represent numbers.

EXAMINATION

2 8 1 4 3 5 1 7 3 6 5

$$A = 1$$

$$E = 2$$

$$I = 3$$

$$M = 4$$

$$N = 5$$

$$O = 6$$

$$T = 7$$

$$X = 8$$

For example, find the number represented by MOTION.

Solution

Since $M = 4$, $O = 6$, $T = 7$, $I = 3$ and $N = 5$
 MOTION = 467365

Section F (page 57)

$$1. \quad 5 \textcircled{R} 2 = \frac{5+2}{5-2} = \frac{7}{3}$$

$$2. \quad 8 \textcircled{C} 6 = \frac{8-6}{2} \div \frac{8+6}{2}$$

$$= \frac{2}{2} \div \frac{14}{2}$$

$$= 1 \div 7 \rightarrow \frac{1}{7}$$

Section G (page 58)

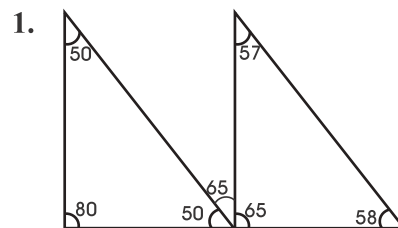
In this section, we are expected to study the given diagram carefully and answer the questions that follows.

Section H (page 59)

The sum of the angles in each triangle must be equal to 180.

Also, the sum of the angles on the straight line joining the two triangles must be equal to 180.

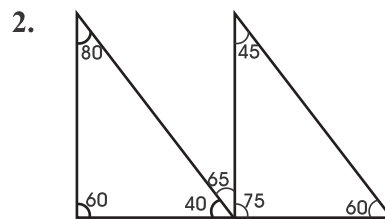
Example



For the first triangle:
 $50 + 50 + 80 = 180$

For the second triangle:
 $57 + 58 + 65 = 180$

For the straight line
 $50 + 65 + 65 = 180$



For the first triangle:
 $80 + 60 + 40 = 180$

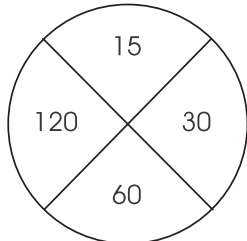
For the second triangle:
 $75 + 45 + 60 = 180$

For the straight line
 $40 + 65 + 75 = 180$

Preparatory Exercise 6

Section A (page 62)

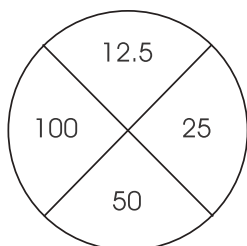
1.



Multiply 15 by 2 to get 30
 Multiply 30 by 2 to get 60
 Multiply 60 by 2 to get 120

i.e. $15 \times 2 = 30$
 $30 \times 2 = 60$
 $60 \times 2 = 120$

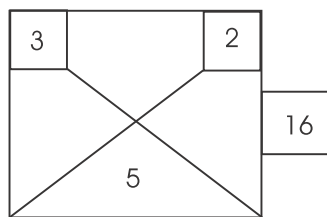
2.



$12.5 \times 2 = 25$
 $25 \times 2 = 50$
 $50 \times 2 = 100$

Section B (page 63)

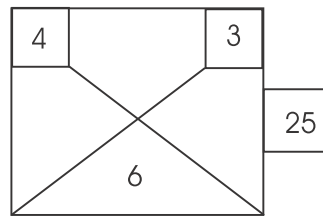
1.



To arrive at 16, we find the square of 3, then add 2 and 5 to it. That is,

$3^2 + 2 + 5$
 $= 9 + 2 + 5$
 $= 16$

2.



$4^2 + 3 + 6$
 $= 16 + 3 + 6$
 $= 25$

Section C (page 64)

$P] Q$ implies $\frac{P+Q}{2}$

$P [Q$ implies $\frac{P-Q}{2}$

To solve $3] (4 [2)$

We will first solve the one in the brackets,

That is,

$4 [2 = \frac{4-2}{2} = \frac{2}{2} = 1$

Then,

$3] 1 = \frac{3+1}{2} = \frac{4}{2} = 2$

Section D (page 65)

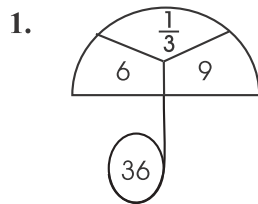
In this section, $P \Delta Q = \frac{P+Q}{P}$

That is, $2 \Delta 4 = \frac{2+4}{2} = \frac{6}{2} = 3$

Also, $P \nabla Q = \frac{P-Q}{Q}$

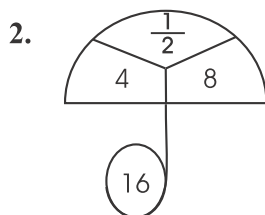
That is, $8 \nabla 2 = \frac{8-2}{2} = \frac{6}{2} = 3$

Section E (page 65)



Divide 6 by 9 to get $\frac{1}{3}$ then find the square of 6 to get 36.

$$\text{That is, } \frac{6}{9} = \frac{1}{3}; 6^2 = 36$$



$$\frac{4}{8} = \frac{1}{2}; 4^2 = 16$$

Section F (page 65)

In this section, we are expected to study the given Venn diagram and use the information to answer the questions that follows.

Section G (page 67)

To arrive at the number on the right hand side, we find the square of the first number on the left hand side, subtract 1 from the second number on the left hand side and multiply their results.

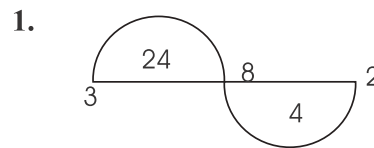
Example

1. $3 \otimes 4 = 3^2 \times (4 - 1)$
 $= 9 \times 3$
 $= 27$

2. $5 \otimes 4 = 5^2 \times (4 - 1)$
 $= 25 \times 3 = 75$

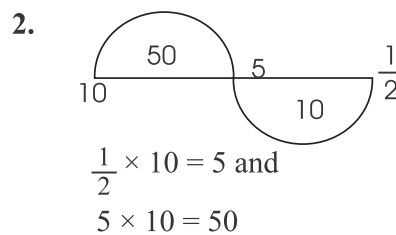
3. $4 \otimes 4 = 4^2 \times (4 - 1)$
 $= 16 \times 3 = 48$

Section H (page 68)

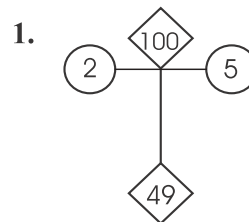


Multiply 2 by 4 to get 8, then multiply 8 by 3 to get 24.

$$\text{That is, } 2 \times 4 = 8 \text{ and} \\ 8 \times 3 = 24$$



Section I (page 69)



Find the square of the sum of 5 and 2 to get 49. Also, find the square of their product to get 100.

$$\text{That is,} \\ (2 + 5)^2 = 7^2 \\ = 49$$

$$\text{Also,} \\ (2 \times 5)^2 = 10^2 \\ = 100$$

Preparatory Exercise 7

Section A (page 70)

This section involves the arrangement of numbers using different methods.

For example,

Find the next three terms in the given set of numbers.
100, 81, 64

Solution

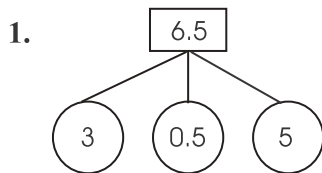
Note that

$$\begin{aligned} 100 &= 10^2 \\ 81 &= 9^2 \\ 64 &= 8^2 \end{aligned}$$

This implies that the next three set of numbers will be 7^2 , 6^2 and 5^2

That is,
100, 81, 64, 49, 36, 25

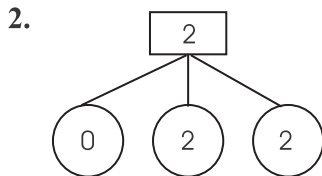
Section B (page 70)



Multiply 3 by 0.5, then add 5 to the result to get 6.5.

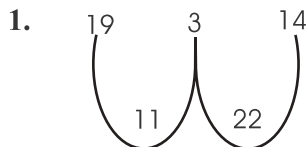
That is,

$$\begin{aligned} (3 \times 0.5) + 5 \\ = 1.5 + 5 = 6.5 \end{aligned}$$



$$\begin{aligned} (0 \times 2) + 2 \\ = 0 + 2 = 2 \end{aligned}$$

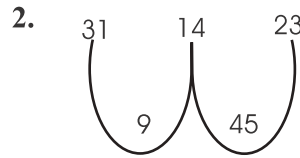
Section C (page 72)



Add 3 to 19 to get 22 and subtract 3 from 14 to get 11.

That is,

$$\begin{aligned} 19 + 3 &= 22 \text{ and} \\ 14 - 3 &= 11 \end{aligned}$$



$$\begin{aligned} 31 + 14 &= 45 \\ 23 - 14 &= 9 \end{aligned}$$

Section D (page 73)

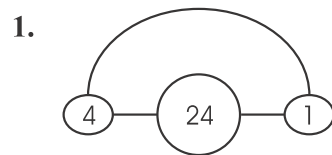
d implies multiplication
p implies division

1.
$$\frac{27 \text{ d } 2}{9 \text{ p } 3} = \frac{27 \times 2}{9 \div 3} = \frac{54}{3} = 18$$

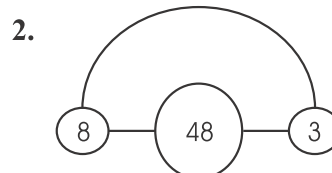
2.
$$\frac{16 \text{ d } 3}{24 \text{ p } 6} = \frac{16 \times 3}{24 \div 6} = \frac{48}{4} = 12$$

Section E (page 73)

Add 1 to the number on the right and interchange its position with the number on the left to make up the 2-digit number in the middle.



$1 + 1 = 2$, then merge it with 4 to get 24.

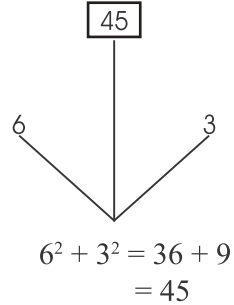


Since $3 + 1 = 4$, we have 48.

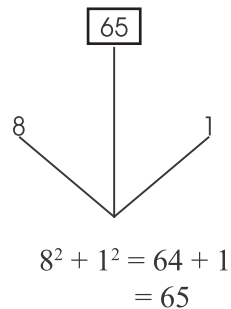
Section F (page 74)

To get the number at the top, find the sum of the squares of the other two numbers.

Example

1. 

$$6^2 + 3^2 = 36 + 9 = 45$$

2. 

$$8^2 + 1^2 = 64 + 1 = 65$$

Section G (page 75)

In this section, \ominus means finding the square of the difference between the numbers on the left hand side to get the numbers on the right hand side.

\ominus means finding the square of the sum of the numbers on the left hand side to get the numbers on the right hand side.

Example

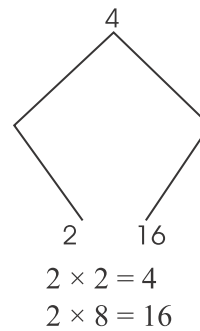
1. $12 \ominus 7 = (12 - 7)^2$
 $= 5^2$
 $= 25$

2. $2 \ominus 4 = (2 + 4)^2$
 $= 6^2$
 $= 36$

Section H (page 76)

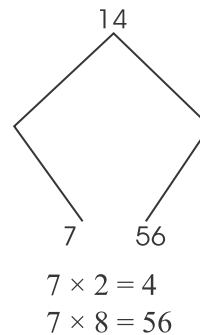
Multiply the number at the bottom left position by 2 to get the number at the top position. Also, multiply the same number by 8 to get the number at the bottom right position.

Example

1. 

$$2 \times 2 = 4$$

$$2 \times 8 = 16$$

2. 

$$7 \times 2 = 14$$

$$7 \times 8 = 56$$

Preparatory Exercise 8**Section A (page 77)**

1.

2	15
5	
18	1

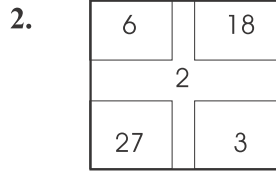
Observe that the result of subtracting 2 from 18 is the same as that of adding 1 to 15.

That is, $18 - 2 = 15 + 1$
 $= 16$

Now, to get 5

Divide 15 by the sum of 2 and 1.

$$\text{That is, } \frac{15}{2+1} = \frac{15}{3} = 5$$





$$27 - 6 = 18 + 3$$


$$= 21$$

$$\frac{18}{6+3} = \frac{18}{9} = 2$$

Section B (page 78)

1.  means $\frac{5+2}{5-2} = \frac{7}{3} = 2\frac{1}{3}$

2.  means $\frac{7 \times 2}{7+2} = \frac{14}{9} = 1\frac{5}{9}$

3. Find x if  = $1\frac{2}{3}$

Solution

To solve this, we know that

$$\begin{aligned} \triangle x &= \frac{x+2}{x-2} = 1\frac{2}{3} \\ &= \frac{x+2}{x-2} = \frac{5}{3} \end{aligned}$$

Cross multiply to get

$$3(x+2) = 5(x-2)$$

$$3x+6 = 5x-10$$

Collect like terms

$$5x-3x = 10+6$$

$$2x = 16$$

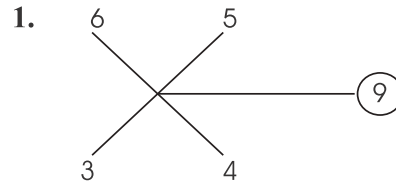
$$x = \frac{16}{2} = 8$$

Therefore, $x = 8$

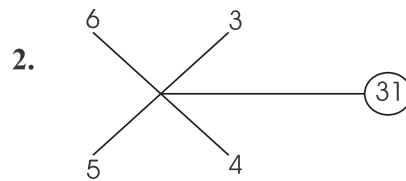
Section C (page 78)

Combine the numbers on the left hand side to form a 2-digit number; also, combine the numbers on the right hand side to form a 2-digit number. Find the difference between the newly formed numbers to get the number at the circle.

Example



$$63 - 54 = 9$$



$$65 - 34 = 31$$

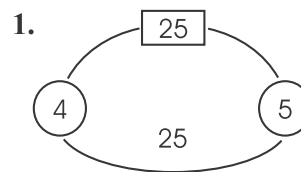
Section D (page 80)

1. $5 @ 2 \rightarrow (5 \times 2) + 2$
= 12

2. $9 @ 3 \rightarrow (9 \times 3) + 3$
= 27 + 3
= 30

3. $7 @ 4 \rightarrow (7 \times 4) + 4$
= 28 + 4
= 32

Section E (page 81)



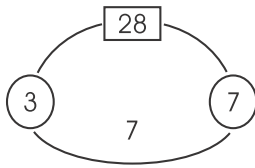
Find the difference between the two numbers by the sides.

That is, $5 - 4 = 1$

Divide the number at the top (25) by the result above (1) to get the number at the centre.

That is, $\frac{25}{5-4} = \frac{25}{1} = 25$

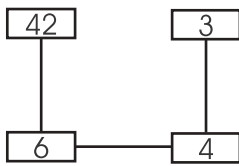
2.



$$\frac{28}{7-3} = \frac{28}{4} = 7$$

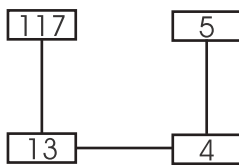
Section F (page 82)

1.



$$(3 + 4) \times 6 = 7 \times 6 = 42$$

2.



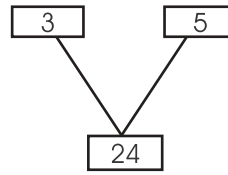
$$(5 + 4) \times 13 = 9 \times 13 = 117$$

Section G (page 83)

Add the two numbers at the top, multiply their sum by an imaginary number (3) to get the number at the bottom.

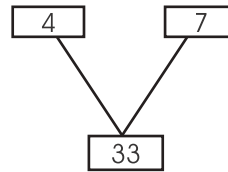
Example

1.



$$3(3 + 5) = 3 \times 8 = 24$$

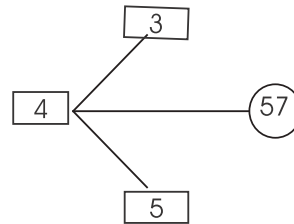
2.



$$(4 + 7) \times 3 = 11 \times 3 = 33$$

Section H (page 84)

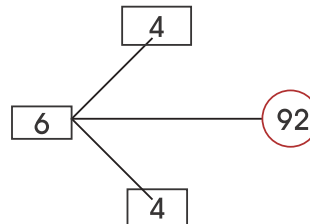
1.



To arrive at 57, we find the product of 5, 4 and 3, then subtract 3 from the result.

That is, $(5 \times 4 \times 3) - 3 = 60 - 3 = 57$

2.

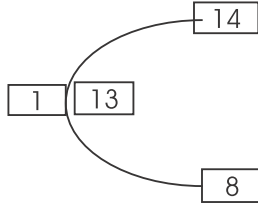


$$(4 \times 6 \times 4) - 4 = 96 - 4 = 92$$

Preparatory Exercise 9

Section A (page 85)

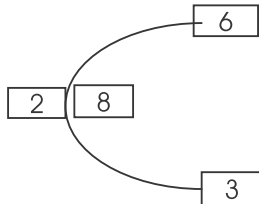
1.



Double the difference between 14 and 8, then add 1 to it to get 13, i.e.

$$\begin{aligned} [(14 - 8) \times 2] + 1 &= (6 \times 2) + 1 \\ &= 12 + 1 \\ &= 13 \end{aligned}$$

2.



Double the difference between 6 and 3, then add 2 to it to get 8, i.e.

$$\begin{aligned} [(6 - 3) \times 2] + 2 &= (3 \times 2) + 2 \\ &= 6 + 2 \\ &= 8 \end{aligned}$$

Section B (page 86)

Consider the word,

U	N	S	C	R	A	M	B	L	E
↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
0	7	9	3	8	1	6	2	5	4

Each letter is being merged with its corresponding number.

Example

1. CRUMBLE

Since

C → 3

R → 8

U → 0

M → 6

B → 2

L → 5

E → 4

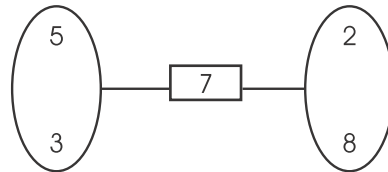
Then

CRUMBLE = 3806254

2. CLEAR = 35418

Section C (page 87)

1.

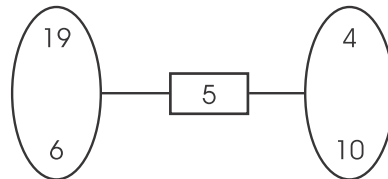


Add 5 to 8, then subtract the product of 2 and 3 from the result to get 7.

That is,

$$\begin{aligned} (5 + 8) - (2 \times 3) \\ &= 13 - 6 \\ &= 7 \end{aligned}$$

2.



$$\begin{aligned} (19 + 10) - (6 \times 4) \\ &= 29 - 24 \\ &= 5 \end{aligned}$$

Section D (page 88)

Add the square of the second number on the left hand side to the first number to obtain the number on the right hand side.

Example

1. $5 \vee 1 = 6$, implies that

$$5 + 1^2 = 5 + 1 = 6$$

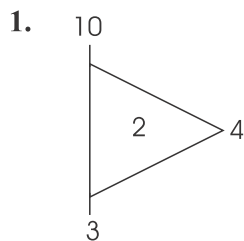
2. $3 \vee 2 = 7$ implies that

$$3 + 2^2 = 3 + 4 \\ = 7$$

3. $13 \vee 10 = 113$ implies that

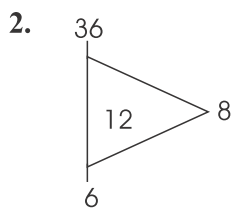
$$13 + 10^2 = 13 + 100 \\ = 113$$

Section E (page 89)



Subtract 10 from the product of 4 and 3 to get 2.

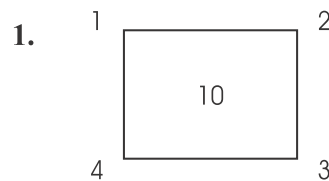
$$\text{That is, } (4 \times 3) - 10 \\ = 12 - 10 \\ = 2$$



Subtract 36 from the product of 8 and 6 to get 12.

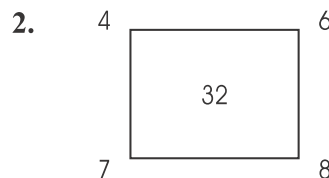
$$(8 \times 6) - 36 \\ = 48 - 36 \\ = 12$$

Section F (page 90)



Subtract the product of 1 and 2 from the product of 4 and 3 to obtain 10.

$$\text{That is, } (4 \times 3) - (1 \times 2) \\ = 12 - 2 = 10$$



Subtract the product of 4 and 6 from the product of 7 and 8.

$$(7 \times 8) - (4 \times 6) \\ = 56 - 24 \\ = 32$$

Section G (page 91)

This section involves the arrangement of numbers using a set of rules or pattern. Study each set of numbers and pick out the odd one.

Example

2 5 10 14 26

The set of rules that governs the arrangement of numbers here is.

$$n^2 + 1, n = 1, 2, 3, 4, 5$$

When $n = 1$, $1^2 + 1 = 2$

When $n = 2$, $2^2 + 1 = 5$

When $n = 3$, $3^2 + 1 = 10$

When $n = 4$, $4^2 + 1 = 17$

When $n = 5$, $5^2 + 1 = 26$

14 is the odd one out because it does not obey the rule.

Section H (page 91)

1. $8 \text{ J } 3$ means $\frac{8 \times 3}{2}$
 $= \frac{24}{2} = 12$

2. $\frac{5}{2} \text{ J } \frac{3}{4} = \frac{\frac{5}{2} \times \frac{3}{4}}{2}$
 $= \frac{15}{8} \times \frac{1}{2} = \frac{15}{16}$

Preparatory Exercise 10

Section A (page 93)

1	6	3	1	4	7	2
2	6	1	3	5	2	4
4	8	6	7	2	1	3
3	6	7	5	5	2	5
5	3	5	7	2	5	5
5	2	6	5	5	4	6
7	7	5	4	3	6	7

words that can be obtained from the word POPULATION.

Also,

P O P U L A T I O N
 ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓
 6 5 6 8 3 1 7 2 5 4

Circle the numbers that represent each given word on the table and write it out.

Example

APPOINT = 1665247

Since A → 1
 P → 6
 P → 6
 O → 5
 I → 2
 N → 4
 T → 7

Note that 1665247 is circled on the table.

Section B (page 94)

1. $3 \text{ N } 4 \rightarrow 3 \times 4^2$
 $= 3 \times 16$
 48

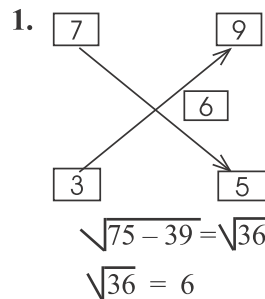
2. $5 \text{ N } 2 \rightarrow 5 \times 2^2$
 $= 5 \times 4$
 = 20

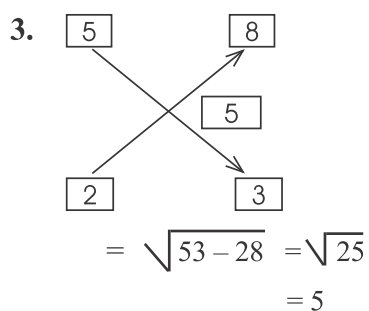
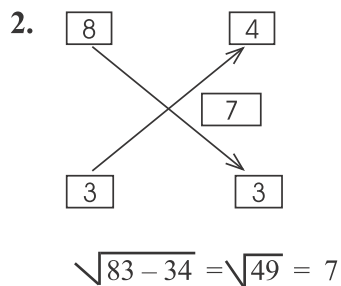
3. $12 \text{ N } 3 \rightarrow 12 \times 3^2$
 $= 12 \times 9$
 = 108

Section C (page 95)

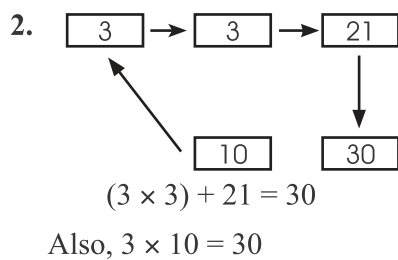
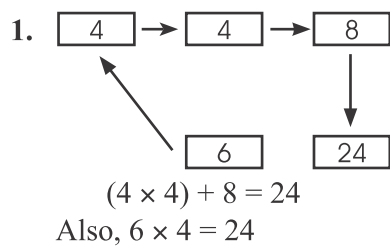
Considering the direction of the arrow in each case, write the numbers that fall on the same line as 2-digit numbers, then find the square root of their difference.

Example

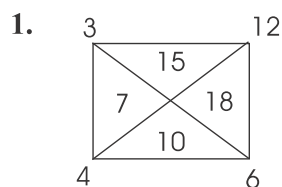




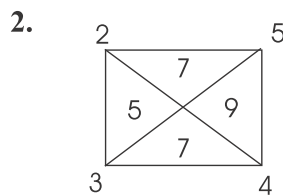
Section D (page 96)



Section E (page 96)



$3 + 4 = 7; 4 + 6 = 10$
 $3 + 12 = 15; 6 + 12 = 18$

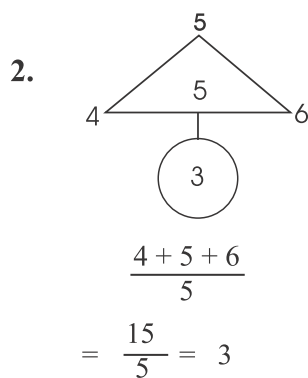
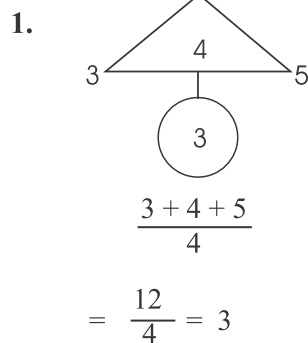


$2 + 3 = 5; 3 + 4 = 7$
 $4 + 5 = 9; 2 + 5 = 7$

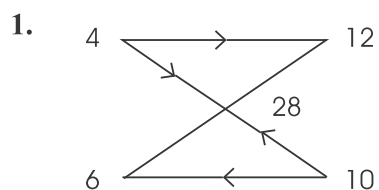
Section F (page 97)

Add the number at the edges of the triangle and divide the result by the number in the centre of the triangle to get the number in the circle.

Example



Section G (page 98)



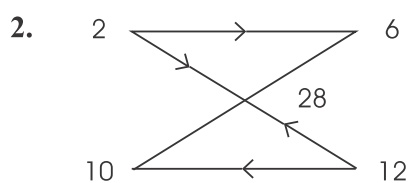
- (i) Multiply 4 by 3 (imaginary number) to get 12
- (ii) Multiply the sum of the 4 and 10 by 2 (imaginary number) to get 28
- (iii) Subtract 4 from 10 to get 6

That is,

$$4 \times 3 = 12$$

$$2(4 + 10) = 28$$

$$10 - 4 = 6$$



- (i) Multiply 2 by 3 (imaginary number) to get 6
- (ii) Multiply the sum of the 2 and 12 by 2 (imaginary number) to get 28
- (iii) Subtract 2 from 12 to get 10

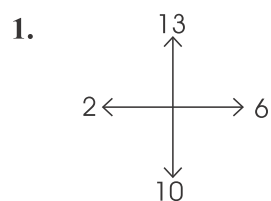
That is,

$$2 \times 3 = 6$$

$$2(2 + 12) = 2 \times 14 = 28$$

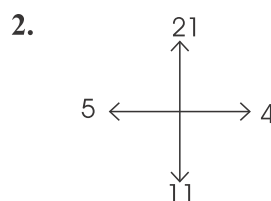
$$12 - 2 = 10$$

Section H (page 99)



$$(2 \times 6) + 1 = 13$$

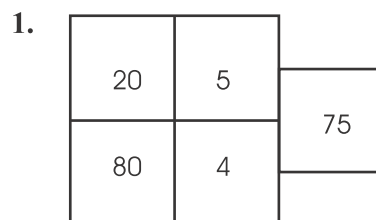
$$(2 + 6) + 2 = 10$$



$$(5 \times 4) + 1 = 21$$

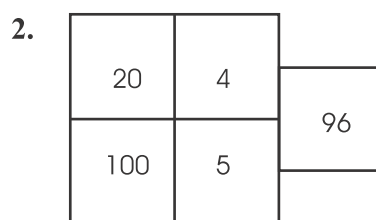
$$(5 + 4) + 2 = 11$$

Section I (page 100)



$$20 \times 4 = 80$$

$$80 - 5 = 75$$



$$20 \times 5 = 100$$

$$100 - 4 = 96$$