

Name: Date:

INSTRUCTIONS TO CANDIDATES

Section A (40 marks)

Time: 45 minutes

- 1. Answer all the questions in this section.
- 2. Calculators may not be used in this section.
- 3. All working must be clearly shown. Omission of essential working will result in loss of marks.
- 4. The marks for each question is shown in brackets [] at the end of each question.

1 (a) The set of ten numbers is shown below.

5, 8, 16, 12, 4, 5, 7, 12, 21, 5

For this distribution, find the

- (i) mode,
- (ii) median,
- (iii) mean.

(b) When the number x is added to the above set, the new mean is 10. Calculate the value of x .

Answer (a) (i) [1]

(ii) [1]

(iii) [1]

(b) $x =$ [1]

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[2]
[3]
[2]

tion

- 2 A farmer planted some tomato plants. The following are the number of tomatoes he picked from each plant on Sunday.

7 4 10 1 8 3 6 5 6 7
 5 8 3 5 7 5 10 8 6 5
 8 7 4 6 10 7 1 7 5 6

- (a) Construct a dot diagram to represent the data.

Answer (a)

[1]

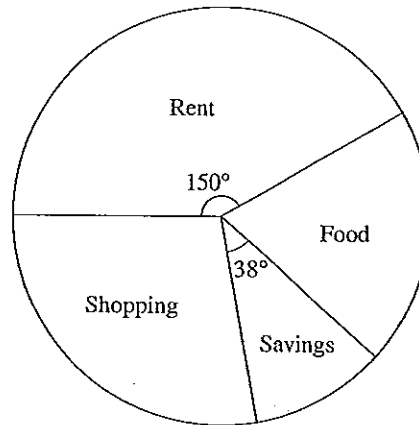
- (b) For this distribution, find the
 (i) mode,
 (ii) median,
 (iii) mean.

Answer (b) (i) [1]

(ii) [1]

(iii) [2]

- 3 The pie chart shows Linda's monthly expenditure. She spent \$450 on rent and 20% of the monthly expenditure on food.
- How much is her monthly expenditure?
 - Find the amount she spent on food.
 - Calculate the angle of the sector representing food.
 - How much did she spend on shopping?



- Answer (a) \$ [1]
 (b) (i) \$ [1]
 (ii) ° [1]
 (c) \$ [1]

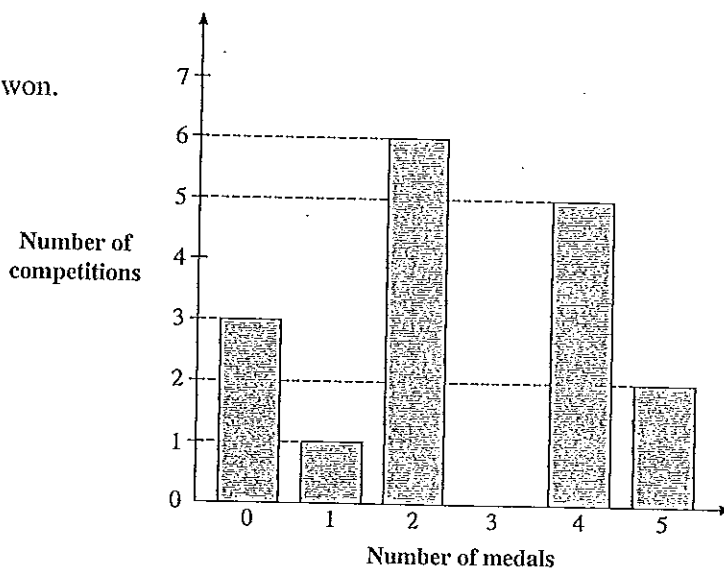
- 4 (a) The mean of the six numbers p , 8, q , 6, r and 2 is 9. The mean of the eight numbers 7, p , q , r , 10, 5, s and t is 12. Find the mean of s and t .
- (b) The median of ten numbers in the order 3, 5, 5, 6, 6, x , 8, 9, 10, 10 is 7. Find the value of x .

Answer (a) [2]

(b) $x =$ [1]

- 5 The bar graph shows the number of medals won by a gymnast in 17 competitions. Find for this distribution,

- (a) the mode,
 (b) the median,
 (c) the total number of medals won.



Answer (a) [1]

(b) [1]

(c) [2]

- 6 The stem and leaf diagram below shows the number of books read by a group of kindergarten children last year.

Stem	Leaf						
0	5	6	7	9			
1	0	0	2	2	2	5	5
2	1	3	3				
3	0						

- (a) How many children were there in the group?
(b) For this distribution, find
(i) the median,
(ii) the mean.

Answer (a) [1]

(b) (i) [1]

(ii) [2]

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7 A group of 30 students were asked how many times they were late for school in a certain month. The results are shown in the table below.

Number of days late	0	1	2	3
Number of students	8	7	13	2

For this distribution, find

- (a) the mode,
- (b) the median,
- (c) the mean.

Answer (a) [1]

(b) [1]

(c) [2]

8 The data below shows the number of goals scored by a school's soccer team in 20 matches.

1	3	2	0	4	3	1	3	4	3
0	5	4	3	1	0	3	0	2	4

(a) Construct a frequency table to represent the information given above.

Answer (a)

[2]

(b) For this distribution, find the
 (i) median number of goals,
 (ii) mean number of goals.

Answer (b) (i) [1]

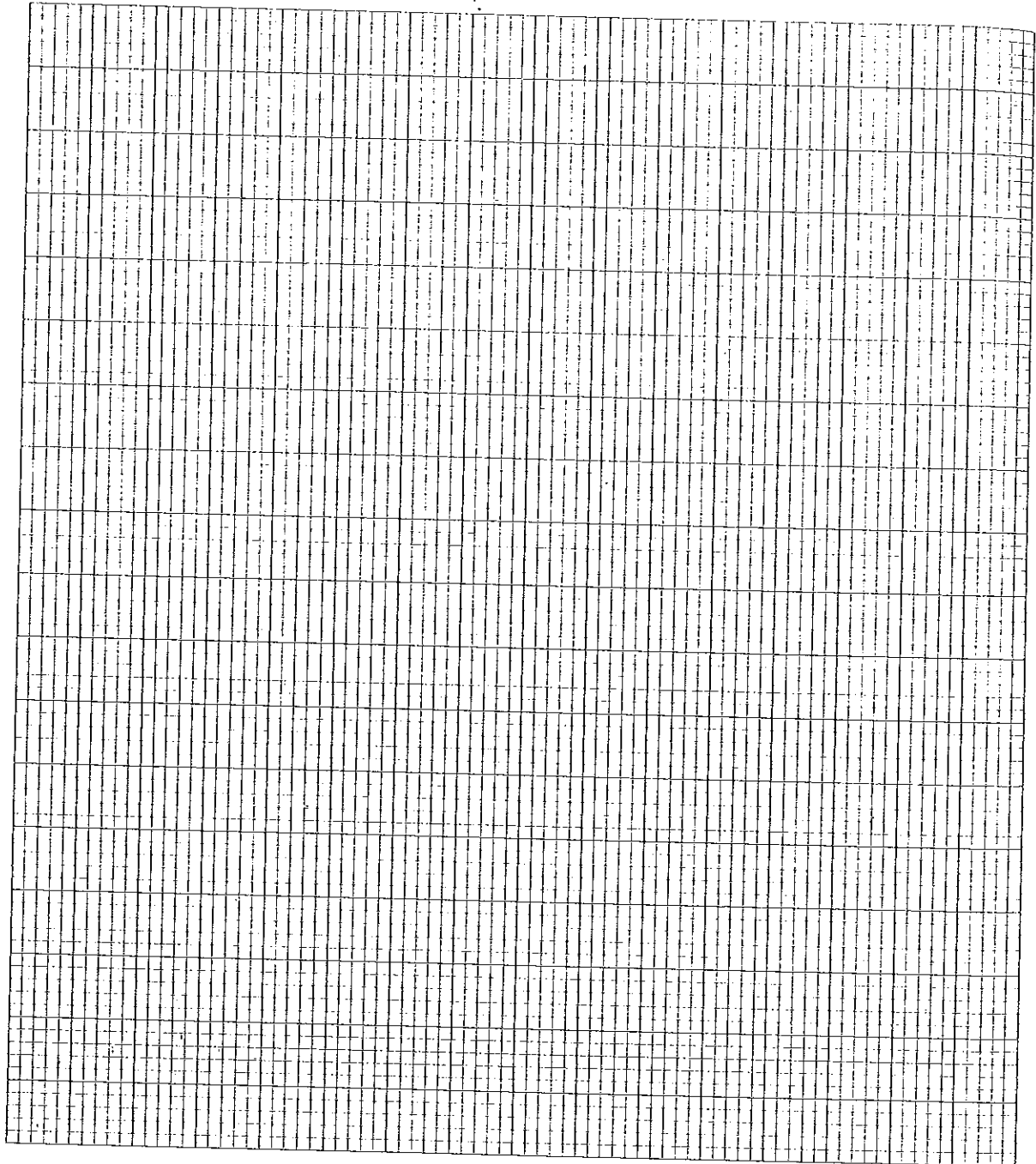
(ii) [2]

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(c) On the graph paper provided below, draw a histogram to display the information.

Answer (c)

[2]



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INSTRUCTIONS TO CANDIDATES

Section B (40 marks)

Time: 45 minutes

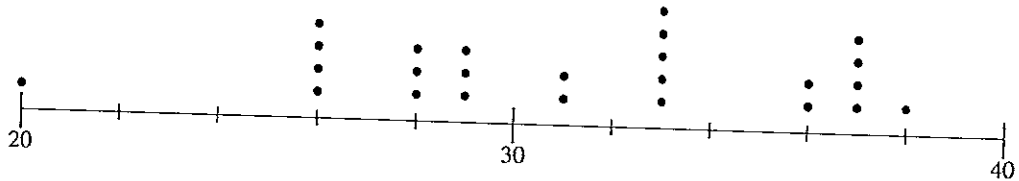
1. Answer all the questions in this section.
2. Calculators may be used in this section.
3. All working must be clearly shown. Omission of essential working will result in loss of marks.
4. The marks for each question is shown in brackets [] at the end of each question.

- 10 (a) The weekly wages of the employees in a restaurant are given in the table below.

Weekly wage (\$)	180	200	250	370	760
Number of employees	5	8	7	3	1

For this distribution, calculate the

- (i) mode,
 - (ii) mean.
- (b) The dot diagram below shows the distribution of the ages, in years, of the actors of a theatre company.



For this distribution, find

- (i) the mode,
- (ii) the median,
- (iii) the mean.

Answer (a) (i) [1]

(ii) [2]

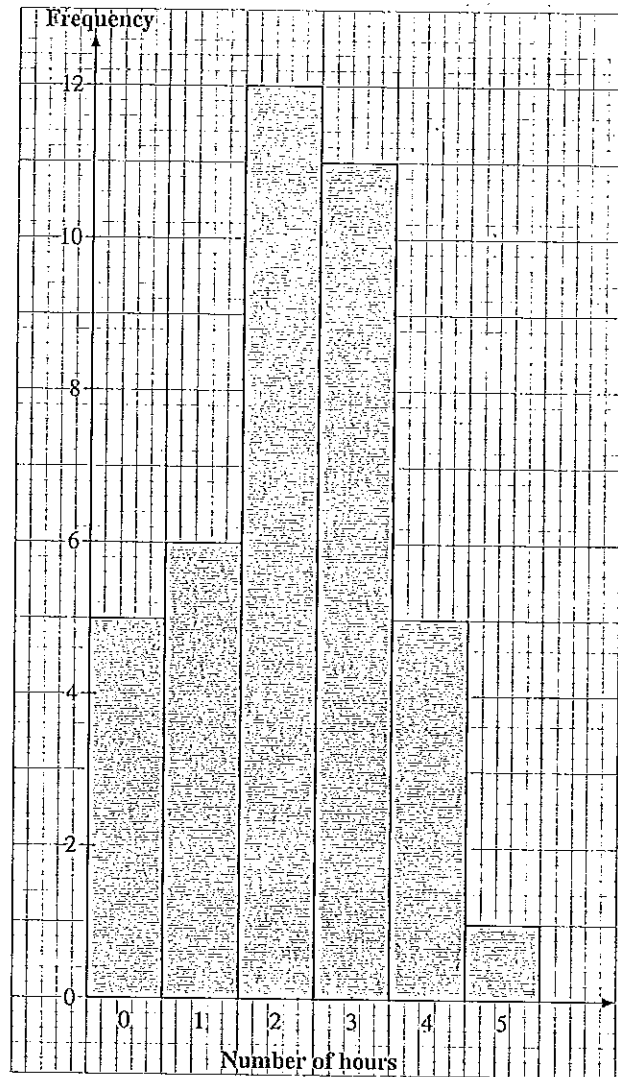
(b) (i) [1]

(ii) [1]

(iii) [2]

11 The histogram below shows the results of a survey to determine the amount of time a group of students spent surfing the internet in a day.

- (a) How many students were involved in the survey?
- (b) What is the modal time spent surfing the internet?
- (c) What is the mean time spent surfing the internet?
- (d) Calculate the percentage of pupils who spent at least 3 hours surfing the internet.



- Answer (a) [1]
- (b) [1]
- (c) [2]
- (d) % [2]

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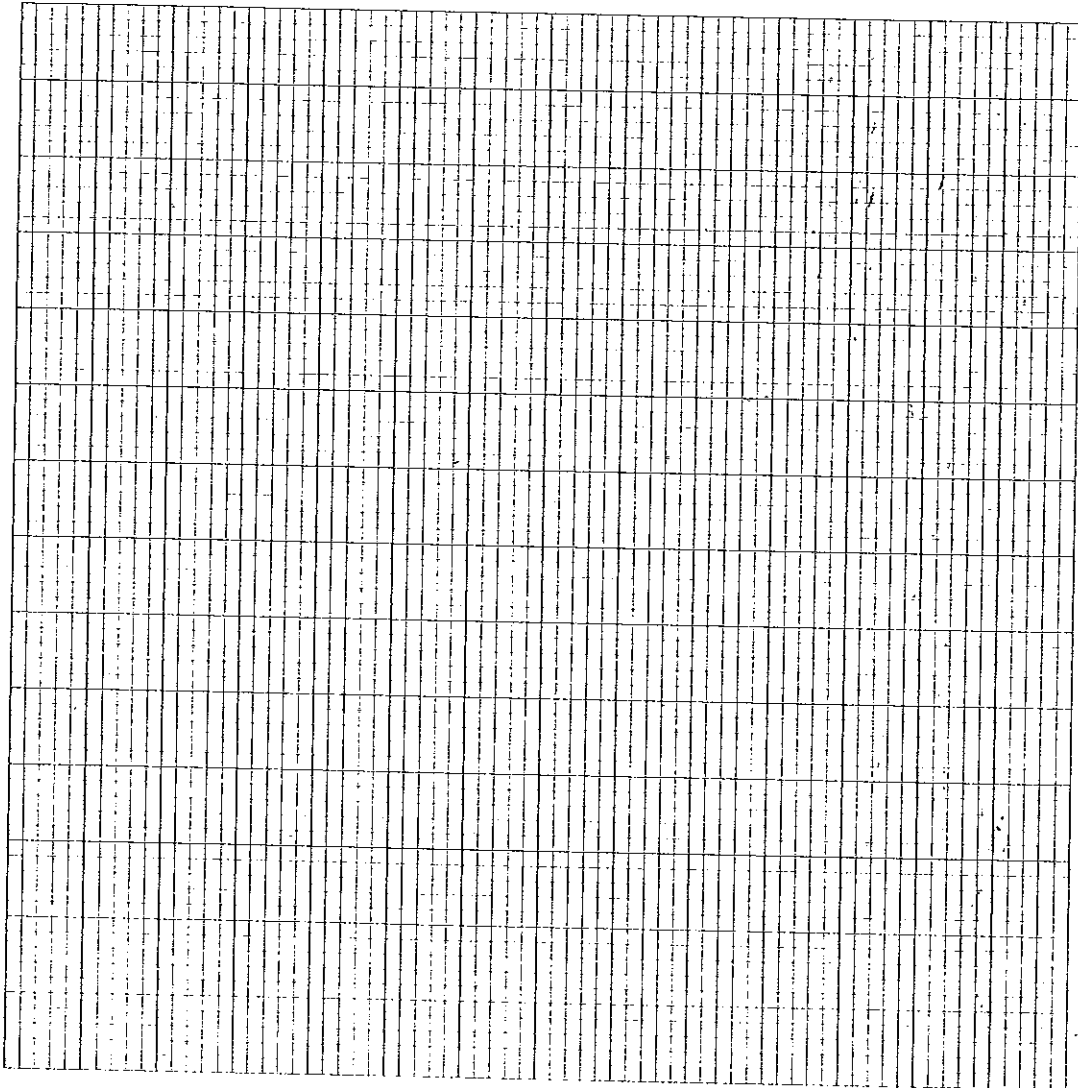
13 The number of pets a group of children have is tabulated below.

Number of pets	0	1	2	3	4
Number of children	3	1	2	5	x

- (a) If the mode is 4, write down the smallest possible value of x .
- (b) If the median is 3, find the largest possible value of x .
- (c) Given that $x = 3$, draw a histogram to represent the above data.

Answer (c)

[2]



Answer (a) $x = \dots\dots\dots$ [1]

(b) $x = \dots\dots\dots$ [2]

14 The distances ran by a class of 40 students are shown in the table below.

Distance (km)	5	10	15	20	25
Number of students	6	4	x	y	10

- (a) Show that $x + y = 20$. [1]
 (b) Given that the mean of the distribution is 16.5, show that $3x + 4y = 68$. [2]
 (c) Find the values of x and y .
 (d) State for this distribution,
 (i) the mode,
 (ii) the median.

Answer (c) $x = \dots\dots\dots$

$y = \dots\dots\dots$ [3]

(d) (i) $\dots\dots\dots$ [1]

(ii) $\dots\dots\dots$ [1]

15 The table below shows how much time Marc spent watching television last week.

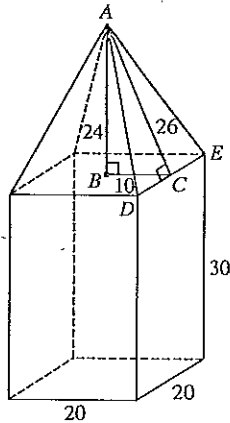
Day	Time spent
Monday	30 min
Tuesday	45 min
Wednesday	1 h
Thursday	30 min
Friday	2 h

- (a) Calculate for the above distribution
- (i) the mode,
 - (ii) the median,
 - (iii) the mean.
- (b) Marc decided to include the time he spent watching television for Saturday and Sunday as well. He found that the new mean was $1\frac{1}{2}$ h. If the ratio of the time spent watching television on Saturday and Sunday was 11 : 12, how long did he watch television on Sunday? Give your answer in hours.

Answer (a) (i) [1]
 (ii) [1]
 (iii) [2]
 (b) h [3]

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15.



(a) (i) Vol. of solid
 = Vol. of pyramid + Vol. of cuboid
 $= \left(\frac{1}{3} \times 20^2 \times 24 \right) + (20 \times 20 \times 30)$
 $= 3200 + 12\,000$ Vol. of pyramid:
 $= 15\,200 \text{ cm}^3$ $= \frac{1}{3} \times \text{Base area} \times \text{Height}$

Vol. of cuboid
 $= \text{Length} \times \text{Breadth} \times \text{Height}$

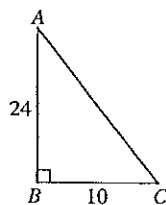
(ii) $BC = \frac{20}{2} = 10 \text{ cm}$

Using Pythagoras' Theorem on $\triangle ABC$,

$$AC^2 = 24^2 + 10^2$$

$$= 676$$

$$AC = \sqrt{676} = 26 \text{ cm}$$



Required total surface area
 $= (\text{Surface area of sides}) + (\text{Surface area of tops})$
 $= [4 \times (20 \times 30)] + \left[4 \times \left(\frac{1}{2} \times 20 \times 26 \right) \right]$
 $= 2400 + 1040$
 $= 3440 \text{ cm}^2$

(b) Total surface area to be painted
 $= 124 \times 3440$
 $= 426\,560 \text{ cm}^2$

No. of tins required
 $= \frac{426\,560 \text{ cm}^2}{60\,000 \text{ cm}^2}$
 $= 7.109$
 $\therefore 8 \text{ tins of paint are required.}$

$1 \text{ m} = 100 \text{ cm}$
 $1 \text{ m}^2 = (100 \text{ cm})^2$
 $= 10\,000 \text{ cm}^2$
 $\therefore 6 \text{ m}^2 = 60\,000 \text{ cm}^2$

Test 16: Statistics – Measures of Central Tendency

Section A

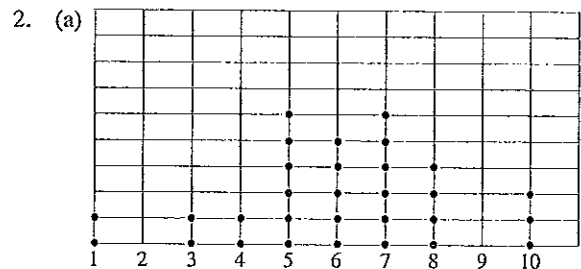
1. (a) 4, 5, 5, 5, 7, 8, 12, 12, 16, 21 Arrange the numbers in ascending order first.
- ↑
two middle numbers

(i) Mode = 5 The mode is the number which occurs most often.
 5 occurs the most often.

(ii) Median = $\frac{7+8}{2} = 7.5$ • The median is the middle value of the numbers arranged in order.
 • When there are two middle numbers, the median is the mean of the two numbers.

(iii) Mean = $\frac{4+5+5+5+7+8+12+12+16+21}{10}$
 $= \frac{95}{10}$ The mean is obtained by dividing the sum of all the numbers by how many numbers there are.
 $= 9.5$

- (b) Sum of the 10 numbers = 95
 Sum of the 11 numbers = $11 \times 10 = 110$
 $\therefore x = 110 - 95$
 $= 15$



Teacher's Tip

- In a dot diagram, the information is displayed using dots.
- Each dot represents a data.

(b) (i) Mode = 5 tomatoes and 7 tomatoes
 There are two modes. 5 and 7 are repeated 6 times.

(ii) Median = 6 tomatoes

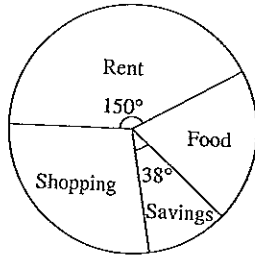
The middle term is the mean of the 15th and 16th term which are both 6.

(iii) Mean

$$\begin{aligned} &= \frac{[(1 \times 2) + (3 \times 2) + (4 \times 2) + (5 \times 6) + (6 \times 5) + (7 \times 6) + (8 \times 4) + (10 \times 3)]}{30} \\ &= \frac{2 + 6 + 8 + 30 + 30 + 42 + 32 + 30}{30} \\ &= \frac{180}{30} \\ &= 6 \text{ tomatoes} \end{aligned}$$

Mean = $\frac{\text{Total no. of tomatoes}}{\text{Total no. of plants}}$

3.



(a) Monthly expenditure

$$\begin{aligned} &= \frac{360^\circ}{150^\circ} \times \$450 \\ &= \$1080 \end{aligned}$$

(b) (i) Amount spent on food = 20% of \$1080

$$\begin{aligned} &= \frac{20}{100} \times \$1080 \\ &= \$216 \end{aligned}$$

(ii) Angle of the sector representing food

$$\begin{aligned} &= \frac{20}{100} \times 360^\circ \\ &= 72^\circ \end{aligned}$$

(c) Angle of sector representing shopping = $360^\circ - 150^\circ - 72^\circ - 38^\circ = 100^\circ$

Amount spent on shopping

$$\begin{aligned} &= \frac{100^\circ}{360^\circ} \times \$1080 \\ &= \$300 \end{aligned}$$

4. (a) $\frac{p + 8 + q + 6 + r + 2}{6} = 9$

Multiply both sides by 6.

$$\begin{aligned} p + q + r + 16 &= 54 \\ p + q + r &= 38 \end{aligned}$$

$$\frac{7 + p + q + r + 10 + 5 + s + t}{8} = 12$$

Multiply both sides by 8.

$$\begin{aligned} (p + q + r) + s + t + 22 &= 96 \\ 38 + s + t + 22 &= 96 \\ s + t &= 36 \end{aligned}$$

Subs. $p + q + r = 38$.

$$\begin{aligned} \text{Mean of } s \text{ and } t &= \frac{s + t}{2} \\ &= \frac{36}{2} \\ &= 18 \end{aligned}$$

two middle numbers

(b) 3, 5, 5, 6, $\overbrace{6, x, 8, 9, 10, 10}$

Median = 7 Given

$$\frac{6 + x}{2} = 7$$

$$6 + x = 14$$

$$\begin{aligned} x &= 14 - 6 \\ &= 8 \end{aligned}$$

5. (a) Mode = 2 medals

The data with the highest frequency.

(b) Median = 2 medals

The middle term is the 9th term which is 2 medals.

$$0, 0, 0, 1, 2, 2, 2, 2, 2, 2, 4, 4, \dots$$

3 competitions will zero medals won. \uparrow 9th term

(c) Total number of medals won

$$\begin{aligned} &= (0 \times 3) + (1 \times 1) + (2 \times 6) + (4 \times 5) + (5 \times 2) \\ &= 0 + 1 + 12 + 20 + 10 \\ &= 43 \end{aligned}$$

Multiply each number of medals by the number of competitions and add it up.

The tens digit of the numbers.

The ones digit of the numbers.

6.

Stem	Leaf
0	5 6 7 9
1	0 0 2 2 2 5 5
2	1 3 3
3	0

This row represents the data 5, 6, 7, 9.
median
This row represents the data 21, 23, 23.
This row represents 30.

Teacher's Tip

- In a stem and leaf diagram, a value is split into two parts, the stem and the leaf.
- In the above question, the stems are the tens digits and the leaves are the ones digit.

(a) No. of children in the group = 15

(b) (i) Median = 12 books The middle term is the 8th term.

$$\begin{aligned} \text{(ii) Mean} &= \frac{27 + 86 + 67 + 30}{15} \\ &= \frac{210}{15} \\ &= 14 \end{aligned}$$

Sum of the subtotal of each row.

7. (a) Mode = 2 days

(b) Median = $\frac{1+2}{2}$ The middle term is the mean of the 15th and 16th term which are 1 and 2 respectively.
= 1.5 days

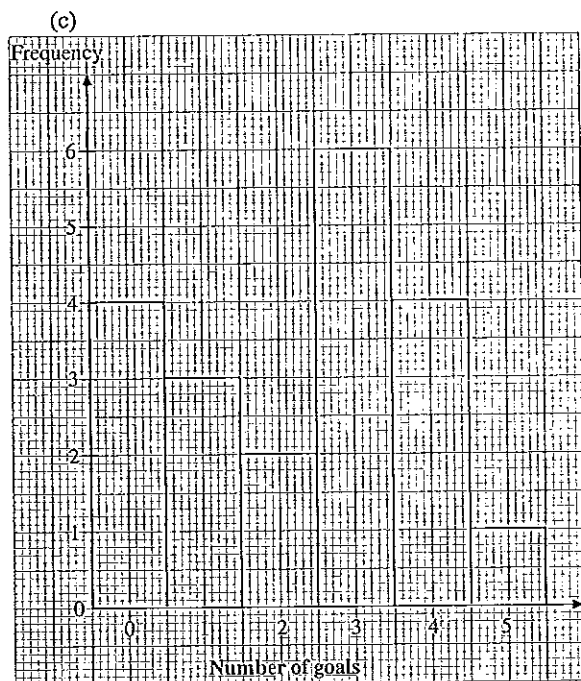
(c) Mean = $\frac{(0 \times 8) + (1 \times 7) + (2 \times 13) + (3 \times 2)}{30}$
= $\frac{0 + 7 + 26 + 6}{30}$ Mean
= $\frac{39}{30}$ = $\frac{\text{Total no. of days}}{\text{Total no. of students}}$
= 1.3 days

8. (a)	Number of goals	0	1	2	3	4	5
	Number of matches	4	3	2	6	4	1

(b) (i) Median number of goals = 3

The middle term is the mean of the 10th and 11th term, which are both 3.

(ii) Mean number of goals
= $\frac{[(0 \times 4) + (1 \times 3) + (2 \times 2) + (3 \times 6) + (4 \times 4) + (5 \times 1)]}{20}$
= $\frac{0 + 3 + 4 + 18 + 16 + 5}{20}$
= $\frac{46}{20}$
= 2.3



Teacher's Tip

- In a histogram, there are no gaps in between the bars.
- A histogram is drawn from a frequency table.

9. (a)	Stem	Leaf
	1	2 2 2 2 5 5 7 8
	2	0 0 1 2 3 3 5 5 6 7 7 9
	3	0 0 0 1 2 5 5 6 6

(b) (i) Mode = 12 laps The data which occurs most often.

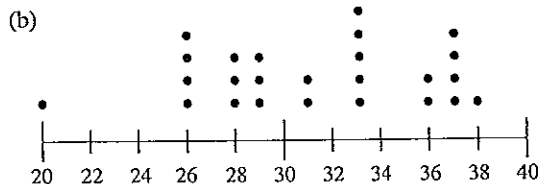
(ii) Median = $\frac{23+25}{2}$ The middle term is the mean of the 15th and 16th term which are 23 laps and 25 laps respectively.
= 24 laps

(c) Required percentage = $\frac{21}{30} \times 100\%$
= 70%

Section B

10. (a) (i) Mode = \$200 Pick the wage which has the highest frequency.

(ii) Mean
= $\frac{\$[(180 \times 5) + (200 \times 8) + (250 \times 7) + (370 \times 3) + (760 \times 1)]}{5 + 8 + 7 + 3 + 1}$
= $\frac{\$6120}{24}$
= \$255



(i) Mode = 33 years The data with the highest frequency.

(ii) Median = 31 years The middle term is the 13th term which is 31 years.

(iii) Mean
= $\frac{[(20 \times 1) + (26 \times 4) + (28 \times 3) + (29 \times 3) + (31 \times 2) + (33 \times 5) + (36 \times 2) + (37 \times 4) + (38 \times 1)]}{25}$
= $\frac{780}{25}$ = 31.2 years

11. (a) No. of students involved in the survey
= 5 + 6 + 12 + 11 + 5 + 1
= 40

(b) Modal time spent surfing the internet
= 2 hours The data with the highest frequency.

(d)	Distance (km)	5	10	15	20	25
	No. of students	6	4	12	8	10

(i) Mode = 15 km Choose the data with the highest frequency.

(ii) Median = 15 km The middle term is the mean of the 20th and 21st term which are both 15 km.

Median (middle no.)



15. (a) 30, 30, 45, 60, 120

(i) Mode = 30 min

(ii) Median = 45 min

$$\begin{aligned} \text{(iii) Mean} &= \frac{30 + 30 + 45 + 60 + 120}{5} \\ &= \frac{285}{5} \\ &= 57 \text{ min} \end{aligned}$$

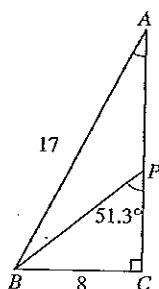
(b) Total time spent watching TV on weekdays = 285 min

$$\begin{aligned} \text{Total time spent watching TV last week} &= 1 \text{ h } 30 \text{ min} \times 7 \\ &= 90 \text{ min} \times 7 \\ &= 630 \text{ min} \end{aligned}$$

$$\begin{aligned} \text{Time spent watching TV on Saturday and Sunday} &= 630 \text{ min} - 285 \text{ min} \\ &= 345 \text{ min} \end{aligned}$$

$$\begin{aligned} \text{Time spent watching TV on Sunday} &= \frac{12}{11 + 12} \times 345 \\ &= \frac{12}{23} \times 345 \\ &= 180 \text{ min} \\ &= 3 \text{ h} \end{aligned}$$

$$180 \text{ min} = \frac{180}{60} \text{ h} = 3 \text{ h}$$



Teacher's Tip

First, change all to the same units. Then arrange them in ascending order.
1 h = 60 min;
2 h = 120 min

(b) Using Pythagoras' Theorem on $\triangle ABC$,

$$AB^2 = AC^2 + CB^2$$

$$17^2 = AC^2 + 8^2$$

$$AC^2 = 17^2 - 8^2 = 225$$

$$AC = \sqrt{225} = 15 \text{ cm}$$

From $\triangle BPC$,

$$\tan \hat{BPC} = \frac{BC}{PC}$$

$$\tan 51.3^\circ = \frac{8}{PC}$$

$$PC = \frac{8}{\tan 51.3^\circ}$$

$$= \frac{8}{1.25}$$

$$= 6.4 \text{ cm}$$

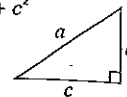
$$\therefore AP = AC - PC$$

$$= 15 - 6.4$$

$$= 8.6 \text{ cm}$$

Pythagoras' Theorem

$$a^2 = b^2 + c^2$$



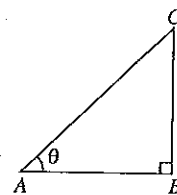
Teacher's Tip

For a right-angled $\triangle ABC$,

$$\sin \theta = \frac{\text{opposite}}{\text{hypotenuse}} = \frac{BC}{AC}$$

$$\cos \theta = \frac{\text{adjacent}}{\text{hypotenuse}} = \frac{AB}{AC}$$

$$\tan \theta = \frac{\text{opposite}}{\text{adjacent}} = \frac{BC}{AB}$$



2. $\cos \hat{ACB} = \frac{BC}{AC}$

$$\cos \theta = \frac{20}{AC}$$

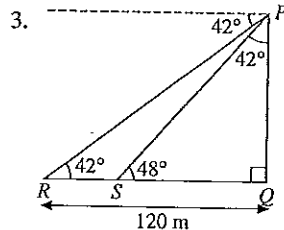
$$AC = \frac{20}{\cos \theta}$$

$$= \frac{20}{\frac{5}{13}}$$

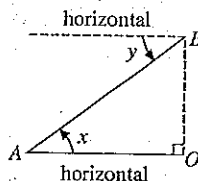
$$\cos \theta = \frac{5}{13} \text{ (Given)}$$

$$= 20 \times \frac{13}{5}$$

$$= 52 \text{ cm}$$



Teacher's Tip



$\angle x$ = angle of elevation of B from A.

$\angle y$ = angle of depression of A from B.

$\angle x = \angle y$

Test 17: Trigonometrical Ratios

Section A

1. (a) From $\triangle ABC$,

$$\begin{aligned} \sin \hat{BAC} &= \frac{BC}{AB} \\ &= \frac{8}{17} \end{aligned}$$