

NEITHER ELECTRONIC CALCULATOR NOR MATHEMATICAL TABLES MAY BE USED IN THIS PAPER.

1 Given that $x = 3.2 \times 10^{-4}$ and $y = 160 \times 10^{-7}$. Find and express in standard form, the values of

(a) $2x + 3y$,

(b) $\frac{x}{y}$

Answer (a)..... [2]

(b)..... [1]

2 The diagram on the right shows the promotional price given to all items in the shop.

(a) If the original price of a camera before discount is \$150, find the price after discount.

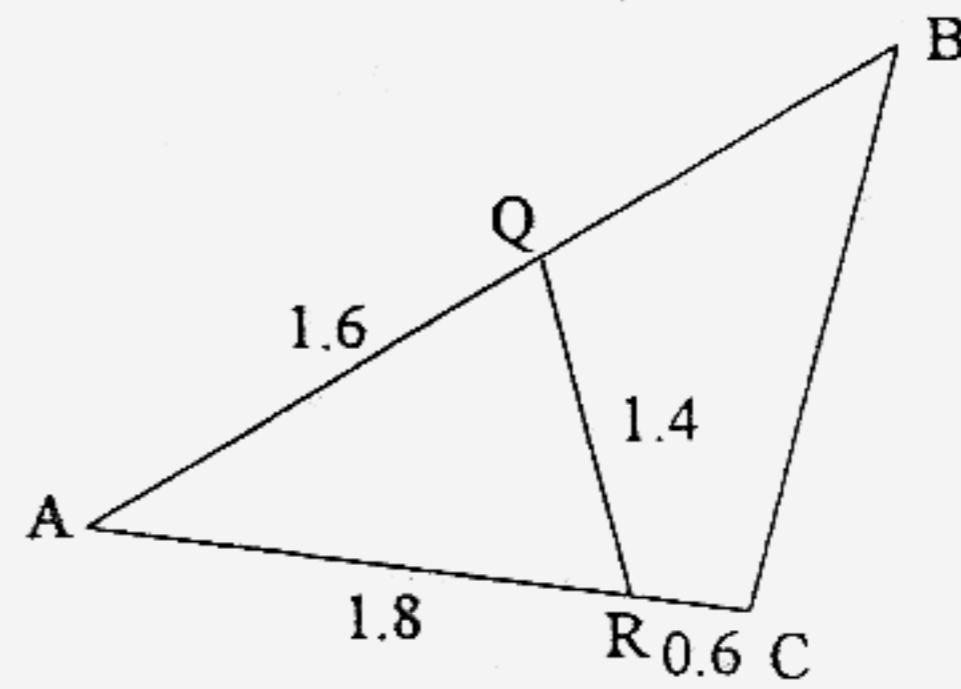
(b) If the price of a MP3 player after discount is \$144, find the original price.



Answer (a)\$..... [1]

(b)\$..... [2]

- 3 Given that the triangle ABC is similar to ARQ and $AQ = 1.6\text{cm}$, $AR = 1.8\text{cm}$, $RQ = 1.4$ and $RC = 0.6\text{ cm}$. Find the length of
- BC ,
 - QB .



Answer (a)..... cm [1]

(b)..... cm [2]

- 4 The map of Sengkang area shows a square carpark with an area of 25 cm^2 . If the actual carpark has length of 20m , write down
- the scale of in the form $1 : n$,
 - the map length of the MRT line that has an actual length of 3 km , leave your answers in cm ,
 - the actual area of the shopping mall that has a map area of 12 cm^2 , leave your answers in m^2 .

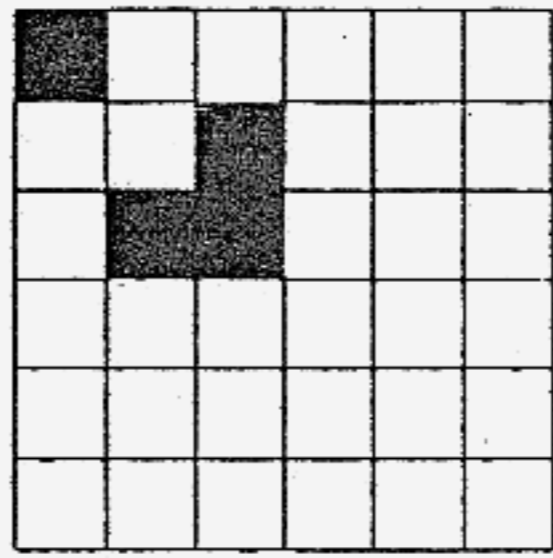
Answer (a)..... [2]

(b)..... cm [1]

(c)..... m^2 [1]

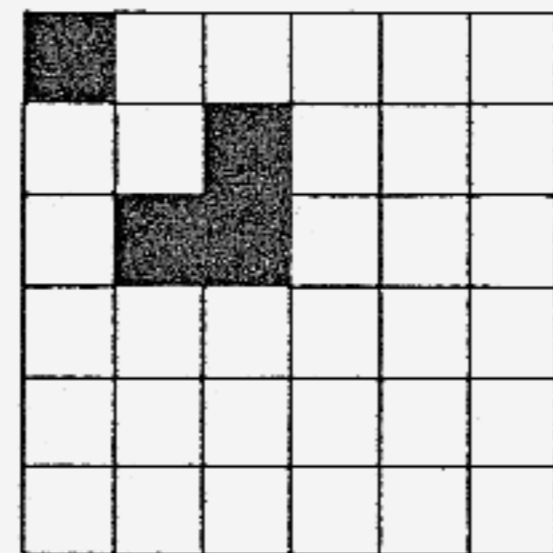
- 5 Shade the boxes below such that the diagram has
 (a) rotational symmetry of 2,

[1]

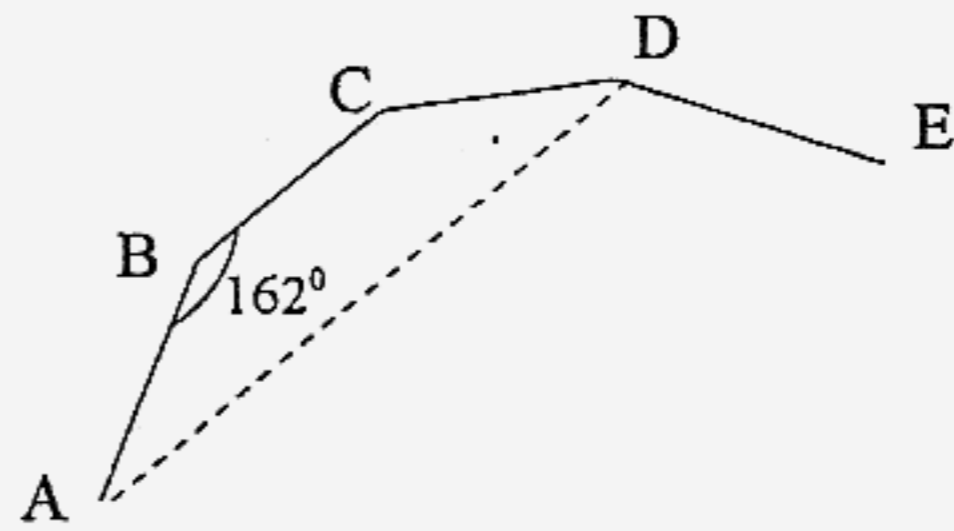


- (b) line of symmetry of 4.

[1]



- 6 The diagram shows part of a regular polygon such that the interior angle is 162° . Find
 (a) $\angle BCA$,
 (b) number of sides of the polygon.



Answer (a)⁰ [1]

(b) [2]

7 Complete the following questions

(a) Simplify $(x-3)^2 - (x^2 + 9)$.

(b) (i) Factorise completely $ka^2 - kb^2$.

(ii) Hence, find the value of $(1.85)(0.75)^2 - (1.85)(0.25)^2$

Answer (a) [2]

(bi) [2]

(bii) [1]

8 Given $\frac{3t}{3t^2 - 5t + 2} - \frac{5}{t-1} = \frac{3}{3t-2}$, solve for t .

Answer [4]

9 Solve the following simultaneous equation

$$2x + y + 1 = \frac{3}{2}x - \frac{1}{2}y - 1 = x - y$$

Answer $x = \dots\dots\dots y = \dots\dots\dots$ [4]

10 Simplify

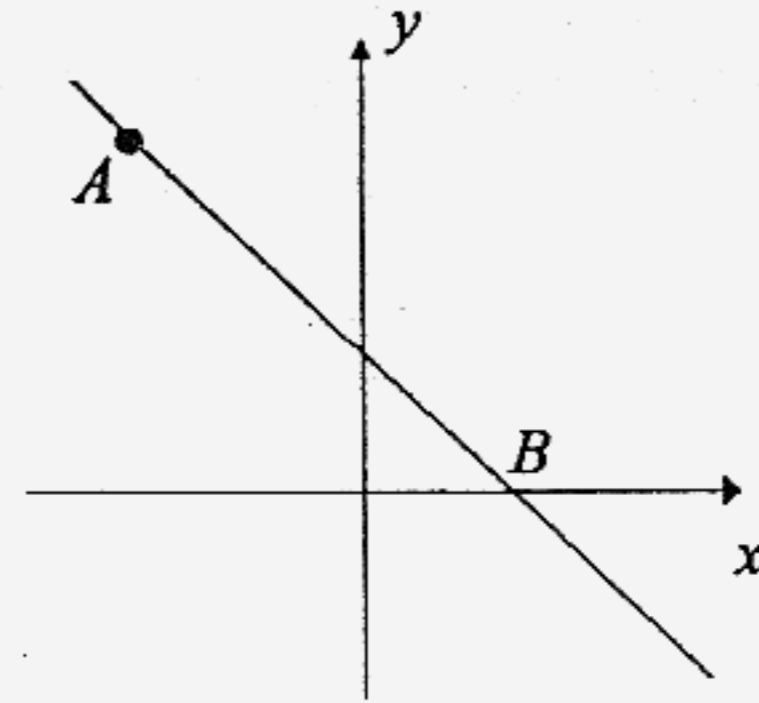
(a) $\frac{5x}{3a-b} + \frac{x}{2b-6a}$,

(b) $\frac{m^2 + 4m - 45}{3m^2 - 14m - 5}$ and express your answer as a single fraction.

Answer (a)..... [2]

(b)..... [3]

11 The diagram shows a sketch of the line $y = ax + 3$. Given that the point $A(-5, 8)$ lies on the line and the point B is the where the line intersect the x -axis, find



- (a) the value of a ,
- (b) the coordinates of B .

Answer (a) $a = \dots\dots\dots$ [2]

(b) $(\dots\dots\dots, \dots\dots\dots)$ [1]

12 Given that the number of days (d) and the number of workers (w) painting the wall varies inversely. On an occasion where there are 8 workers, they took only 5 days to complete the paint job.

- (a) Write an expression of d in terms w ,
- (b) Find out the number of workers needed to clean up the garden in 4 days.

Answer (a) $\dots\dots\dots$ [2]

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

- 13 Given that $A = \{x : 15 < x < 26 \text{ and } x \text{ is an integer}\}$.
- (a) Write down the list of all elements in the set A,
- (b) If a number is chosen at random from A, find the probability that
- the number is a prime number,
 - the number is an odd number.

Answer (a)..... [1]

(bi)..... [1]

(bii)..... [1]

14 The table below shows the number of errors made by 20 students when reciting a passage.

Number of errors	0	1	2	3	4	5
Number of students	5	3	x	4	y	2

- (a) If the median is given to be 2.5, find the value of x and y .
- (b) Using the values of x and y in (a), find
- mode,
 - mean.

Answer (a)..... [2]

(bi)..... [1]

(bii)..... [2]

--- END OF PAPER ---

Name:

Register Number:

Class:



南侨中学

Nan Chiau High School

End-of-Year Examination 2006

MATHEMATICS

Paper 2

Secondary 2 Special / Express

Time: 1 hour 30 minutes

Maximum Marks: 50

11 Oct 2006, Wednesday

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INSTRUCTIONS TO CANDIDATES

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO.

Write your name, index number and class in the spaces provided above.

Answer **ALL** the questions in Section B and choose **ONLY ONE** in section B.

Write your answers and working on the separate answer paper provided.

Show all your working on the same page as the rest of the answer.

CALCULATORS ARE ALLOWED TO BE USED IN THIS PAPER.

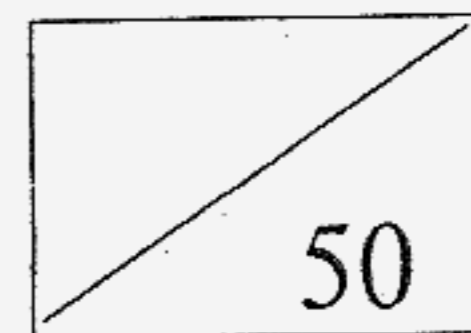
OMISSION OF ESSENTIAL WORKINGS WILL RESULT IN LOSS OF MARKS.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [] at the end of each question or part question.

If the degree of accuracy is not specified in the question and if the answer is not exact, the answer should be given to three significant figures. Answers in degrees should be given to one decimal place.

Setter: Mr Raffi Bin Buang



This question paper consists of 5 printed pages, including this cover page.

Section A (42 Marks)
Answer ALL questions
Begin each question on a fresh page

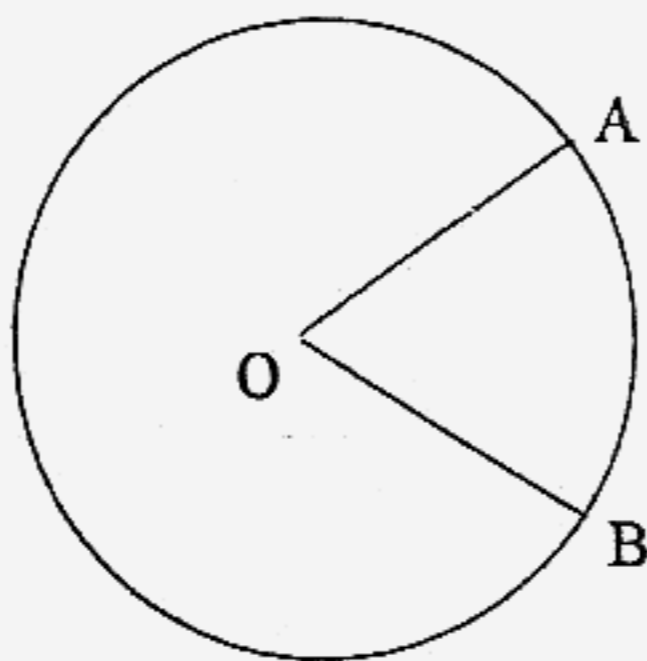
- 1 2 dice were thrown simultaneously and the sum of the total score for each throw is tabulated. Results of 80 throws are shown below.

Score	2	3	4	5	6	7	8	9	10	11	12
Frequency	2	4	6	8	17	16	8	7	5	4	3

From the given distribution, find the

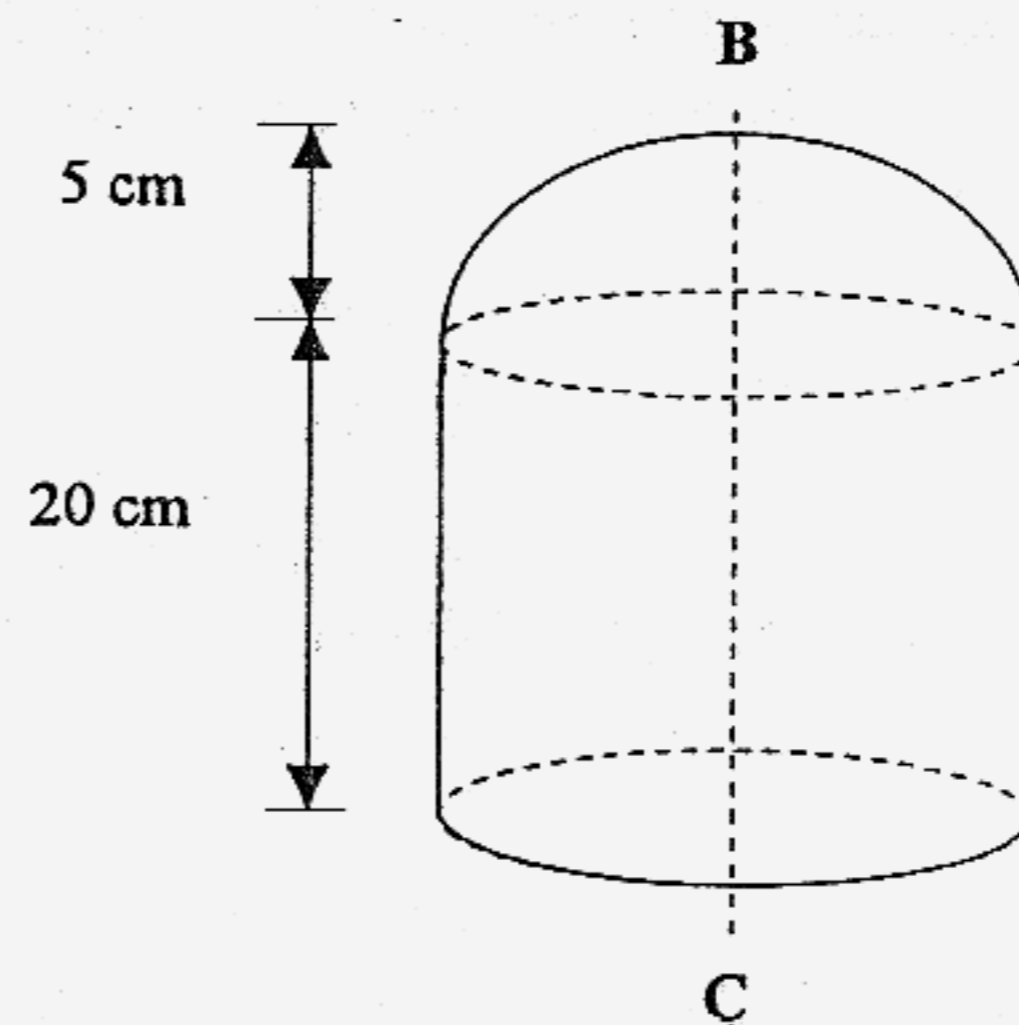
- (a) mode [1]
 (b) median [1]
 (c) mean [2]
-
- 2 (a) Solve the equation $\frac{x-2}{3} + \frac{x}{2} = x-2$ [2]
 (b) 472 man-hours are needed to renovate an office. A renovation company employs workers for 8 hours a day. Find the minimum number of workers needed to complete the renovation in 6 days. [3]

- 3 The diagram below shows a circle with centre O . The diameter is 6.8 cm and the arc length of AB is 4.7 cm. Take π to be 3.14.



- (a) Calculate the angle AOB , correct to 1 decimal place. [2]
 (b) Calculate the area of the sector AOB , correct to the nearest cm^2 . [2]
-
- 4 The universal set ξ and the sets O , P and M are given by
- $\xi = x : x \text{ is an integer such that } 7 \leq x \leq 30$,
 $O = x : x \text{ is an odd number}$,
 $P = x : x \text{ is a prime number}$,
 $M = x : x \text{ is a multiple of } 5$.
- (a) Draw a Venn Diagram to illustrate the above sets. [3]
 (b) State the value of $n(O \cap M)$ and $n(O \cup M)$. [2]

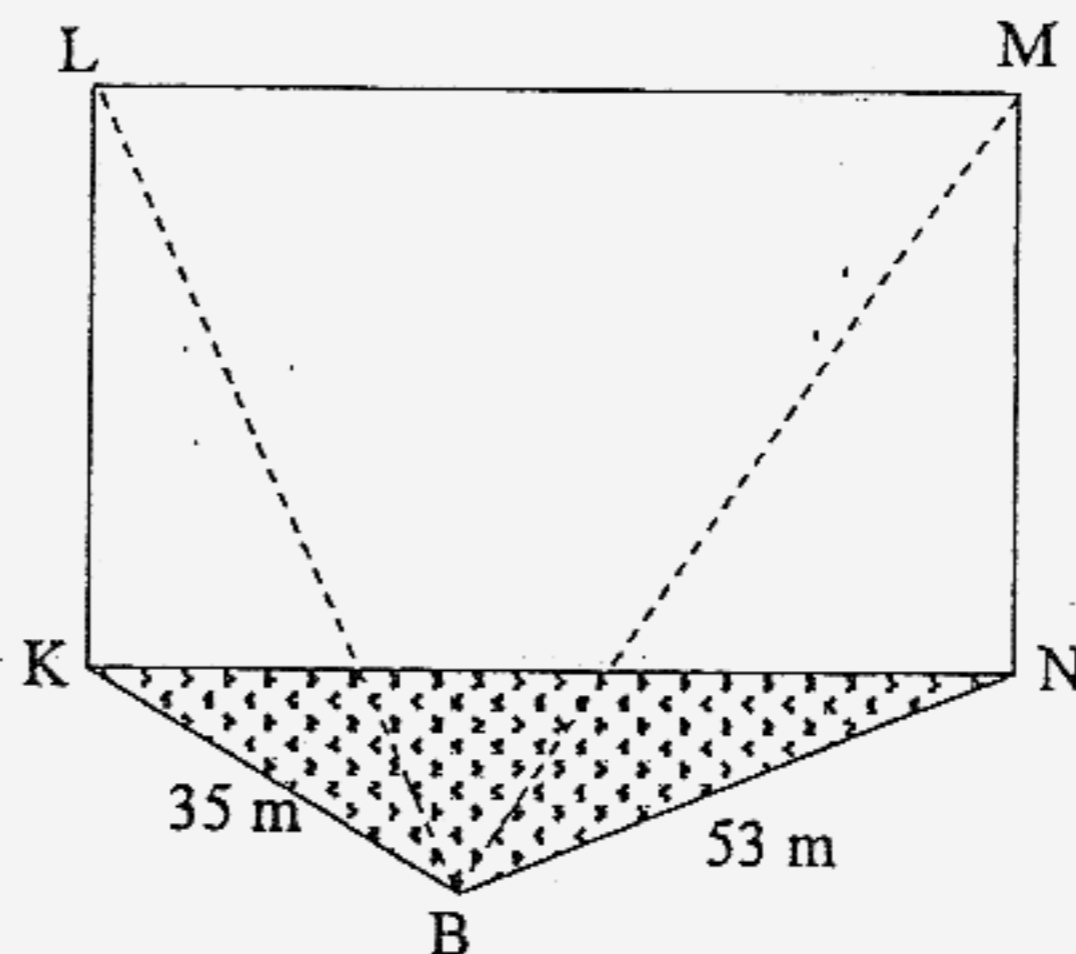
- 5 The diagram shows a cylindrical solid with a hemispherical cover



- (a) Find its volume. [2]
- (b) Find the cost of painting the hemispherical cover of the solid if it costs \$1.20 to paint 1 cm^2 . [2]
- (c) If the whole solid figure is cut into two equal parts along the line BC , find the area of one vertical surface parallel to BC . Correct your answer to the nearest square centimeters.

Take $\pi = 3.142$, volume of sphere = $\frac{4}{3} \pi r^3$, surface area of sphere = $4 \pi r^2$ [3]

- 6 In the diagram, the rectangle $KLMN$ represents a vertical cliff and KNB represents part of the horizontal surface of the sea. The sea meets the cliff along the horizontal line KN . The area of the rectangle is twice the area of the triangle KNB . The boat is at the point B . $NB = 53 \text{ m}$, $KB = 35 \text{ m}$,



- (a) Given that the shortest distance from the boat to the cliff is 20 m, find the length of KN . [3]
- (b) A man at point M looking down towards the boat. Find the distance from the man to the boat? [3]

7 A box contains 6 black pens, 4 blue pens and 3 red pens. The pens are drawn at random from the box, one after the other, and are not replaced. Expressing your answer as a fraction, find the probability that

- (a) the first pen drawn is blue, [1]
 - (b) the first and second pen are blue, [1]
 - (c) If the two blue pens drawn earlier are placed back into the box, find the probability that the next pen drawn will be black. [2]
-

8 **The whole of this question is to be done on a piece of graph paper.**

An eastbound train leaves from Bukit Batok Station to Tanah Merah Station. It travels at a uniform speed of 80 km/h and reached Tanah Merah Station in 30 mins. Due to some technical problems, it had to stay at Tanah Merah Station for 5 mins. It then leaves the station and head to the depot which is 5 km away. It travelled at uniform speed for 15 mins before reaching.

- (a) How far away is Tanah Merah Station from where the eastbound train leaves? [2]
 - (b) Find the constant speed of the train traveling towards the depot? [2]
 - (c) Draw the distance-time graph of the eastbound train from Bukit Batok Station to the depot, using the distance of the train as the y -axis and the time taken to travel as the x -axis. [2]
 - (d) What is the average speed of the train from Bukit Batok Station to the depot? [1]
-

Section B (8 Marks)
Answer ONE question ONLY

- 9 **The whole of this question is to be done on a piece of graph paper.**
The vertices of the $\triangle ABC$ are $A(1, 6)$, $B(5, 6)$ and $C(1, 4)$.
The vertices of the $\triangle A_1B_1C_1$ are $A_1(6, 1)$, $B_1(6, 5)$ and $C_1(4, 1)$.
- (a) Using a scale of 1 cm to represent 1 unit on each axis, draw x and y axes for $-8 \leq x \leq 8$ and $0 \leq y \leq 14$. Draw and label $\triangle ABC$ and $\triangle A_1B_1C_1$. [2]
- (b) Describe fully the single transformation which maps $\triangle ABC$ onto $\triangle A_1B_1C_1$. [1]
- (c) A rotation of 90° anticlockwise about the origin maps $\triangle ABC$ onto $\triangle A_2B_2C_2$. Draw and label $\triangle A_2B_2C_2$. [2]
- (d) A translation of 3 units in the positive x -direction and 7 units in the positive y -direction maps $\triangle A_2B_2C_2$ onto $\triangle A_3B_3C_3$.
- i) Draw and label $\triangle A_3B_3C_3$. [1]
- ii) $\triangle A_3B_3C_3$ can be mapped onto $\triangle ABC$ by a rotation. Given that the centre of rotation is at the point $(-2, 5)$, describe the transformation completely. [2]
-

- 10 **The whole of this question is to be done on a piece of graph paper.**
(a) Given that $y = 7x - x^2$, copy and complete the following table. [2]

x	0	1	2	3	4	5	6	7
y	0	6			12			0

- (b) Using a scale of 1 cm to represent 1 unit on each axis,
draw the graph $y = 7x - x^2$ for values of x in the range $0 \leq x \leq 7$. [2]
- (c) **Using the graph,**
- (i) state the equation of the line of symmetry [1]
- (ii) solve the equation $x^2 - 7x + 2 = 0$, [1]
- (iii) solve the following simultaneous equations:
 $y = 7x - x^2$
 $y = x + 1$ [2]
-

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Given that $x = 3.2 \times 10^{-4}$ and $y = 160 \times 10^{-7}$. Find and express in standard form, the values of

(a) $2x + 3y$,

(b) $\frac{x}{y}$

$$\begin{aligned}
 \text{(a) } 2x + 3y &= 2(3.2 \times 10^{-4}) + 3(160 \times 10^{-7}) \\
 &= (6.4 \times 10^{-4}) + (0.48 \times 10^{-4}) \\
 &= 6.88 \times 10^{-4}
 \end{aligned}$$

$$\begin{aligned}
 \text{(b) } \frac{x}{y} &= \frac{3.2 \times 10^{-4}}{160 \times 10^{-7}} \\
 &= \frac{0.2 \times 10^{-4}}{10 \times 10^{-7}} \\
 &= 2.0 \times 10^1
 \end{aligned}$$

Answer (a)..... [2]

(b)..... [1]

The diagram on the right shows the promotional price given to all items in the shop.

(a) If the original price of a camera before discount is \$150, find the price after discount.

(b) If the price of a MP3 player after discount is \$144, find the original price.



(a) After discount

$$\$150 \times \frac{60}{100} = \$90$$

(b) After discount

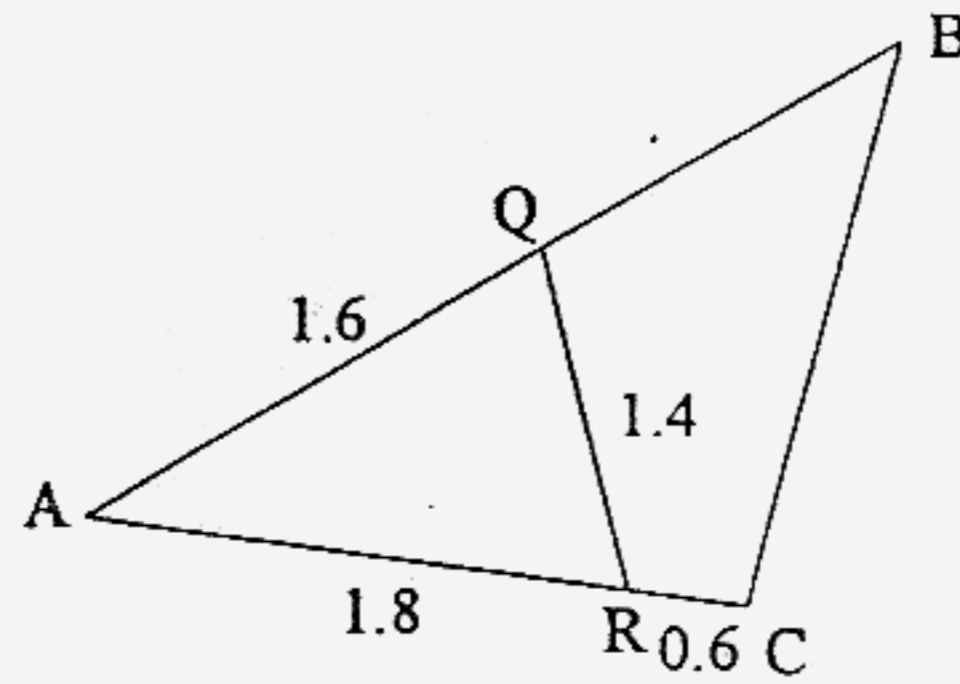
$$\$144 \times \frac{100}{60} = \$240$$

Answer (a)\$..... [1]

(b)\$..... [2]

Given that the triangle ABC is similar to ARQ and $AQ = 1.6\text{cm}$, $AR = 1.8\text{cm}$, $RQ = 1.4$ and $RC = 0.6\text{ cm}$. Find the length of

- (a) BC ,
- (b) QB .



(a) $\frac{BC}{RQ} = \frac{AC}{AQ} = \frac{2.4}{1.6}$
 $BC = 1.5 \times 1.4 = 2.1$

(b) $\frac{AB}{AR} = \frac{AC}{AQ} = \frac{2.4}{1.6}$
 $AB = 1.5 \times 1.8 = 2.7$
 $QB = 2.7 - 1.6 = 1.1$

Answer (a)..... cm [1]

(b)..... cm [2]

The map of Sengkang area shows a square carpark with an area of 25 cm^2 . If the actual carpark has length of 20m, write down

- (a) the scale of in the form $1 : n$,
- (b) the map length of the MRT line that has an actual length of 3 km, leave your answers in cm,
- (c) the actual area of the shopping mall that has a map area of 12 cm^2 , leave your answers in m^2 .

(a) linear scale
 $5\text{cm} : 20\text{m}$
 $1\text{cm} : 400\text{cm}$
 $1 : 400$

(b) $1\text{cm} : 4\text{m}$
 $0.25\text{cm} : 1\text{m}$
 $750\text{cm} : 3000\text{m}$
 Map length is 750cm

Answer (a)..... [2]

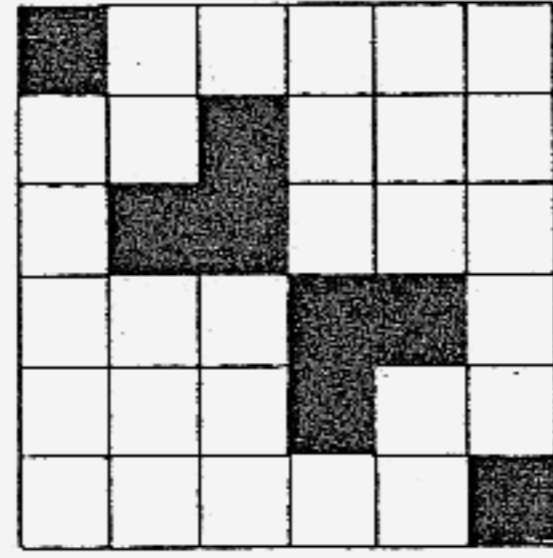
(c) $1\text{cm} : 4\text{m}$
 $1\text{cm}^2 : 16\text{m}^2$
 $12\text{cm}^2 : 192\text{m}^2$
 Actual area = 192m^2

(b)..... cm [1]

(c)..... m^2 [1]

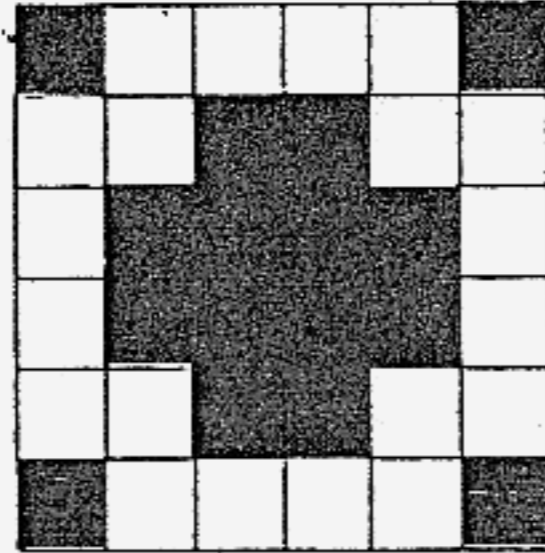
Shade the boxes below such that the diagram has
(a) rotational symmetry of 2,

[1]



(b) line of symmetry of 4.

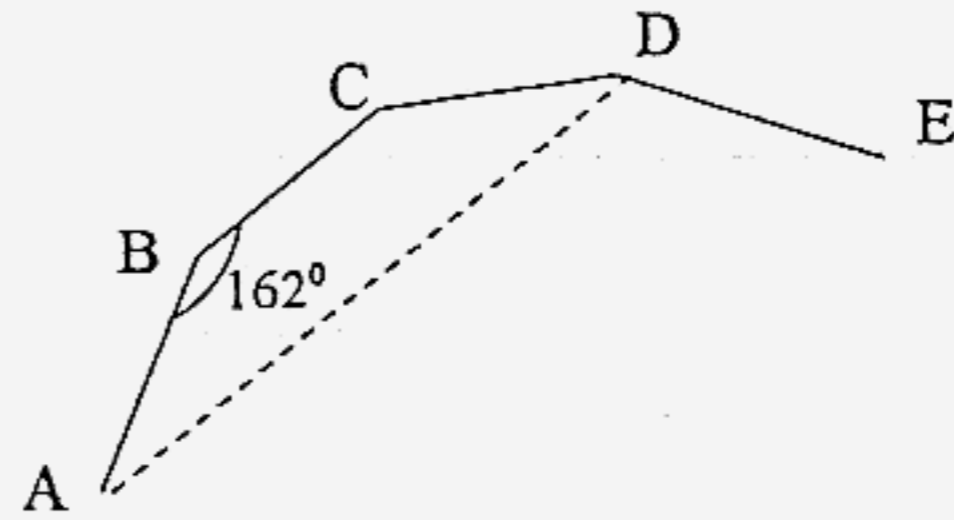
[1]



The diagram shows part of a regular polygon such that the interior angle is 162° . Find

(a) $\angle BCA$,

(b) number of sides of the polygon.



$$\begin{aligned} \text{(a) } \angle BCA &= (180^\circ - 162^\circ)/2 \\ &= 9^\circ \end{aligned}$$

$$\text{(b) } 1 \text{ ext angle} = 18^\circ$$

$$\begin{aligned} n &= \frac{360^\circ}{18^\circ} \\ &= 20 \end{aligned}$$

Answer (a)⁰ [1]

(b) [2]

Complete the following questions

(a) Simplify $(x-3)^2 - (x^2 + 9)$.

(b) (i) Factorise completely $ka^2 - kb^2$.

(iii) Hence, find the value of $(1.85)(0.75)^2 - (1.85)(0.25)^2$

(a)

$$\begin{aligned} &(x-3)^2 - (x^2 + 9) \\ &= x^2 - 6x + 9 - x^2 - 9 \\ &= -6x \end{aligned}$$

(bi) $k(a^2 - b^2) = k(a+b)(a-b)$

(bii) $(1.85)(0.75)^2 - (1.85)(0.25)^2$
 $= (1.85)(0.75 + 0.25)(0.75 - 0.25)$
 $= (1.85)(1)(0.5)$
 $= 0.925$

Answer (a) [2]

(bi) [2]

(bii) [1]

Given $\frac{3t}{3t^2 - 5t + 2} - \frac{5}{t-1} = \frac{3}{3t-2}$, solve for t .

$$\frac{3t}{3t^2 - 5t + 2} - \frac{5}{t-1} = \frac{3}{3t-2}$$

$$\frac{3t}{(3t-2)(t-1)} - \frac{5}{t-1} = \frac{3}{3t-2}$$

$$3t = 5(3t-2) = 3(t-1)$$

$$3t - 15t + 10 = 3t - 3$$

$$13 = 15t$$

$$t = \frac{13}{15}$$

Answer [4]

Solve the following simultaneous equation

$$2x + y + 1 = \frac{3}{2}x - \frac{1}{2}y - 1 = x - y$$

$$2x + y + 1 = \frac{3}{2}x - \frac{1}{2}y - 1$$

$$4x + 2y + 2 = 3x - y - 2$$

$$x + 3y = -4 \text{ --- (1)}$$

$$2x + y + 1 = x - y$$

$$x + 2y = -1 \text{ --- (2)}$$

$$(1) - (2):$$

$$y = -3$$

Sub y into (2)

$$x = -1 + 6 = 5$$

Answer $x = \dots\dots\dots y = \dots\dots\dots$ [4]

Simplify

(a) $\frac{5x}{3a-b} + \frac{x}{2b-6a}$,

(b) $\frac{m^2 + 4m - 45}{3m^2 - 14m - 5}$ and express your answer as a single fraction.

(a)

$$\begin{aligned} & \frac{5x}{3a-b} + \frac{x}{2b-6a} \\ &= \frac{5x}{3a-b} + \frac{x}{2(b-3a)} \\ &= \frac{10x}{2(3a-b)} - \frac{x}{2(3a-b)} \\ &= \frac{9x}{2(3a-b)} \end{aligned}$$

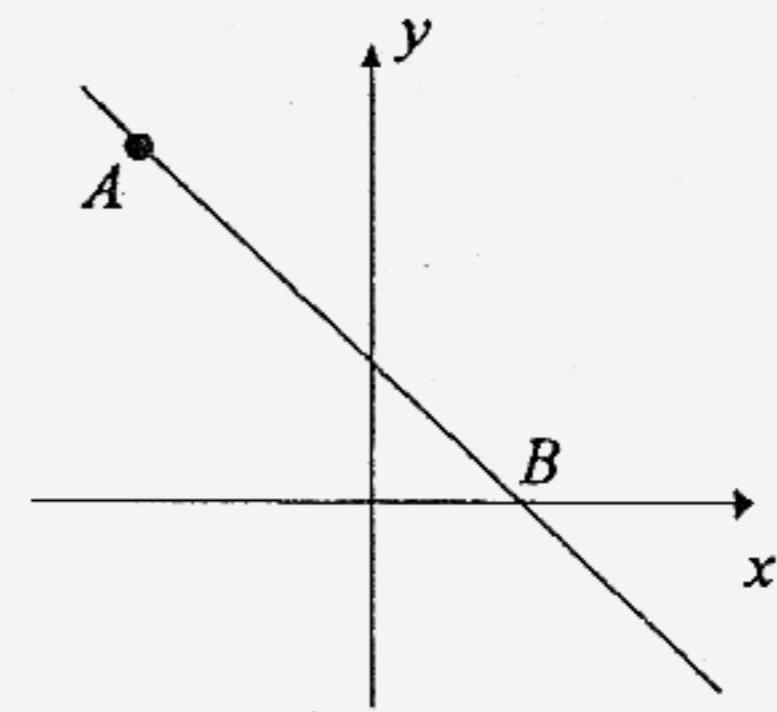
(b)

$$\begin{aligned} & \frac{m^2 + 4m - 45}{3m^2 - 14m - 5} \\ &= \frac{(m+9)(m-5)}{(3m+1)(m-5)} \\ &= \frac{m+9}{3m+1} \end{aligned}$$

Answer (a)..... [2]

(b)..... [3]

The diagram shows a sketch of the line $y = ax + 3$. Given that the point $A(-5, 8)$ lies on the line and the point B is the where the line intersect the x -axis, find



- (a) the value of a ,
- (b) the coordinates of B .

(a) Sub A into equation

$$8 = a(-5) + 3$$

$$8 - 3 = -5a$$

$$a = -1$$

(b) At B , $y = 0$

$$0 = -x + 3$$

$$x = 3$$

B is $(3, 0)$

Answer (a) $a = \dots\dots\dots$ [2]

(b) $(\dots\dots\dots, \dots\dots\dots)$ [1]

Given that the number of days (d) and the number of workers (w) painting the wall varies inversely. On an occasion where there are 8 workers, they took only 5 days to complete the paint job.

- (a) Write an expression of d in terms w ,
- (b) Find out the number of workers needed to clean up the garden in 4 days.

(a)

$$d = \frac{k}{w}$$

$$5 = \frac{k}{8}$$

$$k = 40$$

$$d = \frac{40}{w}$$

(b)

$$4 = \frac{40}{w}$$

$$w = 10$$

Answer (a) $\dots\dots\dots$ [2]

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

Given that $A = \{x : 15 < x < 26 \text{ and } x \text{ is an integer}\}$.

- (a) Write down the list of all elements in the set A ,
 (b) If a number is chosen at random from A , find the probability that
 (i) the number is a prime number,
 (ii) the number is an odd number.

(a) $A = \{16, 17, 18, 19, 20, 21, 22, 23, 24, 25\}$

(bi) $P(\text{prime}) = \frac{3}{10}$

(bii) $P(\text{odd}) = \frac{1}{2}$

Answer (a)..... [1]

(bi)..... [1]

(bii)..... [1]

The table below shows the number of errors made by 20 students when reciting a passage.

Number of errors	0	1	2	3	4	5
Number of students	5	3	x	4	y	2

- (a) If the median is given to be 2.5, find the value of x and y .
 (b) Using the values of x and y in (a), find
 (i) mode,
 (ii) mean.

(a) $5 + 3 + x = 10$
 $x = 2$
 $4 + y + 2 = 10$
 $y = 4$

(b) mode = 0

(c) mean

$$= \frac{5 + 3 + 2(2) + 3(4) + 4(4) + 5(2)}{20}$$

$$= \frac{50}{20}$$

$$= 2.5$$

Answer (a)..... [2]

(bi)..... [1]

(bii)..... [2]

— END OF PAPER —

Section 3

1

a) Mode = 6

B1

b) Total Score = $2+4+6+8+17+16+8+7+5+4+3$
 $= 80$

therefore, Median lies between 40th and 41st position

$$= \frac{40^{\text{th}} + 41^{\text{st}}}{2}$$

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

B1

c) Mean =

$$\frac{2 \times 2 + 3 \times 4 + 4 \times 6 + 5 \times 8 + 6 \times 17 + 7 \times 16 + 8 \times 8 + 9 \times 7 + 10 \times 5 + 11 \times 4 + 12 \times 3}{80} =$$

M1

$$\frac{551}{80} \approx 6.89 \text{ (3 significant figure)}$$

A1

2

(a) $\frac{2(x-2)}{2 \times 3} + \frac{3x}{2 \times 3} = x - 2$

M1

$$\frac{2(x-2) + 3x}{6} = x - 2$$

$$2x - 4 + 3x = 6x - 12$$

$$6x - 3x - 2x = 12 - 4$$

A1

$$x = 8$$

(b) Number of days = $\frac{478}{8} = 59$ Days

M1

$$y = \frac{k}{x} \quad 59 = \frac{k}{1} \quad k = 59$$

M1

$$\therefore y = \frac{59}{x}$$

$$6 = \frac{59}{x} \quad x = \frac{59}{6} = 9.833$$

\therefore the least number workers is 10.

A1

(a) Arc Length AB = $\frac{\angle AOB}{360^\circ} \times 2\pi r$

$4.7 = \frac{\angle AOB}{360^\circ} \times 2(3.14)(3.4)$

$\angle AOB = \frac{360 \times 4.7}{6.8 \times 3.14}$

$\angle AOB = \frac{1692}{21.352}$

$= 79.2^\circ$ (2 decimal place)

M1

A1

(b) Area of sector = $\frac{\angle AOB}{360} \times \pi r^2$

$= \frac{79.2}{360} \times (3.14)(3.4)^2$

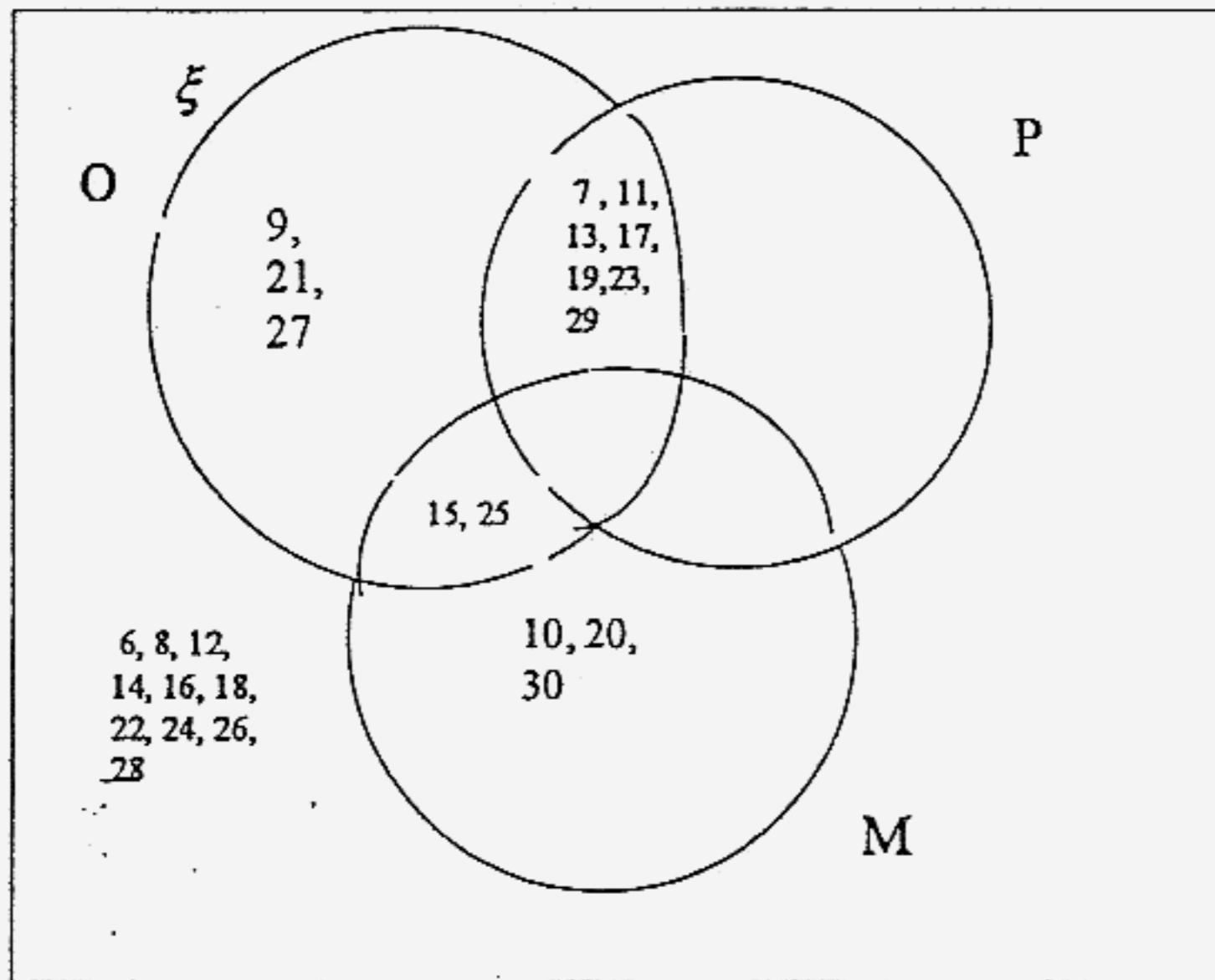
$= 7.985 \text{ cm}^2$

$= 8 \text{ cm}^2$

M1

A1

(a)



B3

(b) $n(O \cap M) = 2$

$n(O \cup M) = 15$

B1

B1

(a) Volume of hemisphere = $\frac{2}{3} \times (3.142)(5)^3$
= 261.833

Volume of cylinder = $(3.142)(5)^2(20)$
= 1571

Total Volume = 1832.83 cm³ (2 decimal place)
= 1830 (3 significant figures)

(b) Surface area of hemisphere = $(2)(3.142)(5)^2$
= 157.1 cm²

Total cost = \$1.20 × 157.1
= \$188.52

(c) Vertical surface area of hemisphere parallel to BC = $\frac{(3.142)(5)^2}{2}$
= 39.275 cm²

Vertical surface area of cylinder parallel to BC = $(2)(5)(20)$
= 200 cm²

Total surface area = 239.275 cm²
= 239 cm² (3 significant figures)

- 6 (a) By Pythagoras Theorem
- $$(x_1)^2 = 35^2 - 20^2 \qquad (x_2)^2 = 53^2 - 20^2$$
- $$x_1 = \sqrt{825} \qquad x_2 = \sqrt{2409}$$
- $$x_1 = 28.722 \text{ m} \qquad x_2 = 49.082 \text{ m}$$
- KN = 28.722 + 49.082
= 77.8 m
- b) Area of triangle = $\frac{1}{2} \times (20)(77.8)$
= 778 m²
- Area of rectangle = 2 × 778
= 1556 m²
- $$MN = \frac{1556}{77.8}$$
- $$= 20 \text{ m}$$
- Distance MB = $\sqrt{(20)^2 + (53)^2}$
= 56.65 m (2 decimal place)
- 7 (a) E – first pen drawn is blue
 $P(E) = \frac{4}{13}$
- (b) E – second pen drawn is blue
 $P(E) = \frac{3}{12}$
 $P(E) = \frac{1}{4}$
- (c) E – the next pen drawn is black
 $P(E) = \frac{6}{13}$

8 (a) $\text{Time} = \frac{30}{60} = \frac{1}{2} h$

$\text{Speed} = 80 \text{ km/h}$

$\text{Distance} = 80 \times \frac{1}{2} = 40 \text{ km}$

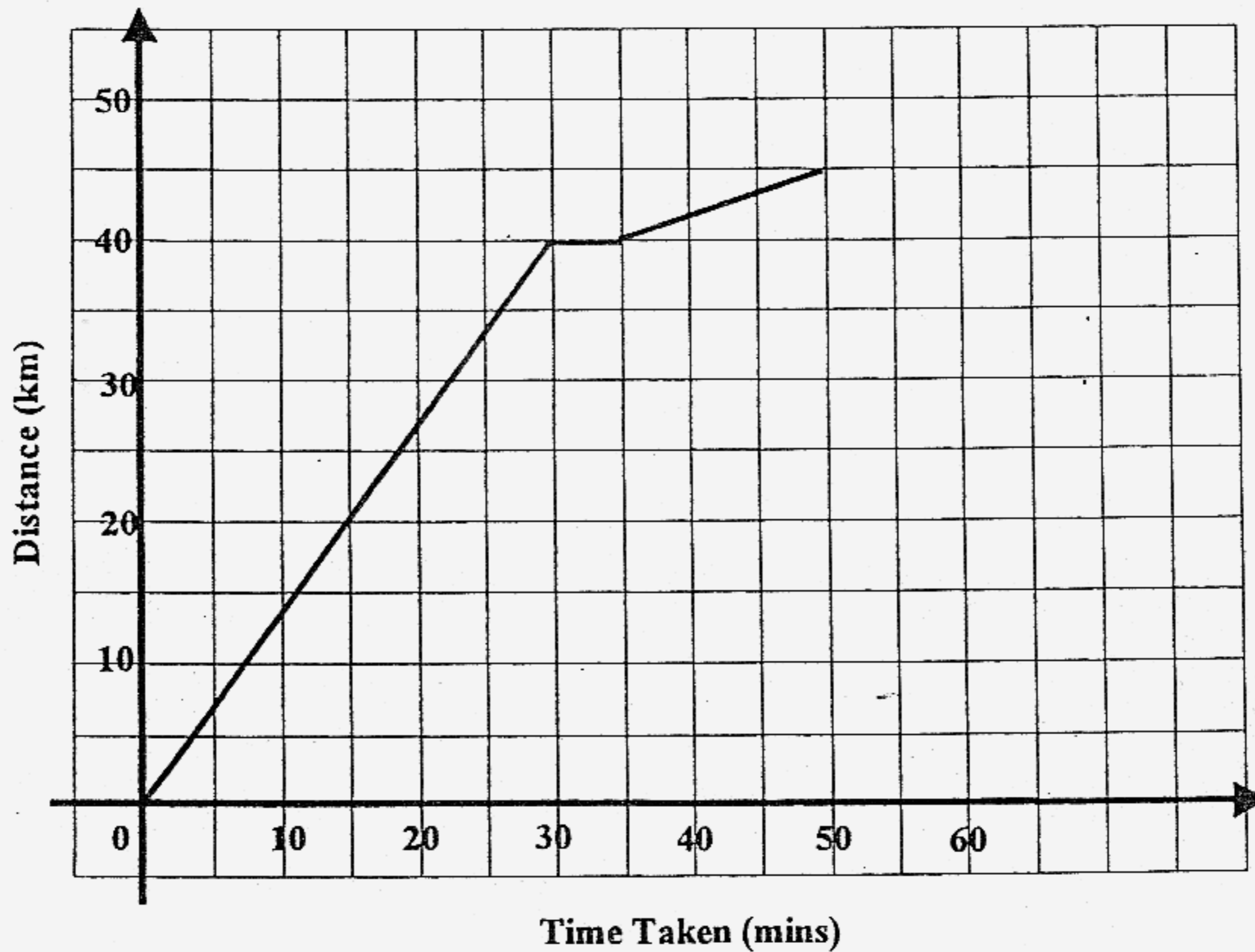
B1

A1

(b) $\text{Speed} = \frac{5}{15/60} = 20 \text{ km/h}$

A2

(c)



(d) $\text{Average speed} = \frac{45}{50} \times 60 = 54 \text{ km/h}$

A1

