Name:	Index No.:	Class:

PRESBYTERIAN HIGH SCHOOL

MATHEMATICS **4052/01**
PAPER 1

19 August 2025 Tuesday 2 hours 15 minutes

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2025 SECONDARY FOUR EXPRESS / FIVE NORMAL PRELIMINARY EXAMINATION

DO NOT OPEN THIS QUESTION PAPER UNTIL YOU ARE TOLD TO DO SO.

INSTRUCTIONS TO CANDIDATES:

Write your name, index number and class on the spaces provided above. Write in dark blue or black pen. You may use an HB pencil for any diagrams or graphs. Do not use staples, paper clips, glue or correction fluid.

Answer **all** the questions.
If working is needed for any question, it must be shown with the answer.
Omission of essential working will result in loss of marks.
The use of an approved scientific calculator is expected, where appropriate.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.
For π, use either your calculator value or 3.142, unless the question requires the answer in terms of π.
Note that all the diagrams in this paper are not drawn to scale.

The number of marks is given in brackets [ ] at the end of each question or part question.
The total of the marks for this paper is 90.

For Examiner's Use				
Category	Accuracy	Notations	Others	*Marks Deducted*
Question No.				

Total Marks
90

Setter: Mr Tan Chee Wee
Vetter: Ms Ong Bi Ru

This question paper consists of **23** printed pages (including this cover page) and **1** blank page.

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Mathematical Formulae

Compound Interest

$$\text{Total amount} = P\left(1+\frac{r}{100}\right)^n$$

Mensuration

$$\text{Curved surface area of a cone} = \pi rl$$

$$\text{Surface area of a sphere} = 4\pi r^2$$

$$\text{Volume of a cone} = \frac{1}{3}\pi r^2 h$$

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$$\text{Area of triangle } ABC = \frac{1}{2}ab\sin C$$

$$\text{Arc length} = r\theta, \text{ where } \theta \text{ is in radians}$$

$$\text{Sector area} = \frac{1}{2}r^2\theta, \text{ where } \theta \text{ is in radians}$$

Trigonometry

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

Statistics

$$\text{Mean} = \frac{\Sigma fx}{\Sigma f}$$

$$\text{Standard deviation} = \sqrt{\frac{\Sigma fx^2}{\Sigma f} - \left(\frac{\Sigma fx}{\Sigma f}\right)^2}$$

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Answer **all** the questions.

1 Calculate $\sqrt[3]{27.38^2 - \frac{7.9}{0.021}}$.

Answer ……..…….. [1]

2 Simplify

(a) $4\sqrt[5]{y^6} \times y^{-1}$,

Answer ……..…….. [1]

(b) $5x - 7 - 9x + 3x - 2$.

Answer ……..…….. [1]

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3 **(a)** Expand and simplify $(p+2)(1+3p-p^2)$.

Answer ……. [2]

(b) Write as a single fraction in its simplest form $\frac{3}{(5-2x)^2}-\frac{1}{5-2x}$.

Answer ……. [2]

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4 **(a)** Express 504 as a product of its prime factors.

Answer …… [1]

(b) Find the smallest positive integer value of k such that $\sqrt[3]{504k}$ is an integer.

Answer $k =$ …… [1]

(c) The highest common factor (HCF) of two numbers is 84. The lowest common multiple (LCM) of the two numbers is 504. Both numbers are more than 100. Find the two numbers.

Answer …… and …… [2]

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5 It is given that x pencils cost y dollars and 4 cents.

(a) Find the cost of one pencil in cents.

Answer ……cents [1]

(b) Write down an expression for the number of pencils that could be bought for t dollars.

Answer …… [1]

6 Given that $A:B=\frac{1}{6}:\frac{1}{5}$ and $B:C=3:7$, find $A:C$ as a ratio of two integers.

Answer …….. : …….. [2]

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7 Find the smallest integer that satisfies $6y - 3 > 17$.

Answer ……[2]

8 The force F, between two particles is inversely proportional to the square of the distance between them. The force is 64 units when the distance between the particles is r metres. Find the force when the distance between the particles is reduced by 20%.

Answer ……units [2]

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9 The distance between Earth and Venus is 150.4 million kilometres.

(a) Express 150.4 million in standard form.

Answer ……[1]

(b) A space shuttle can travel 7500 metres in 1 second.

(i) Find the speed, in kilometres per hour, of the space shuttle.

Answer ……km/h [1]

(ii) Find the number of days the space shuttle will take to travel from Earth to Venus.
Give your answer to the nearest whole number.

Answer ……days [2]

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10 Given that $3a + 5c = \frac{3-c}{2b}$, make c the subject of the equation.

Answer …… [3]

11 The scale of a map is given as 1: 50000.

(a) A road on the map is 16 cm long. Find the actual length of a road in kilometres.

Answer ……..km [1]

(b) A lake has an area of 40 km^2. Find the area of the lake on the map in square centimetres.

Answer …… cm^2 [2]

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12 The frequency table shows the masses of 50 students from Class A.

Mass (m kg)	$20 < m \leq 30$	$30 < m \leq 40$	$40 < m \leq 50$	$50 < m \leq 60$	$60 < m \leq 70$
Frequency	2	11	20	12	5

(a) Calculate the mean mass of the students from Class A. .

Answer ……kg [1]

(b) Calculate the standard deviation for the mass of students in class A. .

Answer ……kg [1]

(c) Explain why the value of the mean calculated in **part (a)** is only an estimate.

Answer

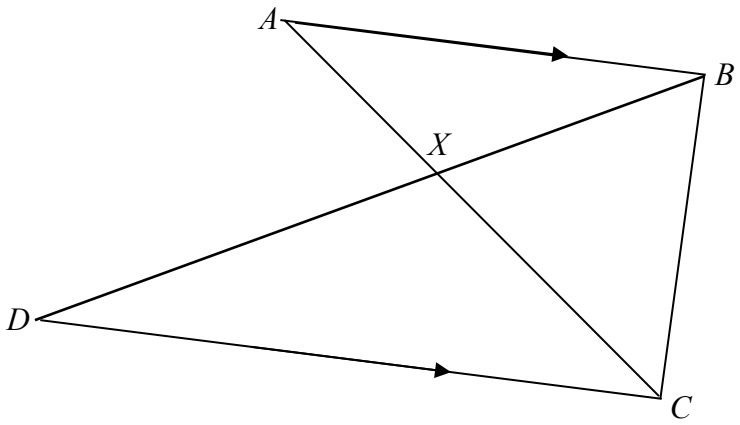
……

……

…… [1]

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13 In the diagram, AB is parallel to DC. AC and BD meet at X.



(a) Show that triangle ABX and triangle CDX are similar.
Give a reason for each statement you make.

Answer

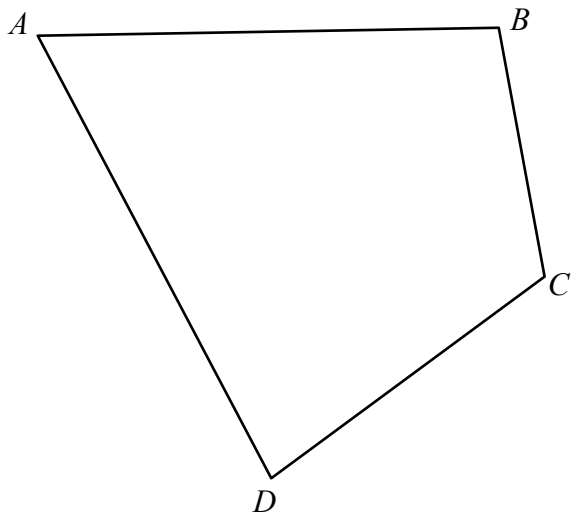
[2]

(b) $AB = 16$ cm, $AX = 8$ cm, $XC = 12$ cm.
Given that $BD = 28$ cm, find BX.

Answer BX=……cm [2]

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14 The diagram shows a quadrilateral playground $ABCD$.



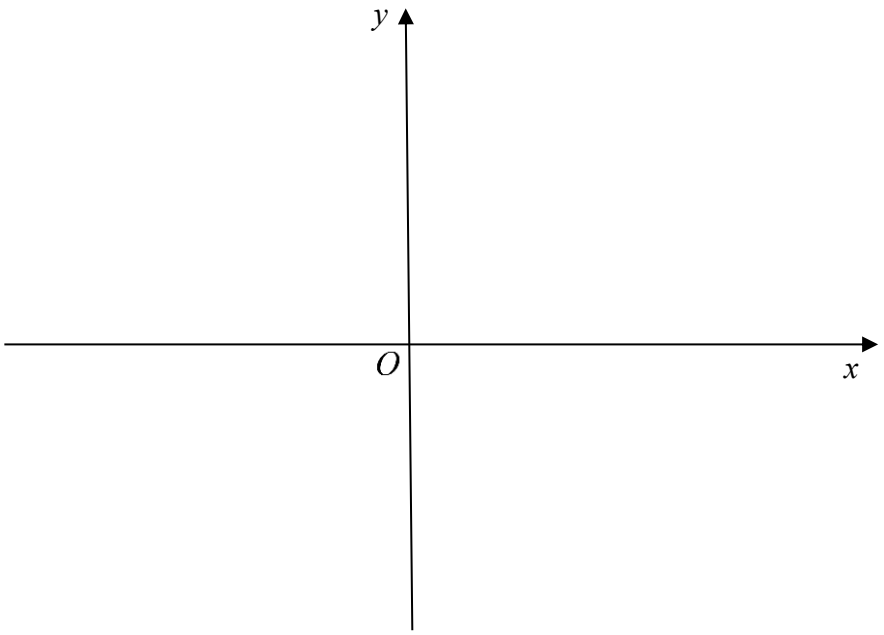
(a) Construct the perpendicular bisector of AB. [1]

(b) Construct the bisector of angle BCD. [1]

(c) Shade the region inside $ABCD$ that is closer to CD than BC and closer to B than A. [1]

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15 **(a)** Sketch the graph of $y = (x+4)(x-8)$ on the axes below.
Indicate clearly the values where the graph crosses the x and y axes.



[2]

(b) Use the graph in **part (a)** to explain whether the graph of $y = (x+4)(x-8)+26$ cuts the x-axis.

Answer

……

……

…… [1]

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16 A, B and C are points $(-4, 3)$, $(1, 9)$ and $(0, 2)$ respectively.

(a) Find the length of AB.

Answer $AB =$ …… units [2]

(b) Find the equation of the line that passes through B and has the same gradient as AC.

Answer …… [2]

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17 Given that $2x - y = 8$ and $xy = 4$, without solving for x and y, find the value of $4x^2 + y^2$.

Answer ……..…… [2]

18 Factorise completely $18ac - 8c + 27ab - 12b$.

Answer ……..…… [2]

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19 The first four terms in a sequence of numbers, $T_1,\ T_2,\ T_3,\ T_4$ ... are given below.

$$T_1 = 2^0 + 1$$
$$T_2 = 2^1 + 3$$
$$T_3 = 2^2 + 5$$
$$T_4 = 2^3 + 7$$
$$\vdots$$

(a) Write down T_5.

Answer ……[1]

(b) Express T_n in terms of n.

Answer ……[2]

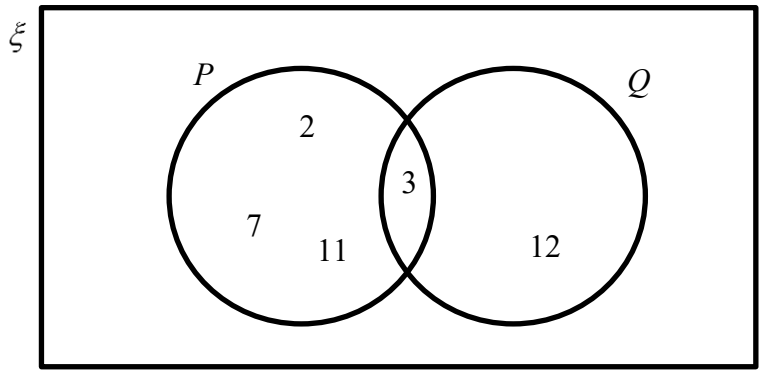
(c) Hence show that $T_n - T_{n-1} = 2^{n-2} + 2$.

Answer

[2]

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20 $\xi = \{\text{integers } x : 1 \le x \le 15\}$
P = {prime numbers}
Q = {multiples of 3}
Some of the elements of P and Q have been filled in the Venn diagram.



(a) **Complete** the Venn diagram above by filling in all the missing elements. [2]

(b) List the elements in $P' \cap Q$.

Answer …… [1]

(c) Use one of the symbols below to complete each statement.

$\varnothing$ $\in$ $\notin$ $\subset$ $\not\subset$

(i) $P \cap Q \neq$ ..... [1]

(ii) $\{2,3,7\}$ ..... P [1]

(iii) 2 ..... Q [1]

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21 A bakery produces cheesecakes, fruit cakes and red velvet cakes The number of cakes sold on a particular weekend is given by the matrix **G**.

$$\mathbf{G} = \begin{array}{c} \begin{matrix} \text{cheese} & \text{fruit} & \text{red velvet} \end{matrix} \\ \begin{pmatrix} 15 & 20 & 14 \\ 12 & 18 & 10 \end{pmatrix} \end{array} \begin{matrix} \\ \text{Saturday} \\ \text{Sunday} \end{matrix}$$

A cheesecake is sold for $\$x$, a fruit cake is sold for $\$(x-8)$ and a red velvet cake is sold for $\$(x-3)$.

(a) Represent this information in a 3×1 matrix, **J**.

Answer **J** = [1]

(b) Find in terms of x, the matrix **K = GJ**.

Answer **K** = [2]

(c) State what the elements of **K** represent.

……

……

…… [1]

(d) The total amount of money collected by the bakery from the sales of all the cakes on this particular weekend is \$5676, find the value of x.

Answer x=…… [2]

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22 Box *X* contains 4 balls numbered 1, 2, 3 and 4.
Box *Y* contains another 4 balls numbered 1, 3, 5 and 6.
In a game, May drew a ball at random from each box, and the sum of both numbers is obtained.

(a) Complete the possibility diagram below.

Box *Y*

Box *X*	+	1	3	5	6
	1	2			7
	2		5		
	3			8	
	4		**7**		10

[2]

(b) Find the probability that the sum obtained is 6.

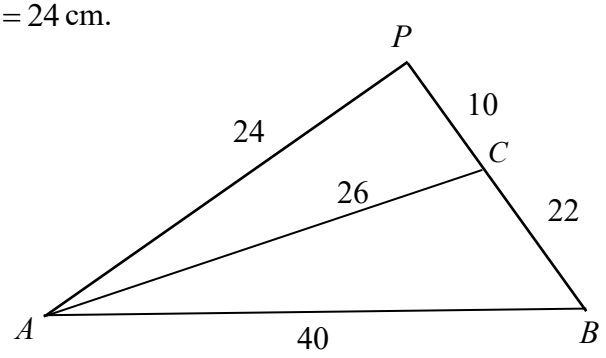
Answer ……..... [1]

(c) Box *Z* contains 4 balls numbered 10, 20, 30 and 40. Albert drew a ball at random from each of the boxes *X, Y* and *Z*, and the sum of all three numbers is obtained.
Find the probability that the sum obtained is more than 30 but less than 36.

Answer ……..... [2]

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23 In triangle ABC, $AB = 40$ cm, $BC = 22$ cm and $AC = 26$ cm. P is a point on BC produced, where $CP = 10$ cm and $AP = 24$ cm.



(a) Explain why angle APB is a right angle.

Answer

[1]

(b) Express the following as a fraction in its lowest term

(i) $\tan \angle ABP$,

Answer ..... [1]

(ii) $\cos \angle ACB$.

Answer ..... [1]

(c) A circle passes through the points A, P and B. John said that the radius of the circle is 16 cm. Do you agree with him?

.....

.....

..... [2]

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24 Eighteen students took a test.
Their scores are shown in the stem-and-leaf diagram below.

Stem	Leaf
0	3 5 8
1	0 1 2 2 3 p 6 7 7 7 9
2	1 8 8 9

Key 1|3 means 13

(a) Given that the median score is 15, find

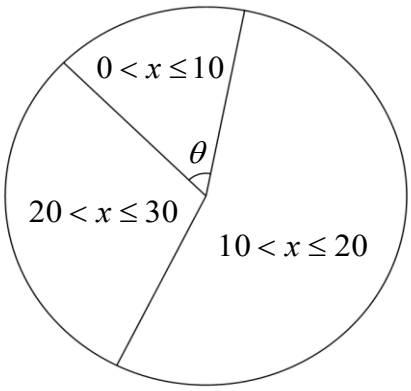
(i) the modal score,

Answer …… [1]

(ii) the value of p.

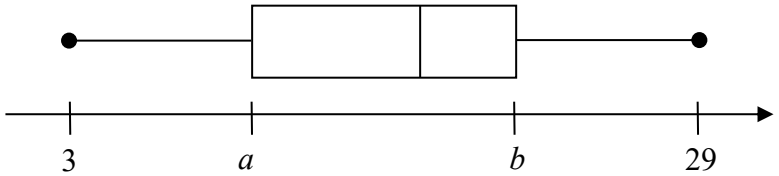
Answer …… [1]

(b) These students are grouped into three groups based on their scores, x. This is represented on the pie chart below. Find the value of θ.



Answer θ=…… [1]

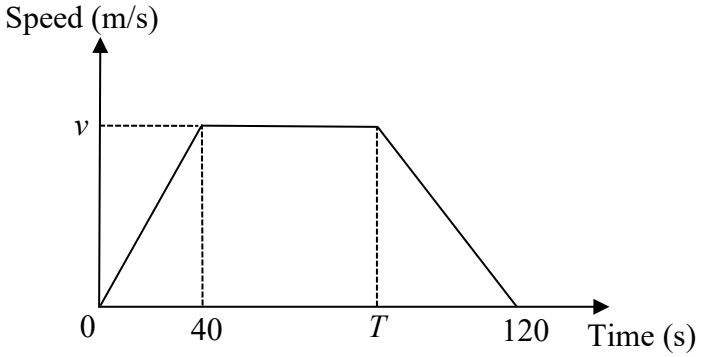
(c) The above data is represented on a box-and-whisker plot shown below.
Find the value of a and of b.



Answer a = …… b= …… [2]

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25 The diagram below shows the speed-time graph of a bus journey.
The bus accelerated from rest at 0.5 m/s^2 to a speed of v m/s in 40 seconds, and travelled at this speed until T seconds before it came to a stop at 120 seconds.
The total distance travelled for the whole journey was 1500 m.
The area beneath the speed-time graph represents the distance travelled by the bus.



Find the value of

(a) v,

Answer v=…… [1]

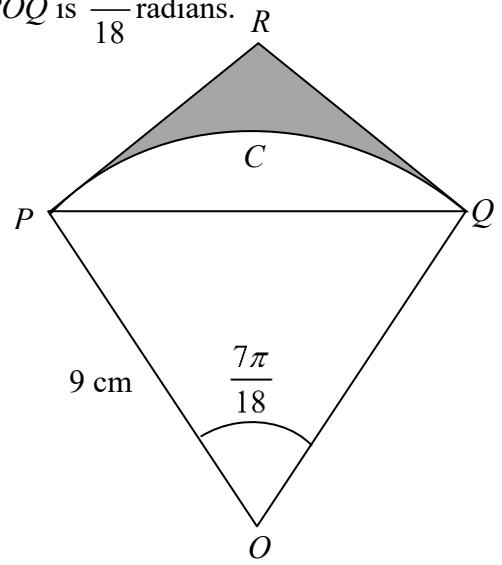
(b) T.

Answer T=…… [2]

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26 PCQ is an arc of a circle, centre O, of radius 9 cm.

The tangents at P and Q meet at R. Angle POQ is $\frac{7\pi}{18}$ radians.



(a) Show that angle $PRQ = \frac{11\pi}{18}$ radians.

Answer [1]

(b) Find the length of arc PCQ.

Answer ……cm [1]

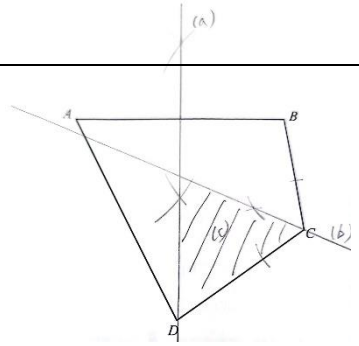
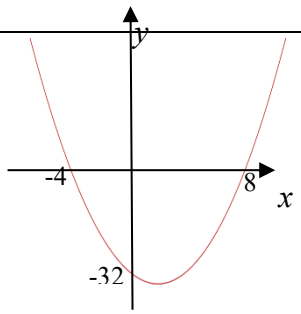
(c) Find the area of the shaded region.

Answer …… cm^2 [3]

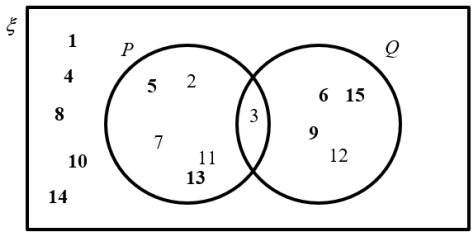
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Answer Key

1	7.20	**2**	**a** $4y^{\frac{1}{5}}$ **b** $-x-9$
3	**a** $2+7p+p^2-p^3$ **b** $\dfrac{2x-2}{(5x-2)^2}$	**4**	**a** $2^3\times3^2\times7$ **b** 147 **c** 168, 252
5	**a** $\dfrac{100y+4}{x}$ **b** $\dfrac{100tx}{100y+4}$	**6**	5 : 14
7	4	**8**	100
9	**a** 1.504×10^8 **bi** 27000 km/h **bii** 232	**10**	$c=\dfrac{3-6ab}{10b+1}$
11	**a** 8 km **b** 160 cm^2	**12**	**a** 46.4 **b** 10.0 **c** The exact/actual mass of each student is not known
14		**15**	 **b** y -intercept of $y=(x+4)(x-8)$ is -32, therefore y -intercept of $y=(x+4)(x-8)+26$ is -6 which is below the x-axis, therefore y **cuts** the x-axis at two points.
13	**a** $\angle ABX=\angle CDX$ (alt $\angle$s, AB//CD) $\angle AXB=\angle CXD$ (vert. oppo $\angle$) ΔABX is similar to ΔCDX (AA Similarity) **b** 11.2	**16**	**a** 7.81 **b** $y=-0.25x+9.25$
17	80	**18**	$(9a-c)(2c+3b)$

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19	**a** $T_5 = 2^4 + 9$ **b** $2^{n-1} + 2n - 1$	**20**	 **b** 6,9,12,15 **ci** $\varnothing$ **cii** $\subset$ **ciii** $\notin$
21	a $\mathbf{J} = \begin{pmatrix} x \\ x-8 \\ x-3 \end{pmatrix}$ **b** $\mathbf{K} = \begin{pmatrix} 49x-202 \\ 40x-174 \end{pmatrix}$ **c** It represents the **total amount** collected from the **sales** of cheesecake, fruit cakes and red velvet cakes sold om Saturday and Sunday respectively. **d** $x = 68$	**22**	**a** $\frac{1}{8}$ **b** $\frac{3}{32}$
23	**a** $AP^2 + BP^2 = 24^2 + 32^2 = 1600$ $AB^2 = 20^2 = 1600$ Since $AB^2 = AP^2 + PB^2$, by converse of Pythagoras theorem, $\angle APB$ is a right angle **bi** $\frac{3}{4}$ **ii** $-\frac{5}{13}$ **c** No. The diameter is AB as it is right angle in a semicircle and radius is 20 cm	**24**	**bi**17 ii $p = 4$ **c** 80 **d** a = 11, b= 19
25	**a** 20 **b** 70	**26**	**b** 11.0 cm **c** 7.24 cm^2

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PRESBYTERIAN HIGH SCHOOL

MATHEMATICS **4052/01**
PAPER 1

19 August 2025 Tuesday 2 hours 15 minutes

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2025 SECONDARY FOUR EXPRESS / FIVE NORMAL
PRELIMINARY EXAMINATION

SUGGESTED ANSWERS

Setter: Mr Tan Chee Wee
Vetter: Ms Ong Bi Ru

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$$a^2 = b^2 + c^2 - 2bc\cos A$$

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$$\text{Mean} = \frac{\Sigma fx}{\Sigma f}$$

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Answer **all** the questions.

1 Calculate $\sqrt[3]{27.38^2 - \frac{7.9}{0.021}}$.

7.20

Answer ……..…….. [1]

2 Simplify

(a) $4\sqrt[5]{y^6} \times y^{-1}$,

$4y^{\frac{6}{5}} \times y^{-1}$

$4y^{\frac{1}{5}}$

Answer …….. [1]

(b) $5x - 7 - 9x + 3x - 2$.

$-x - 9$

Answer …….. [1]

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3 **(a)** Expand and simplify $(p+2)(1+3p-p^2)$.

$(p+2)(1+3p-p^2) = p+3p^2-p^3+2+6p-2p^2$

$(p+2)(1+3p-p^2) = 2+7p+p^2-p^3$

Answer …… [2]

(b) Write as a single fraction in its simplest form $\frac{3}{(5-2x)^2}-\frac{1}{5-2x}$.

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

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

Answer …… [2]

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4 **(a)** Express 504 as a product of its prime factors.

$504 = 2^3 \times 3^2 \times 7$

Answer …… [1]

(b) Find the smallest value of k such that $\sqrt[3]{504k}$ is an integer.

$k = 3 \times 7^2 = 147$

Answer $k =$ …… [1]

(c) The highest common factor (HCF) of two numbers is 84. The lowest common multiple (LCM) of the two numbers is 504. Both numbers are more than 100. Find the two numbers.

168
252

Answer …… and …… [2]

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5 It is given that x pencils cost y dollars and 4 cents.

(a) Find the cost of one pencil in cents.

$$\frac{100y+4}{x}$$

Answer ……cents [1]

(b) Write down an expression for the number of pencils that could be bought for t dollars.

$$100t \div \frac{100y+4}{x} = 100t \times \frac{x}{100y+4}$$
$$= \frac{100tx}{100y+4}$$

/

Answer …… [1]

6 Given that $A:B = \frac{1}{6}:\frac{1}{5}$ and $B:C = 3:7$, find $A:C$ as a ratio of two integers.

$A:B = \frac{1}{6}:\frac{1}{5}$

$A:B = \frac{15}{6}:\frac{15}{5}$

$A:B = \frac{5}{2}:3$ or $A:B = 5:6$

$A:C = \frac{5}{2}:7$

$A:C = 5:14$

Answer …… : …… [2]

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7 Find the smallest integer that satisfies $6y - 3 > 17$.

$6y - 3 > 17$
$6y > 20$
$y > \frac{20}{6}$
Smallest $y = 4$

Answer …… [2]

8 The force F, between two particles is inversely proportional to the square of the distance between them. The force is 64 units when the distance between the particles is r metres. Find the force when the distance between the particles is reduced by 20%.

$F = \frac{k}{r^2}$
$64 = \frac{k}{r^2}$
$F = \frac{k}{(0.8r)^2}$
$F = \frac{k}{0.64r^2}$
$F = \frac{64}{0.64}$
$F = 100$ units

Answer ……units [2]

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9 The distance between Earth and Venus is 150.4 million kilometres.

(a) Express 150.4 million in standard form.

$150.4 \times 10^6 = 1.504 \times 10^8$ km

Answer …… [1]

(b) A space shuttle can travel 7500 metres in 1 second.

(i) Find the speed, in kilometres per hour, of the space shuttle.

$$\frac{7500 \div 1000}{1 \div 3600}$$

$= 27000$ km/h

Answer ……km/h [1]

(ii) Find the number of days the space shuttle will take to travel from Earth to Venus.

Give your answer to the nearest whole number.

$$\frac{1.504 \times 10^8}{27000} \div 24$$

232 days

Answer ……days [2]

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10 Given that $3a + 5c = \frac{3-c}{2b}$, make c the subject of the equation.

$3a + 5c = \frac{3-c}{2b}$
$6ab + 10bc = 3 - c$
$10bc + c = 3 - 6ab$
$c(10b + 1) = 3 - 6ab$
$c = \frac{3-6ab}{10b+1}$

Answer …….. [3]

11 The scale of a map is given as 1: 50000.

(a) A road on the map is 16 cm long. Find the actual length of a road in kilometres.

1 cm : 50000 cm
1 cm : 0.5 km
16 cm : 8 km

Answer ……..km [1]

(b) A lake has an area of 40 km^2. Find the area of the lake on the map in square centimetres.

1 cm : 0.5 km
1 cm^2 : 0.25 km^2
$\frac{40}{0.25}$ cm^2 : 40 km^2
160 cm^2 : 40 km^2

Answer …… cm^2 [2]

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12 The frequency table shows the masses of 50 students from Class A.

Mass (m kg)	$20 < m \leq 30$	$30 < m \leq 40$	$40 < m \leq 50$	$50 < m \leq 60$	$60 < m \leq 70$
Frequency	2	11	20	12	5

(a) Calculate the mean mass of the students from Class A.

$$\text{mean} = \frac{2\times 25 + 11\times 35 + 20\times 45 + 12\times 55 + 5\times 65}{50}$$

$$\text{mean} = 46.4 \text{ kg}$$

Answer ……kg [1]

(b) Calculate the standard deviation for the mass of students in class A.

$$= \sqrt{\frac{2\times 25^2 + 11\times 35^2 + 20\times 45^2 + 12\times 55^2 + 5\times 65^2}{50} - (46.4)^2}$$

$$= 10.0 \text{ kg}$$

Answer ……kg [1]

(c) Explain why the value of the mean calculated in **part (a)** is only an estimate.

Answer

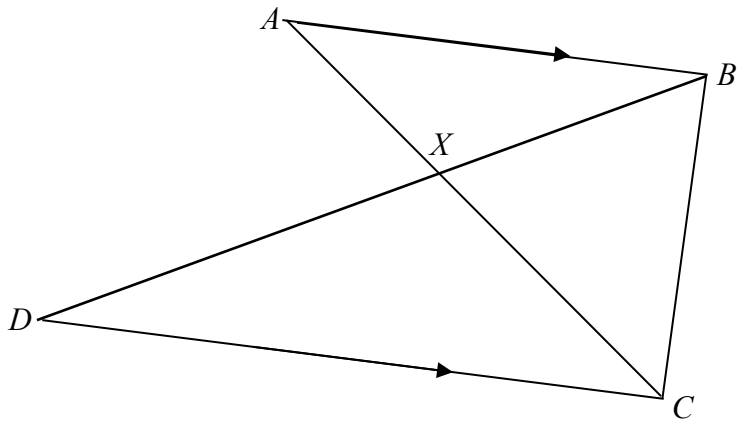
… The exact/actual mass of each student is not known ……

……

…… [1]

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13 In the diagram, AB is parallel to DC. AC and BD meet at X.



(a) Show that triangle ABX and triangle CDX are similar.
Give a reason for each statement you make.

Answer
$\angle ABX = \angle CDX$ (alt $\angle$ s, AB//CD)
$\angle AXB = \angle CXD$ (vert. oppo $\angle$)
ΔABX is similar to ΔCDX (AA Similarity) [-1 m if test not stated]

[2]

(b) AB = 16 cm, AX = 8 cm, XC = 12 cm.
Given that BD = 28 cm, find BX.

$$\frac{BX}{AX} = \frac{DX}{CX}$$

$$\frac{BX}{8} = \frac{28 - BX}{12} \qquad \text{or} \quad BX = \frac{8}{12+8} \times 28$$

$$12BX = 224 - 8BX$$

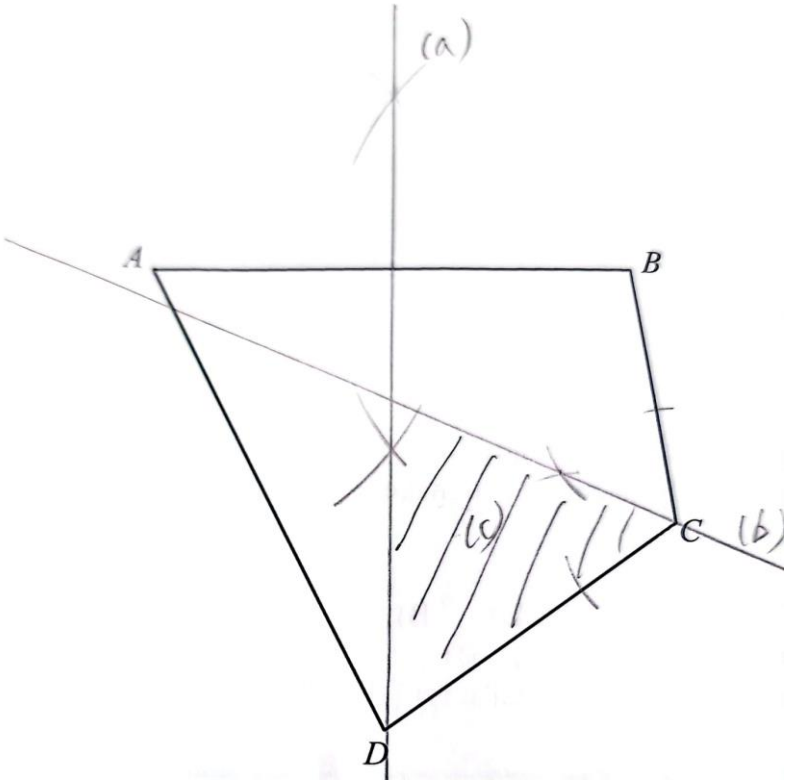
$$20BX = 224$$

$$BX = 11.2 \text{ cm}$$

Answer BX=……cm [2]

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14 The diagram shows a quadrilateral playground $ABCD$.



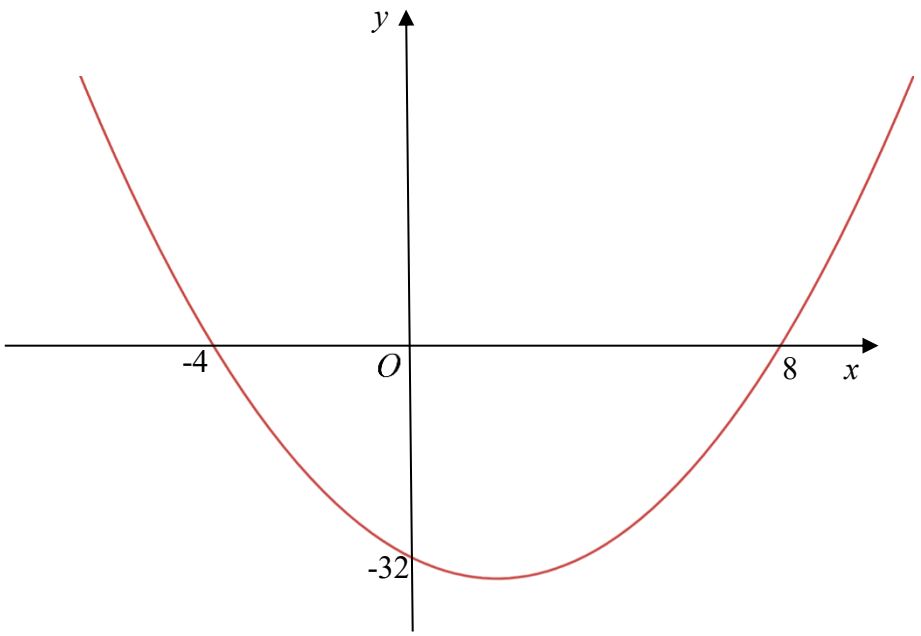
(a) Construct the perpendicular bisector of AB. [1]

(b) Construct the bisector of angle BCD. [1]

(c) Shade the region inside $ABCD$ that is closer to CD than BC and closer to B than A. [1]

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15 **(a)** Sketch the graph of $y=(x+4)(x-8)$ on the axes below.
Indicate clearly the values where the graph crosses the x and y axes.



[2]

(b) Use the graph in **part (a)** to explain whether the graph of $y=(x+4)(x-8)+26$ cuts the x-axis.

Answer

y-intercept of $y=(x+4)(x-8)$ is -32, therefore y-intercept of $y=(x+4)(x-8)+26$ is -6 which is below the x-axis, therefore y **cuts** the x-axis at two points.

Or

Minimum value of $y=(x+4)(x-8)$ is -36, therefore **minimum** value of $y=(x+4)(x-8)+26$ is -10 which is below the x-axis, therefore y **cuts** the x-axis at two points because its vertex lies below the x-axis.

[1]

……

……

……

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16 A, B and C are points $(-4, 3)$, $(1, 9)$ and $(0, 2)$ respectively.

(a) Find the length of AB.

$AB = \sqrt{(1-(-4))^2 + (9-3)^2}$
$AB = 7.81$

Answer $AB =$ …… units [2]

(b) Find the equation of the line that passes through B and has the same gradient as AC.

$m_{AC} = \dfrac{2-3}{0-(-4)} = -0.25$

$y = -0.25x + c$
$9 = -0.25 + c$
$c = 9.25$
$y = -0.25x + 9.25$

Answer …… [2]

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17 Given that $2x - y = 8$ and $xy = 4$, without solving for x and y, find the value of $4x^2 + y^2$.

$(2x - y)^2 = 8^2$

$4x^2 - 4xy + y^2 = 64$

$4x^2 + y^2 = 64 + 4xy$

$4x^2 + y^2 = 64 + 4(4)$

$4x^2 + y^2 = 80$

Answer ……..…… [2]

18 Factorise completely $18ac - 8c + 27ab - 12b$.

$18ac - 8c + 27ab - 12b$

$= 2c(9a - 4) + 3b(9a - 4)$

$= (9a - 4)(2c + 3b)$

Answer ……..…… [2]

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19 The first four terms in a sequence of numbers, $T_1,\ T_2,\ T_3,\ T_4$ ... are given below.

$$T_1 = 2^0 + 1$$
$$T_2 = 2^1 + 3$$
$$T_3 = 2^2 + 5$$
$$T_4 = 2^3 + 7$$
$$\vdots$$

(a) Write down T_5.

$T_5 = 2^4 + 9$

Answer ……[1]

(b) Express T_n in terms of n.

$T_n = 2^{n-1} + 2n - 1$

Answer ……[2]

(c) Hence show that $T_n - T_{n-1} = 2^{n-2} + 2$.

Answer

$T_n - T_{n-1} = 2^{n-1} + 2n - 1 - (2^{n-2} + 2(n-1) - 1)$

$T_n - T_{n-1} = 2^{n-1} + 2n - 1 - 2^{n-2} - 2n + 2 + 1$

$T_n - T_{n-1} = 2^{n-1} - 2^{n-2} + 2$

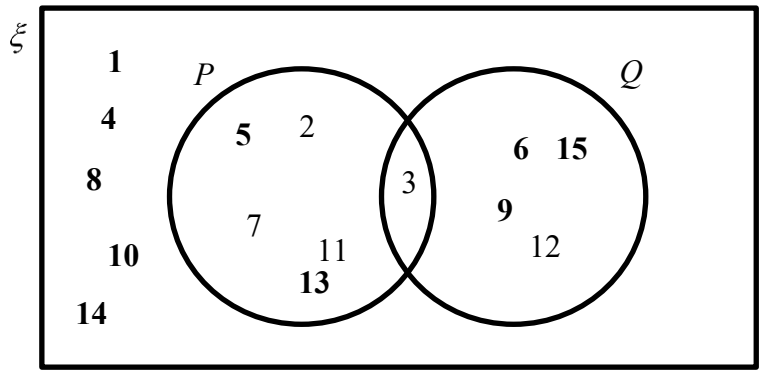
$T_n - T_{n-1} = 2^{n-2}(2-1) + 2$

$T_n - T_{n-1} = 2^{n-2} + 2$

[2]

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20 $\xi = \{\text{integers } x : 1 \le x \le 15\}$
P = {prime numbers}
Q = {multiples of 3}
Some of the elements of P and Q have been filled in the Venn diagram.



(a) **Complete** the Venn diagram above by filling in all the missing elements. [2]

(b) List the elements in $P' \cap Q$.
6, 9, 12, 15

Answer …… [1]

(c) Use one of the symbols below to complete each statement.

$\varnothing \quad \in \quad \notin \quad \subset \quad \not\subset$

(i) $P \cap Q \neq$ .....$\varnothing$..... [1]

(ii) $\{2,3,7\}$ ..... $\subset$ ..... P [1]

(iii) 2 ..... $\notin$ ..... Q [1]

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21 A bakery produces cheesecakes, fruit cakes and red velvet cakes The number of cakes sold on a particular weekend is given by the matrix **G**.

$$\mathbf{G} = \begin{matrix} \\ \text{Saturday} \\ \text{Sunday} \end{matrix} \begin{matrix} \begin{matrix} \text{cheese} & \text{fruit} & \text{red velvet} \end{matrix} \\ \begin{pmatrix} 15 & 20 & 14 \\ 12 & 18 & 10 \end{pmatrix} \end{matrix}$$

A cheesecake is sold for $\$x$, a fruit cake is sold for $\$(x-8)$ and a red velvet cake is sold for $\$(x-3)$.

(a) Represent this information in a 3×1 matrix, **J**.

$$\mathbf{J} = \begin{pmatrix} x \\ x-8 \\ x-3 \end{pmatrix}$$

Answer **J** = [1]

(b) Find in terms of x, the matrix **K = GJ**.

$$\mathbf{K} = \begin{pmatrix} 15 & 20 & 14 \\ 12 & 18 & 10 \end{pmatrix} \begin{pmatrix} x \\ x-8 \\ x-3 \end{pmatrix} = \begin{pmatrix} 15x+20(x-8)+14(x-3) \\ 12x+18(x-8)+10(x-3) \end{pmatrix}$$

$$\mathbf{K} = \begin{pmatrix} 49x-202 \\ 40x-174 \end{pmatrix}$$

Answer **K** = [2]

(c) State what the elements of **K** represent.
It represents the **total amount** collected from the **sales** of cheesecake, fruit cakes and red velvet cakes sold om Saturday and Sunday respectively.

……

…… [1]

(d) The total amount of money collected by the bakery from the sales of all the cakes on this particular weekend is $5676, find the value of x.

$$49x-202+40x-174=5676$$
$$89x=6052$$
$$x=68$$

Answer x=…… [2]

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22 Box *X* contains 4 balls numbered 1, 2, 3 and 4.
Box *Y* contains another 4 balls numbered 1, 3, 5 and 6.
In a game, May drew a ball at random from each box, and the sum of both numbers is obtained.

(a) Complete the possibility diagram below.

Box *Y*

Box *X*	+	1	3	5	6
	1	2	**4**	**6**	7
	2	**3**	5	**7**	**8**
	3	**4**	**6**	8	**9**
	4	**5**	**7**	**9**	10

[2]

(b) Find the probability that the sum obtained is 6.

$$\text{P(total is 6)} = \frac{2}{16} = \frac{1}{8}$$

Answer ……..... [1]

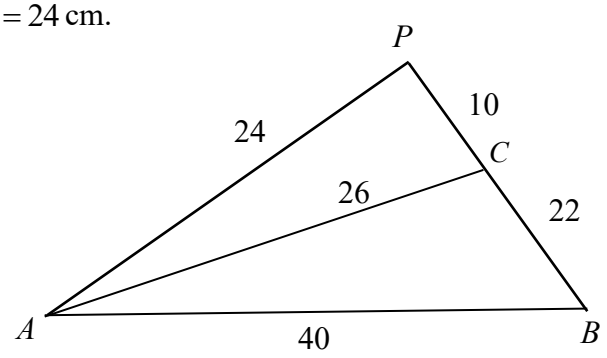
(c) Box *Z* contains 4 balls numbered 10, 20, 30 and 40. Albert drew a ball at random from each of the boxes *X, Y* and *Z*, and the sum of all three numbers is obtained.
Find the probability that the sum obtained is more than 30 but less than 36.

$$= \frac{6}{64} = \frac{3}{32}$$

Answer ……..... [2]

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23 In triangle ABC, $AB = 40$ cm, $BC = 22$ cm and $AC = 26$ cm. P is a point on BC produced, where $CP = 10$ cm and $AP = 24$ cm.



(a) Explain why angle APB is a right angle.

Answer

$AP^2 + BP^2 = 24^2 + 32^2 = 1600$

$AB^2 = 20^2 = 1600$

Since $AB^2 = AP^2 + PB^2$, by converse of Pythagoras theorem, $\angle APB$ is a right angle

[1]

(b) Express the following as a fraction in its lowest term

(i) $\tan \angle ABP$,

$$\tan \angle ABP = \frac{24}{32}$$

$$\tan \angle ABP = \frac{3}{4}$$

Answer …… [1]

(ii) $\cos \angle ACB$.

$$\cos \angle ACB = -\cos \angle ACP$$

$$\cos \angle ACB = -\frac{10}{26}$$

$$\cos \angle ACB = -\frac{5}{13}$$

Answer …… [1]

(c) A circle passes through the points A, P and B. John said that the radius of the circle is 16 cm. Do you agree with him?

No. The diameter is AB as it is right angle in the semicircle () and hence the radius is 20 cm

……

……

[2]

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24 Eighteen students took a test.
Their scores are shown in the stem-and-leaf diagram below.

Stem	Leaf
0	3 5 8
1	0 1 2 2 3 p 6 7 7 7 9
2	1 8 8 9

Key 1|3 means 13

(a) Given that the median score is 15, find

(i) the modal score,

17

Answer …… [1]

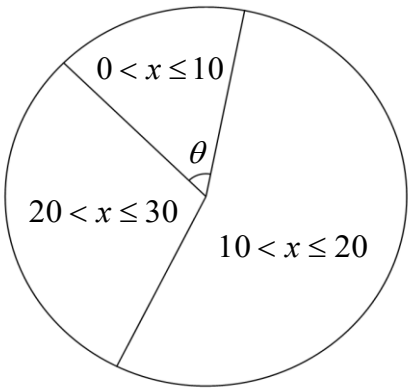
(ii) the value of p.

$$\frac{10+p+16}{2}=15$$
$$p=4$$

Answer …… [1]

(b) These students are grouped into three groups based on their scores, x. This is represented on the pie chart below. Find the value of θ.

$$\theta=\frac{4}{18}\times 360°$$
$$\theta=80°$$



Answer θ=…… [1]

(c) The above data is represented on a box-and-whisker plot shown below.

Find the value of a and of b.

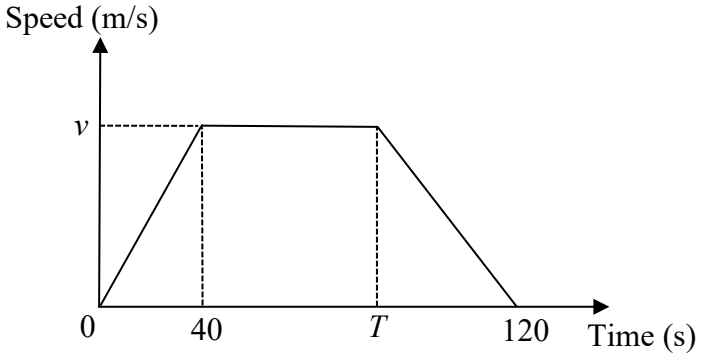


a = 11, b= 19 ,

Answer a = …… b= …… [2]

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25 The diagram below shows the speed-time graph of a bus journey.
The bus accelerated from rest at 0.5 m/s^2 to a speed of v m/s in 40 seconds, and travelled at this speed until T seconds before it came to a stop at 120 seconds.
The total distance travelled for the whole journey was 1500 m.
The area beneath the speed-time graph represents the distance travelled by the bus.



Find the value of

(a) v,

$$\frac{v}{40} = 0.5$$
$$v = 20$$

Answer v=……. [1]

(b) T.

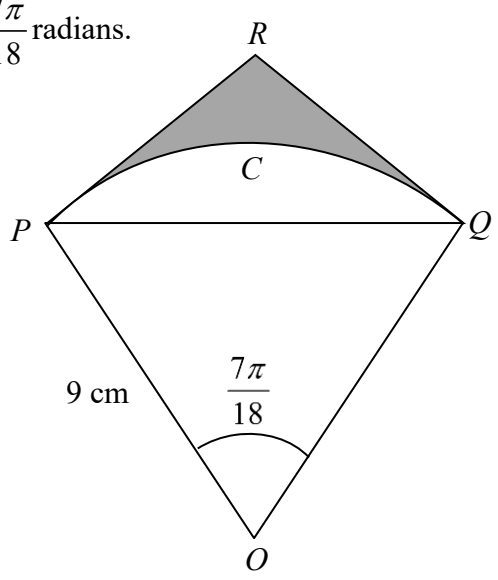
$$\frac{1}{2}(120 + T - 40)(20) = 1500$$
$$(80 + T)(20) = 3000$$
$$80 + T = 150$$
$$T = 70$$

Answer T=……. [2]

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26 PCQ is an arc of a circle, centre O, of radius 9 cm.

The tangents at P and Q meet at R. Angle POQ is $\frac{7\pi}{18}$ radians.



(a) Show that angle $PRQ = \frac{11\pi}{18}$ radians.

Answer [1]

$\angle PRQ = 2\pi - \frac{\pi}{2} - \frac{\pi}{2} - \frac{7\pi}{18}$

$\angle PRQ = \frac{11\pi}{18}$ (shown)

(b) Find the length of arc PCQ.

$\text{arc } PCQ = \frac{7\pi}{18} \times 9$

$\text{arc } PCQ = 11.0 \text{ cm}$

Answer ……cm [1]

(c) Find the area of the shaded region.

$\tan\left(\frac{7\pi}{36}\right) = \frac{PR}{9}$

$PR = 9\tan\left(\frac{7\pi}{36}\right)$

$Area = 2 \times \frac{1}{2} \times 9 \times 9\tan\left(\frac{7\pi}{36}\right) - \frac{1}{2} \times 9^2 \times \frac{7\pi}{18}$

$Area = 7.24 \text{ cm}^2$

Answer …… cm^2 [3]

END OF PAPER

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