

Name: _____ ()

Class: 4 ()



**ANGLICAN HIGH SCHOOL
SECONDARY FOUR
PRELIMINARY EXAMINATION 2025**

S4

MATHEMATICS**4052/01**

Paper 1

21 August 2025

Candidates answer on the Question Paper.

2 hours 15 minutes**READ THESE INSTRUCTIONS FIRST**

Write your name, index number and class in the space at the top of this page.

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.

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

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 total of marks for this paper is 90.

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 .**For Examiners' Use**

Question	1	2	3	4	5	6	7
Marks							
Question	8	9	10	11	12	13	14
Marks							
Question	15	16	17	18	19	20	21
Marks							
Clarity/ Logic		Accuracy/ Precision		Units			90

Parent's Name and Signature:**Date:**

Mathematical Formulae*Compound Interest*

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

Mensuration

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

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

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

$$\text{Volume of a sphere} = \frac{4}{3} \pi r^3$$

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

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

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

Trigonometry

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

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

Statistics

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

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

Answer **all** the questions.

- 1 Simplify $\left(\frac{27\sqrt{a^3}}{b^{-3}}\right)^{-\frac{2}{3}}$, leaving your answer in positive index form.

1	$\left(\frac{27\sqrt{a^3}}{b^{-3}}\right)^{-\frac{2}{3}}$ $= \frac{3^{-2}a^{-1}}{b^2}$ $= \frac{1}{9ab^2}$	M1 Open Bracket A1
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Answer

..... [2]

- 2 Expand and simplify $(x-y)^2 - (x+1)(x-2y)$.

2	$(x-y)^2 - (x+1)(x-2y)$ $= x^2 - 2xy + y^2 - (x^2 - 2xy + x - 2y)$ $= x^2 - 2xy + y^2 - x^2 + 2xy - x + 2y$ $= y^2 - x + 2y$	M1 – expand M1 – correct sign when remove bracket A1
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Answer [3]

- 3 Factorise completely $ax - 2cy - cx + 2ay$.

3	$ax - 2cy - cx + 2ay$ $= ax - cx - 2cy + 2ay$	
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[Turn Over

$= x(a - c) + 2y(-c + a)$	M1 – Factorise x and $2y$
$= x(a - c) + 2y(a - c)$	A1
$= (x + 2y)(a - c)$	

Answer [2]

- 4 (a) Solve the equation $39 - \frac{3}{4}x = 3 - 2(4 - x)$.

4(a)	$39 - \frac{3}{4}x = 3 - 2(4 - x)$ $39 - \frac{3}{4}x = 3 - 8 + 2x$ $39 + 5 = 2x + \frac{3}{4}x$ $44 = \frac{11}{4}x$ $x = 16$	M1 – expand and rearrange A1
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Answer

$x =$
..... [2]

- (b) Solve the equation $\frac{2x}{3 - 2x} - \frac{7}{x - 3} = 2$.

4(b)	$\frac{2x}{3 - 2x} - \frac{7}{x - 3} = 2$ $\frac{2x(x - 3)}{(3 - 2x)(x - 3)} - \frac{7(3 - 2x)}{(3 - 2x)(x - 3)} = 2$ $\frac{2x^2 - 6x - 21 + 14x}{3x - 9 - 2x^2 + 6x} = 2$ $2x^2 + 8x - 21 = 18x - 18 - 4x^2$ $6x^2 - 10x - 3 = 0$ $x = \frac{-(-10) \pm \sqrt{(-10)^2 - 4(6)(-3)}}{2(6)}$ $x = 1.93 \text{ or } -0.260 \text{ (3s.f.)}$	M1 – to single fraction M1 – apply formula A1
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Answer $x =$ [3]

- 5 Mr Chan is looking at Deepavali decorations. There are two lights, one green and one red, flashing at different intervals. The green light and the red light flash at intervals of 6 seconds and 8 seconds respectively. If the two lights start flashing at the same time, how long will it take for the two lights to next flash simultaneously?

Answer	5	$6 = 2 \times 3$ $8 = 2^3$ $\text{LCM} = 2^3 \times 3 = 24$ It will take 24 s for the two lights to next flash simultaneously again.	M1 – prime factorisation A1 – LCM

..... s [2]

- 6 (a) Express 2250 as the product of its prime factors.

6a	$2250 = 2 \times 3^2 \times 5^3$	B1
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Answer [1]

- (b) The number $\frac{2250h}{k}$, where h and k are integers, is a perfect cube.
Find the smallest positive integer values of h and of k .

6b	$2250 = 2 \times 3^2 \times 5^3$ $h = 3$ and $k = 2$	B1
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Answer $h =$

$k =$ [1]

- (c) Find two smallest possible integers, one is odd and the other is even, such that they have a lowest common multiple of 2250 and a highest common factor of 45.

6c	$2250 = 2 \times 3^2 \times 5^3$ $45 = 3^2 \times 5$	B1 each for 90 and 1125
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7 A student makes a pendulum by tying a string to a small solid sphere and hanging it from a retort stand. The time, in seconds, taken by the pendulum to swing from one end to the other and back again is called the period, P seconds. The period is directly proportional to the square root of the length of the string, L cm. If the value of P increases by 25%, what is the corresponding percentage change in the value of L ?

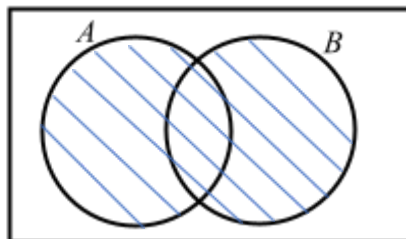
..... % [3]

- Anglican High School Preliminary Examination 2025

7	Let the height of the Great Pyramid be H . Let the height of the replica be h $\left(\frac{h}{H}\right)^3 = \frac{\text{Volume of replica}}{\text{Volume of Great Pyramid}}$ $\left(\frac{h}{H}\right)^3 = \frac{9.22 \times 10^{-6}}{2.45 \times 10^4}$ $\frac{h}{H} = \sqrt[3]{\frac{9.22 \times 10^{-6}}{2.45 \times 10^4}}$ $= 7.2197 \times 10^{-4}$ Let S be the surface area of the Great Pyramid and s be the surface area of the replica $\frac{s}{S} = \left(\frac{h}{H}\right)^2$ $s = \left(\frac{h}{H}\right)^2 \times S$ $= (7.2197 \times 10^{-4})^2 \times 8.30 \times 10^4$ $= 4.33 \times 10^{-2} \text{ m}^2$	M1 – $\left(\frac{h}{H}\right)^3 = \frac{\text{Volume of replica}}{\text{Volume of Great Pyramid}}$ M1 – value of $\frac{h}{H}$ M1 – $\frac{s}{S} = \left(\frac{h}{H}\right)^2$ A1
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Answer m^2 [4]

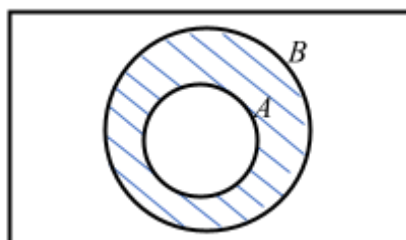
- 9 (a) On the Venn diagram, shade the region which represents $(A' \cap B')'$.



B1

[1]

- (b) Use set notation to describe the shaded region.



9b	$A' \cap B$	B1
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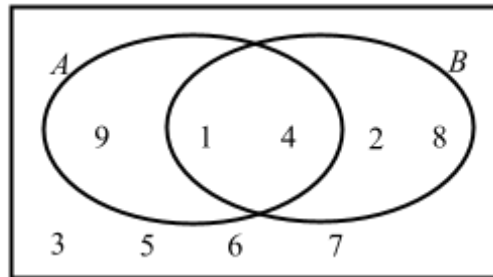
Answer [1]

(c) $\xi = \{x : x \text{ is an integer such that } 0 < x < 10\}$

$$A = \{1, 4, 9\}$$

$$B = \{1, 2, 4, 8\}$$

The Venn diagram shows the universal set and the elements in each of its subsets.



(i) Describe the elements of Set A .

9ci	Perfect square, square numbers	B1
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Answer

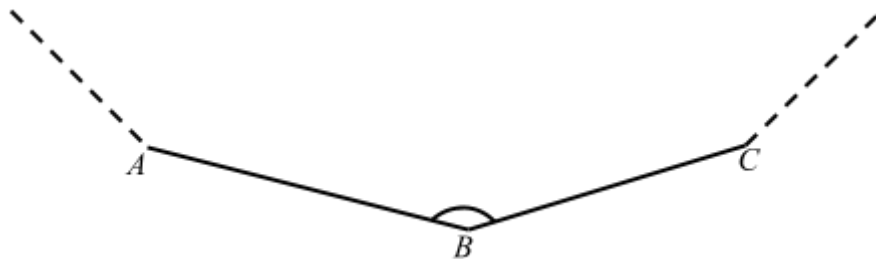
..... [1]

(ii) Find the value of $n(A \cup B')$.

9cii	7	B1
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Answer [1]

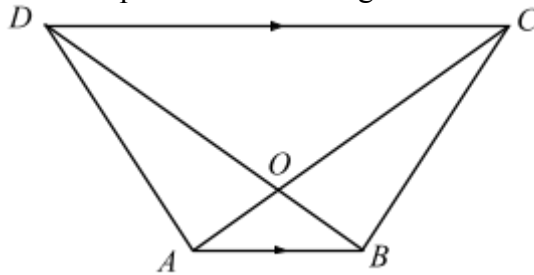
10



In the diagram above, ABC is part of a polygon. $\angle ABC$ is 148° . The remaining interior angles are each equal to 139° . Find the number of sides of this polygon.

10	Let n be the number of sides of the polygon.	M1 – for forming equation
		A1

11 $ABCD$ is a trapezium where DC is parallel to AB . Diagonals AC and BD intersect at O . $DO = CO$.

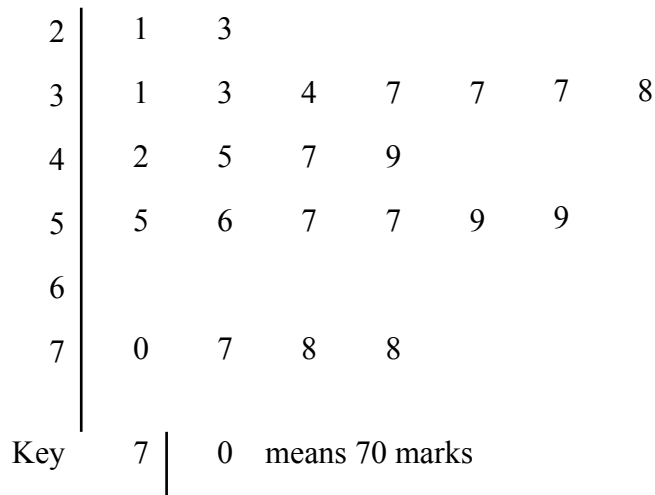


- | | | |
|------------|-------------------------------|-----------|
| 11a | ΔAOB and ΔCOD | B1 |
|------------|-------------------------------|-----------|

[illegible]

12 The test scores for a group of 24 students were recorded.

0	9	Test Scores
1		



The results are shown in the stem-and-leaf diagram.

- (i) Find the interquartile range.

12i	$58 - 35.5 = 22.5$	B1
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Answer marks [2]

- (ii) Find the median result.

12ii	$\frac{45 + 47}{2} = 46$	B1
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Answer marks [1]

- (iii) Find the mode result.

12iii	37	B1
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Answer marks [1]

- (iv) 15 students did not achieve a merit grade. Find the minimum score to achieve merit grade.

12iv	56	B1
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Answer marks [1]

- 13** The table shows the number of books read by some students last month.

Number of books	0	1	2	3
Frequency	1	3	x	5

- (a) Show that the mean value of the data is 2.

13a	$\frac{0(1) + 1(3) + 2x + 3(5)}{1 + 3 + x + 5} = \frac{18 + 2x}{9 + x}$ $= \frac{2(9 + x)}{9 + x}$ $= 2$	M1 – forming equation A1
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[2]

- (b) The standard deviation of the data is 1. Find the value of x .

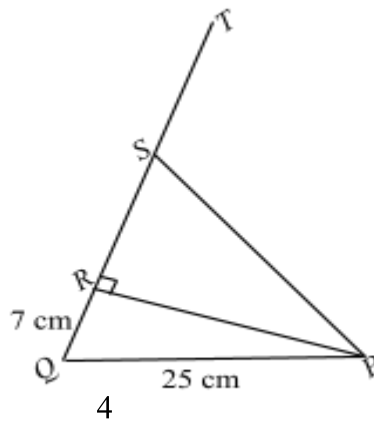
13b	$\sqrt{\frac{1(0)^2 + 3(1)^2 + x(2)^2 + 5(3)^2}{9 + x}} - 2^2 = 1$ $\frac{48 + 4x}{9 + x} - 4 = 1$ $\frac{48 + 4x}{9 + x} = 5$ $48 + 4x = 45 + 5x$ $x = 3$	M1 – forming equation M1 – simplifying A1
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Answer

$x =$

..... [3]

- 14** In the diagram, $PQ = 25$ cm, $QR = 7$ cm and $\angle SRP = 90^\circ$. $QRST$ is a straight line.



- (a) Given that $\sin \angle TSP = \frac{4}{5}$, find the exact value of

[Turn Over

Answer $\cos \angle TSP = \dots\dots\dots$ [1]

(ii) the length of SR .

Answer cm [3]

(b) A triangle with vertices ABC has an area of 16.9 cm^2 . $AB = 8.9 \text{ cm}$ and $AC = 4.7 \text{ cm}$. Find the two possible values of angle BAC .

Answer^o and^o [2]

- 15** A new type of energy harvesting device is being developed to capture energy from small environmental vibrations. The engineers observe that the fraction of energy captured by the device during n th second of continuous operation, relative to its maximum capacity, follows a specific pattern.

Time (second)	Fraction of energy captured relative to its maximum capacity
1st	$\frac{1}{2}\left(1 - \frac{1}{2}\right)$
2nd	$\frac{1}{2}\left(\frac{1}{2} - \frac{1}{3}\right)$
3rd	$\frac{1}{2}\left(\frac{1}{3} - \frac{1}{4}\right)$
...	...
n th	...

- (a) Write down the fraction of energy captured for the n th second of operation.

15a	$\frac{1}{2}\left(\frac{1}{n} - \frac{1}{n+1}\right)$	B1
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Answer [1]

- (b) The team needs to find the total energy captured after K seconds of continuous operation.

Show that the total energy captured after K seconds is $\frac{1}{2}\left(1 - \frac{1}{K+1}\right)$.

Answer

15b	Total energy captured after K seconds $= \frac{1}{2}\left(1 - \frac{1}{2}\right) + \frac{1}{2}\left(\frac{1}{2} - \frac{1}{3}\right) + \frac{1}{2}\left(\frac{1}{3} - \frac{1}{4}\right) + \dots +$ $\frac{1}{2}\left(\frac{1}{K-1} - \frac{1}{K}\right) + \frac{1}{2}\left(\frac{1}{K} - \frac{1}{K+1}\right)$ $= \frac{1}{2}\left(1 - \frac{1}{K+1}\right)$	M1 – Listing M1 – Factorise half A1
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[3]

- (c) The energy harvesting device is considered a success if it is able to harvest at least 49.8% of its maximum capacity. Find the minimum number of seconds for which the device is considered a success.

Answer

..... s [3]

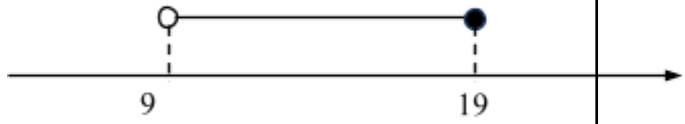
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-
- 16** Map A has a scale of 1: 200 000 and map B has a scale of 1: n .

The area of a lake on map A is 4 cm^2 while the area of the same lake on map B is 2.56 cm^2 .

Find n .

Answer $x = \dots\dots\dots [3]$

- 17** Solve the inequality $2^x - 4^x - 7$, and represent your answer on a number line.

17	$\frac{3}{2} < \frac{x-3}{4} \leq \frac{9+x}{7}$ $\frac{3}{2} < \frac{x-3}{4}$ $12 < 2x - 6$ $18 < 2x$ $9 < x$ $\frac{x-3}{4} \leq \frac{9+x}{7}$ $7x - 21 \leq 36 + 4x$ $3x \leq 57$ $x \leq 19$ $9 < x \leq 19$ 	M1 – Solve both inequalities A1 – Solve inequalities B1
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Answer

..... [3]

18 E is the point $(2, -4)$ and F is the point $(-1, 3)$.

(a) Find the equation of the line EF in the form $y = mx + c$.

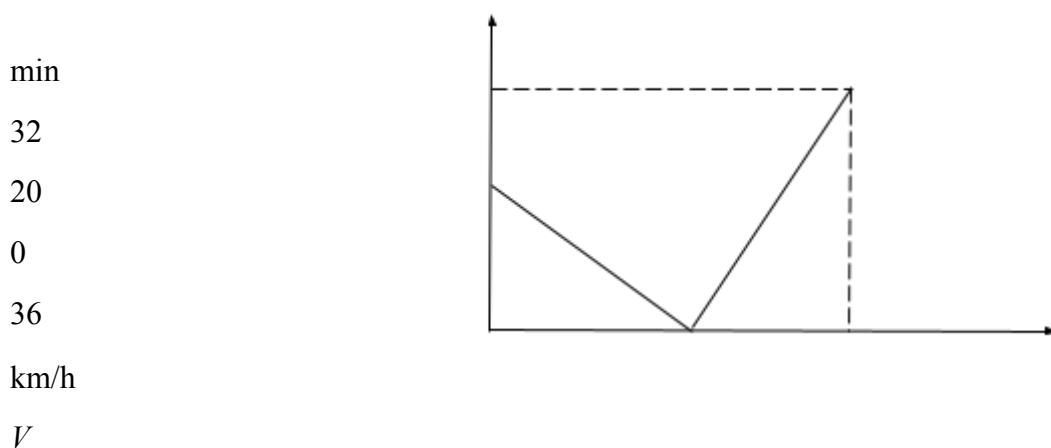
18a	Gradient of $EF = \frac{3 - (-4)}{-1 - 2}$ $= -\frac{7}{3}$ Equation of EF is $y = -\frac{7}{3}x + c$ Subst $(2, -4)$ into equation $-4 = -\frac{7}{3} \times 2 + c$ $c = \frac{2}{3}$ Equation of EF is $y = -\frac{7}{3}x + \frac{2}{3}$	M1 – find gradient A1
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Answer

..... [2]

[illegible]

19 The diagram shows the speed-time graph for a car's journey when it approaches a red traffic light and then drives off when the traffic light turns green. The area beneath each speed-time graph represents the distance travelled by the car.



- Anglican High School Preliminary Examination 2025

<i>Answer</i>	19a $\text{Acceleration} = -36 \text{ km/hr} \div \frac{20}{60} \text{ hr}$ $= -108 \text{ km/hr}^2$ OR $\text{Acceleration} = \frac{0 - 36}{\frac{20}{60} - 0}$ $= -108 \text{ km/hr}^2$	M1 – find gradient A1

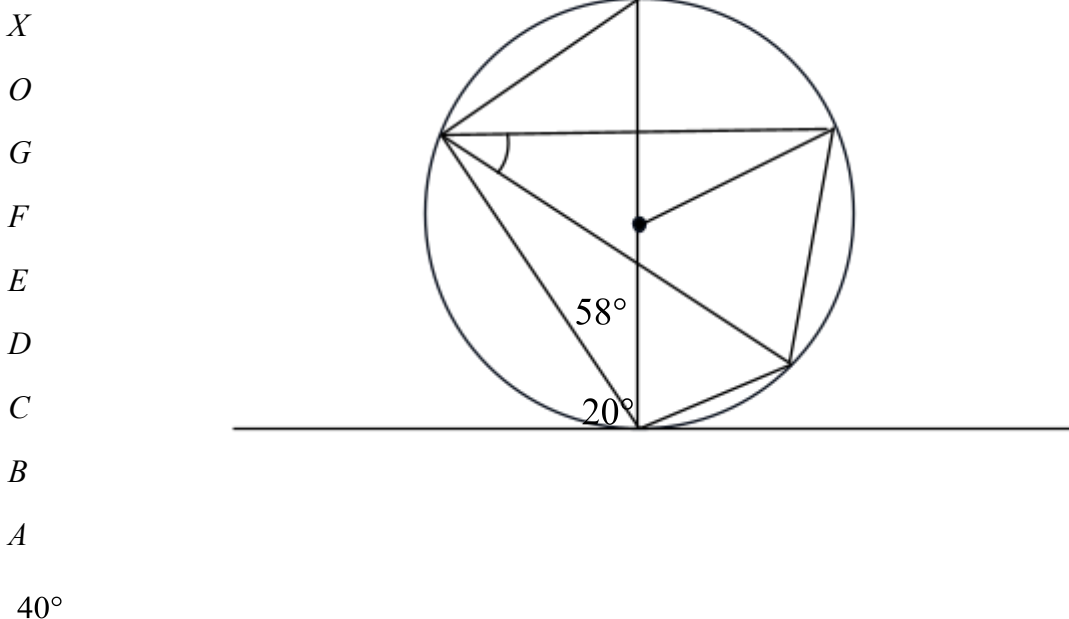
..... km/h² [2]

- (b) Given that the distance travelled in the first 20 minutes is the same as the distance travelled between 20 minutes and 32 minutes, calculate the value of V .

19b	Same distance means the two area of triangles are the same. $\frac{1}{2} \times \frac{(32 - 20)}{60} \times V = \frac{1}{2} \times \frac{(20)}{60} \times 36$ $\frac{V}{10} = 6$ $V = 60$	M1 A1
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Answer $V =$ [2]

- 20** In the diagram below, the points A, E, C, G and F lie on the circle with centre O . BCD is a tangent to the circle at C , AC is the diameter, angle $GEF = 40^\circ$, angle $EGF = 58^\circ$ and angle $DCG = 20^\circ$.





Answer rad [2]

- Answer $r =$ cm [2]

- [Turn Over**

- (a) Peter wants to buy 5 chicken, 4 apple and 2 taro pies.
Jane wants to buy 4 chicken and 7 apple pies.

22a	CAT $Y = \begin{pmatrix} 5 & 4 & 2 \\ 4 & 7 & 0 \end{pmatrix} \begin{matrix} Peter \\ Jane \end{matrix}$	B1
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Represent their purchases in a 2×3 matrix $\mathbf{Y}$.

Answer $\mathbf{Y} =$ [1]

- (b) Evaluate the matrix $\mathbf{W} = \mathbf{YX}$.

[illegible]

Answer $\mathbf{W} =$ [2]

- (c) What does the last column of $\mathbf{W}$ represent?

Answer

22c	The last column represents the savings for Peter and extra cost for Jane if they buy from Bakery B	B1
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	cost for Jane if they buy from Bakery B	
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[1]

- (d) Find the amount that Peter and Jane would spend in Bakery B.

22d	Peter would spend \$23.60 buying from Bakery B Jane would spend \$24.20 buying from Bakery B $\begin{pmatrix} 24.1 & -0.5 \\ 24 & 0.2 \end{pmatrix} \begin{pmatrix} 1 \\ 1 \end{pmatrix} = \begin{pmatrix} 23.6 \\ 24.2 \end{pmatrix}$	B1
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Answer Peter would spend \$

and Jane would spend \$ [1]

- 23** The drawing in the answer space below shows three tents, *A*, *B* and *C* pitched at East Coast Park.

- (a) Construct**

(i) the perpendicular bisector of AB , [1]

(ii) the bisector of angle ABC . [1]

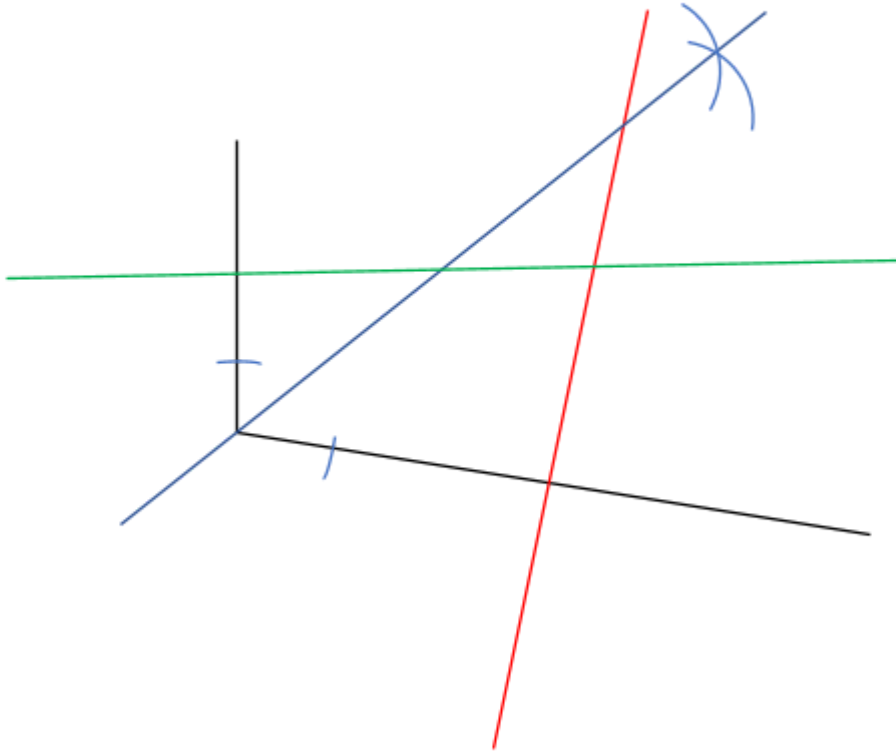
(b) A fast-food restaurant, M , is located equidistant from A and B as well as equidistant from BC and AB .

Mark and label M . [1]

(c) The toilet, T , is located equidistant from the 3 tents.

Mark and label T . [1]

Answer



A

C

B

M

T