

Name: _____ ()

Class: 4 ()



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

S4

MATHEMATICS**4052/01**

Paper 1

20 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	8
Marks								
Question	9	10	11	12	13	14	15	16
Marks								
Question	17	18	19	20	21	22	23	
Marks								
Clarity/ Logic		Accuracy/ Precision		Units				90

Parent's Name and Signature:**Date:**This document consists of **19** printed pages and **1** blank page.

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.

Answer [2]

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

Answer [3]

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

Answer [2]

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

Answer $x =$ [2]

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

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 s [2]

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

Answer [1]

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

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.

[Turn Over]

Answer and [2]

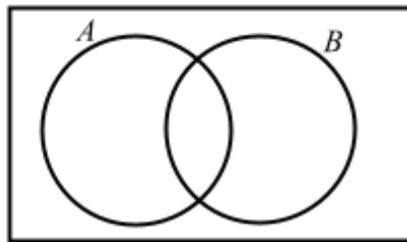
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- 7 A student makes a pendulum by tying a string to a small solid sphere and hanging it from a retort stand. The time, in seconds, taken by the pendulum to swing from one end to the other and back again is called the period, P seconds. The period is 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 ?

Answer % [3]

-
- 8 The Great Pyramid of Giza, located in Egypt, has a surface area of $8.30 \times 10^4 \text{ m}^2$ and a volume of $2.45 \times 10^4 \text{ m}^3$. A vendor is selling geometrically similar replicas of the pyramid. The replica has a volume of $9.22 \times 10^{-6} \text{ m}^3$. Estimate the surface area of the replica, giving your answer in m^2 and in standard form.

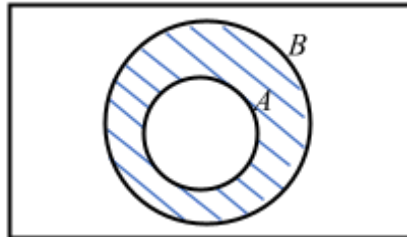
Answer m² [4]

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



[1]

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



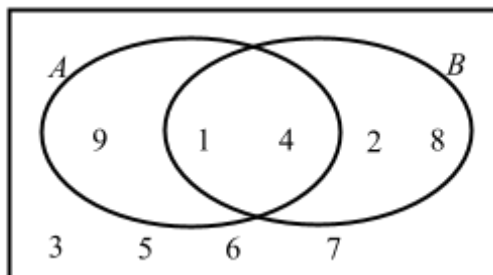
Answer [1]

- (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.



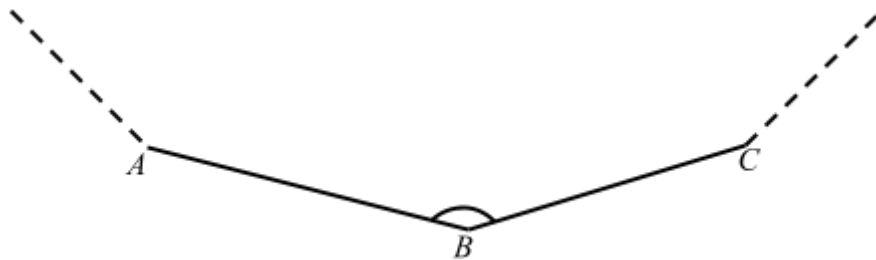
- (i) Describe the elements of Set A .

Answer [1]

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

Answer [1]

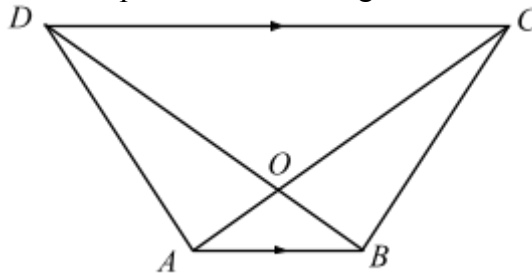
10



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.

Answer [2]

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



- (a) Name a pair of similar isosceles triangles.

Answer triangle..... and triangle..... [1]

- (b) Show that triangle ABC and triangle BAD are congruent.
Give a reason for each statement you make.

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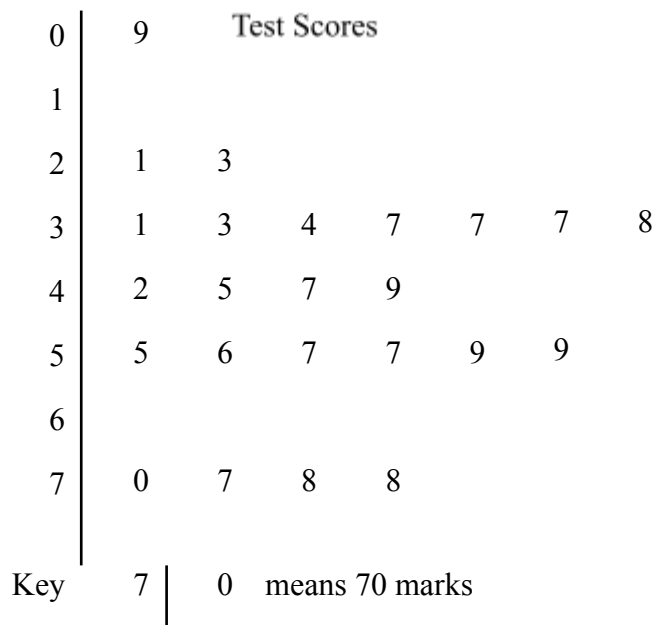
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..... [3]

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



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

- (i) Find the interquartile range.

Answer marks [2]

- (ii) Find the median result.

Answer marks [1]

- (iii) Find the mode result.

Answer marks [1]

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

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.

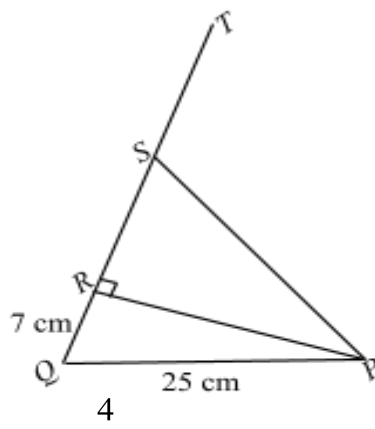
Answer

[2]

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

Answer $x = \dots\dots\dots$ [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
- (i) $\cos \angle TSP$,

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

(ii) the length of SR .

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	...

Answer
cm [3]

.....

(b) A

has an area of 16.9
 $= 4.7$ cm.

triangle with vertices ABC
 cm^2 . $AB = 8.9$ cm and AC

Find the two possible values of angle BAC .

Answer $^\circ$ and $^\circ$ [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.

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

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

[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]

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 $n =$ [3]

17 (a) Solve the inequality $\frac{3}{2} < \frac{x-3}{4} \leq \frac{9+x}{7}$,

Answer [2]

- (b) and represent your answer on a number line.



[1]

- 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 $y = mx + c$.

Answer [2]

- (b) The line PQ has equation $2y + \frac{14}{3}x - 1 = 0$. Explain why PQ does not intersect the line EF .

Answer

.....

.....

..... [2]

- 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.

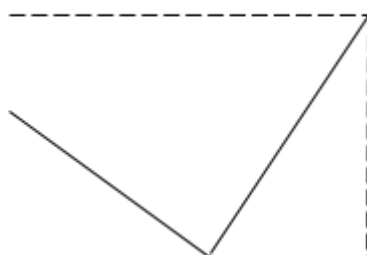
min

32

20

0

36



[Turn Over]

km/h

 V

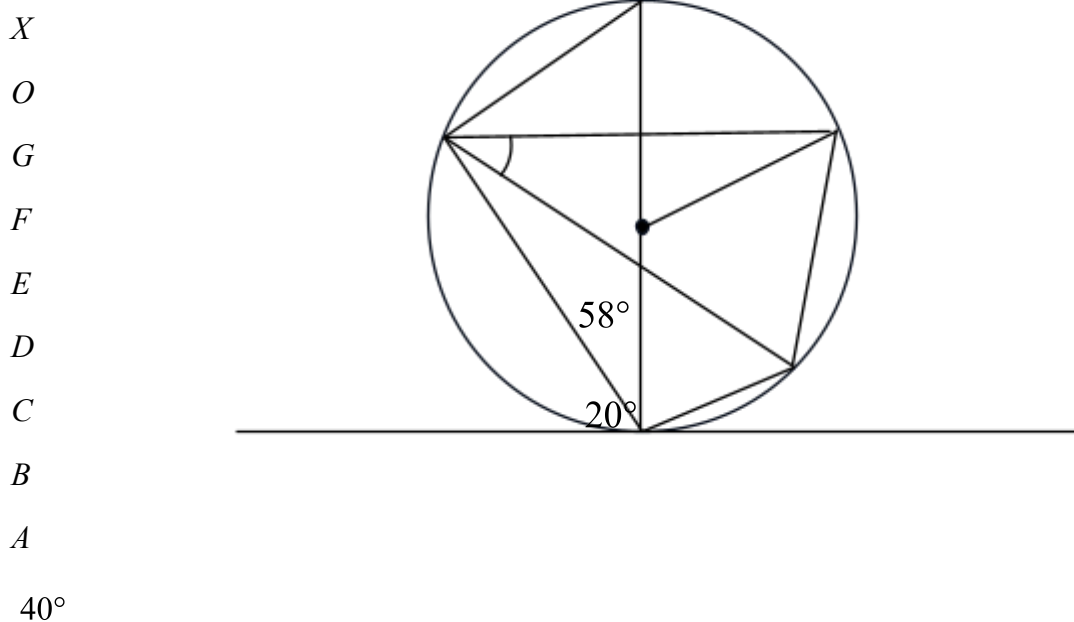
- (a) Calculate the acceleration of the car for the first 20 minutes.

Answer 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 .

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 $DCG = 20^\circ$.



Find, stating your reasons clearly,

- (i) angle ACG ,

- (ii) angle AEX ,

Answer $^\circ$ [1]

(iii) angle FOA ,

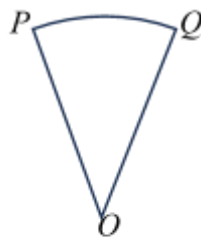
Answer $^{\circ}$ [1]

(iv) angle GCE .

Answer $^{\circ}$ [1]

Answer $^{\circ}$ [2]

- 21** The cross-section of a piece of metal in the shape of a sector of a circle with centre O and radius 20 cm is shown below. The piece of metal is 50 cm thick. The volume of the piece of metal is 2000 cm^3 .



(a) Find angle POQ in radians.

Answer rad [2]

- (b) The piece of metal is melted and recast into a sphere. Find the radius of this sphere.

Answer cm [2]

-
- 22** In Bakery *A*, a chicken pie costs \$2.50, apple pie costs \$2.00 and a taro pie costs \$1.80. In Bakery *B*'s a chicken pie costs \$0.30 less, \$0.20 more for apple pie and \$0.10 more for taro pie.

This information can be represented by the matrix

- (a) Peter wants to buy 5 chicken, 4 apple and 2 taro pies.
Jane wants to buy 4 chicken and 7 apple pies.
Represent their purchases in a 2×3 matrix **Y**.

Answer **Y** = [1]

- (b) Evaluate the matrix **W** = **YX**.

Answer **W** = [2]

- (c) What does the last column of **W** represent?

Answer

.....

.....

..... [1]

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

Answer Peter should spend \$

and Jane should 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]

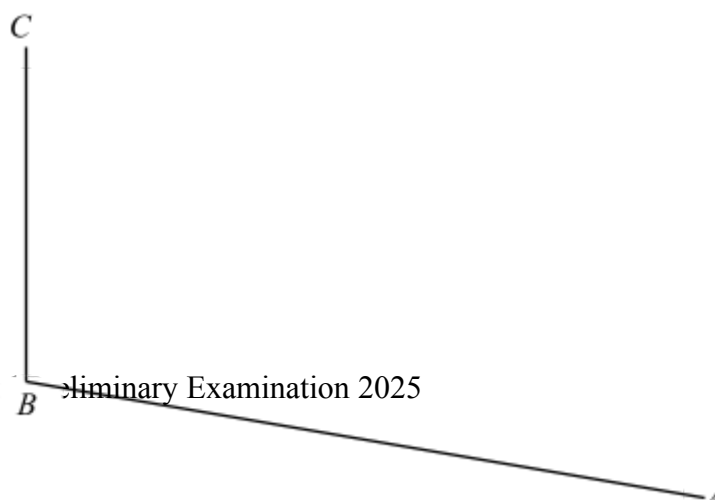
- (b) A fast-food restaurant, M , is located equidistant from A and B as well as equidistant from BC and AB .

Mark and label M . [1]

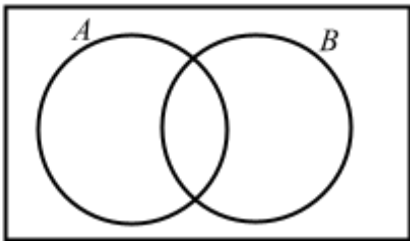
- (c) The toilet, T , is located equidistant from the 3 tents.

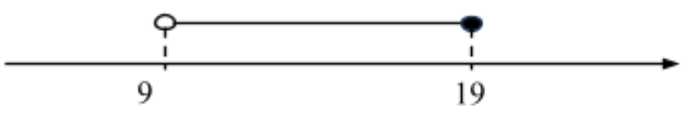
Mark and label T . [1]

Answer



Answer Key

1	$\frac{1}{9ab^2}$	2	$y^2 - x + 2y$
3	$(x + 2y)(a - c)$	4a	$x = 16$
4b	$x = 1.93$ or -0.260	5	It will take 24 s for the two lights to next flash simultaneously again.
6a	$2250 = 2 \times 3^2 \times 5^3$	6b	$h = 3$ and $k = 2$
6c	90 and 1125	7	The length of the string increased by 56.25%.
8	$4.33 \times 10^{-2} \text{ m}^2$		
9a			
9b	$A' \cap B$	9c(i)	Perfect square, square numbers
9c(ii)	7	10	9
11a	$\triangle AOB$ and $\triangle COD$		

11b	AB is common length. $\triangle ODC$ is an isosceles triangle since $DO = CO$, thus $\angle ODC = \angle OCD$. $\angle OBA = \angle ODC$ and $\angle OAB = \angle OCD$ (alt $\angle$s, $DC \parallel AB$), hence $\angle OBA = \angle OAB$ and $AO = BO$. $AC = AO + OC$ $= BO + OD$ $= BD$ Hence, by SAS property, triangle ABC and triangle BAD are congruent.		
12(i)	22.5	12(ii)	46
12(iii)	37	12(iv)	56
13a	2	13b	$x = 3$
14a(i)	$\cos \angle TSP = -\frac{3}{5}$	14a(ii)	$SR = 18 \text{ cm}$
14b	$\angle BAC = 53.9^\circ$ or 126.1°	15a	$\frac{1}{2} \left(\frac{1}{n} - \frac{1}{n+1} \right)$
15b	Total energy captured after K seconds $= \frac{1}{2} \left(1 - \frac{1}{2} \right) + \frac{1}{2} \left(\frac{1}{2} - \frac{1}{3} \right) + \frac{1}{2} \left(\frac{1}{3} - \frac{1}{4} \right) + \dots + \frac{1}{2} \left(\frac{1}{K-1} - \frac{1}{K} \right) + \frac{1}{2} \left(\frac{1}{K} - \frac{1}{K+1} \right) = \frac{1}{2} \left(1 - \frac{1}{K+1} \right)$		
15c	$K \geq 249$	16	250000
17			
18a	Equation of EF is $y = -\frac{7}{3}x + \frac{2}{3}$		
18b	Since gradient of PQ = gradient of AB , PQ and AB are parallel and will not intersect.		
19a	Acceleration = -108 km/hr^2	19b	60
20(i)	$\angle ACG = 70^\circ$	20(ii)	$\angle AEX = 30^\circ$
20(iii)	$\angle FOA = 60^\circ$	20(iv)	$\angle GCE = 98^\circ$
21a	$\angle POQ = \frac{1}{5}$ radians	21b	$r = 7.82 \text{ cm}$
22a	C A T $Y = \begin{pmatrix} 5 & 4 & 2 \\ 4 & 7 & 0 \end{pmatrix} \begin{matrix} \text{Peter} \\ \text{Jane} \end{matrix}$	22b	$\begin{pmatrix} 24.1 & -0.5 \\ 24 & 0.2 \end{pmatrix}$
22c	The last column represents the savings for Peter and extra cost for Jane if they buy from Bakery B		
22d	Peter would spend \$23.60 buying from Bakery B.		

Jane would spend \$24.20 buying from Bakery B.

23

