

Name: Register no: Class:



NGEE ANN SECONDARY SCHOOL

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PRELIMINARY EXAMINATION

MATHEMATICS

4052/01

Paper 1

27 August 2025

2 hours 15 minutes

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your name, register number and class 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 the 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.

For Examiner's Use

Total	/90
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Checked by student:

Date:

*Mathematical Formulae**Compound interest*

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

Geometry and Measurement

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

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

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

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

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

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

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

Trigonometry

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

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

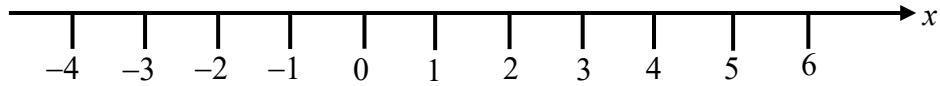
Statistics

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

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

Answer **all** the questions.

- 1 Represent the inequality $-2.5 \leq x < 6$ on the number line below.



[1]

-
- 2 Solve $-8x - 9 = 6$.

Answer $x = \dots\dots\dots$ [1]

-
- 3 The number of pandas in the world increased from 2410 in 2018 to 2660 in 2024.
The number increased by $r\%$ each year.

Find the value of r .

Answer $r = \dots\dots\dots$ [2]

- 4 (a) Calculate $\frac{18.73 - 9.85}{12.07^3}$.

Write your answer correct to 5 significant figures.

Answer [1]

- (b) Write your answer to **part (a)** in standard form.

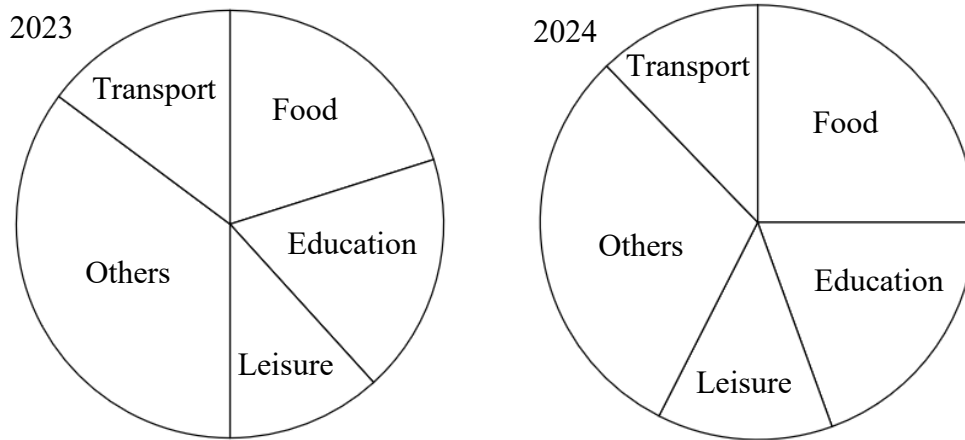
Answer [1]

- 5 James has 600 one-centimetre cubes.
He arranges all the cubes into a cuboid such that the base area of the cuboid is a square.

Find the smallest possible height of the cuboid.

Answer [2]

- 6 The **accurate** pie charts show how a family spent their annual income in 2023 and 2024.



- (a) The family's annual income in 2023 was \$160 000.

Find the amount of money the family spent on food in 2023.

Answer \$..... [2]

- (b) 'The family spent more money on food in 2024 than in 2023.'

Explain why this statement might be false.

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..... [1]

- 7 (a) Expand and simplify $-(5x - 2y)(-3x + 4y)$.

Answer [2]

- (b) Factorise completely $9ab - 12ac + 28bc - 21b^2$.

Answer [2]

- 8 (a) The equation of a straight line is $2y = 3 - 6x$.

Find the gradient of the line.

Answer [1]

- (b) Another line has gradient -3 and passes through the point $(0, 1)$.

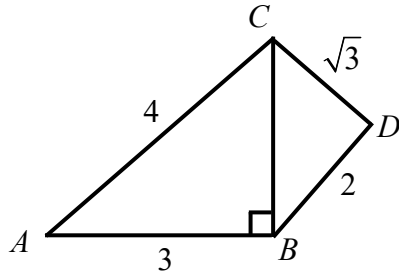
Explain why this line will not intersect the line in **part (a)**.

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..... [2]

9



The quadrilateral $ABCD$ is made up of two triangles, triangle ABC and triangle BCD .
 $AB = 3$ cm, $AC = 4$ cm, $BD = 2$ cm, $CD = \sqrt{3}$ cm and angle $ABC = 90^\circ$.

(a) Find the length of BC .

Answercm [2]

(b) Is triangle BCD right-angled?
 Show your working clearly.

Answer

[1]

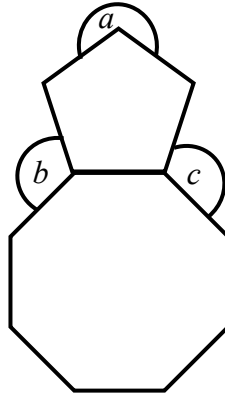
10 Simplify $\frac{4x^2 + 19x - 30}{32x^3 - 50x}$.

Answer [3]

11 Solve $\frac{x-3}{3} - \frac{1-x^2}{2-3x} = 1$.

Answer [3]

12



The diagram shows a shape made from a regular pentagon and a regular octagon.

Find the sum of the angles a , b and c .

Answer [3]

- 13** When a ball is dropped, the distance, d metres, it falls is directly proportional to the square of the time, t seconds, from when the ball is released.
A ball falls 320 metres in the first 8 seconds.

How long does it take for the ball to fall 80 metres?

Answers [2]

14 Amy, Ben and Cal share some money in the ratio 2 : 3 : 4.

Amy gives $\frac{1}{4}$ of her share to Ben.

Ben then gives $\frac{1}{3}$ of his new amount to Cal.

Find the final ratio of the share of money between Amy, Ben and Cal.

Answer : : [4]

- 15 The table shows data from a basketball match for a team of 15 players.

Players	No. of Players	Mean Points Scored Per Player
Starting Players	5	14.4
Non-Starting Players	10	x
All Players	15	5.8

- (a) Find the mean number of points, x , scored by each non-starting player.

Answer $x = \dots\dots\dots$ [2]

- (b) One of the starting players scored 50 points in the match.

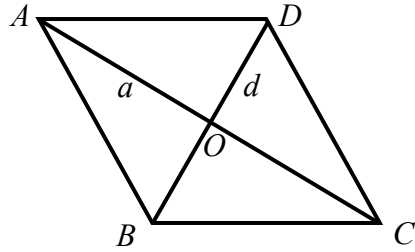
State, with explanation, whether mean or median would be more appropriate to represent a typical starting player's scoring contribution.

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..... [1]

16 (a)

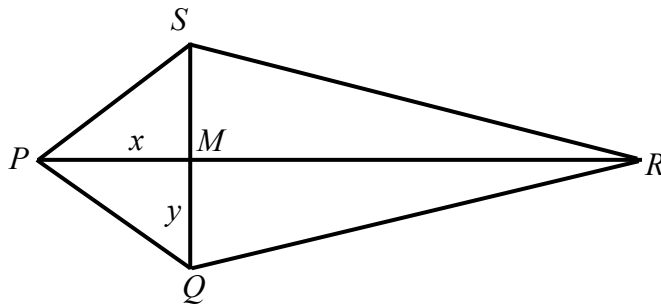


The diagram shows a rhombus $ABCD$.
 The diagonals of the rhombus intersect at the point O .
 $OA = a$ cm and $OD = d$ cm.

Find the area of the rhombus in terms of a and d .

Answercm² [1]

(b)



The diagram shows a kite $PQRS$.
 The diagonals of the kite intersect at the point M .
 $PM = x$ cm and $QM = y$ cm.
 $PM : PR = 1 : 4$.

Find the area of the kite in terms of x and y .

Answercm² [2]

17 (a) Simplify $\left(\frac{625x^4}{y^8}\right)^{-\frac{1}{4}}$.

Answer [2]

(b) $243^a = 3^8 + 3^8 + 3^8$

Find the value of a .

Answer [2]

18

$$y = (x - h)^2 + k$$

- (a) Explain why y has its minimum value when $x = h$.

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 [1]

- (b) The roots of the equation $(x - h)^2 + k = 0$ are -2 and 4 .

Explain why the value of h is 1 .

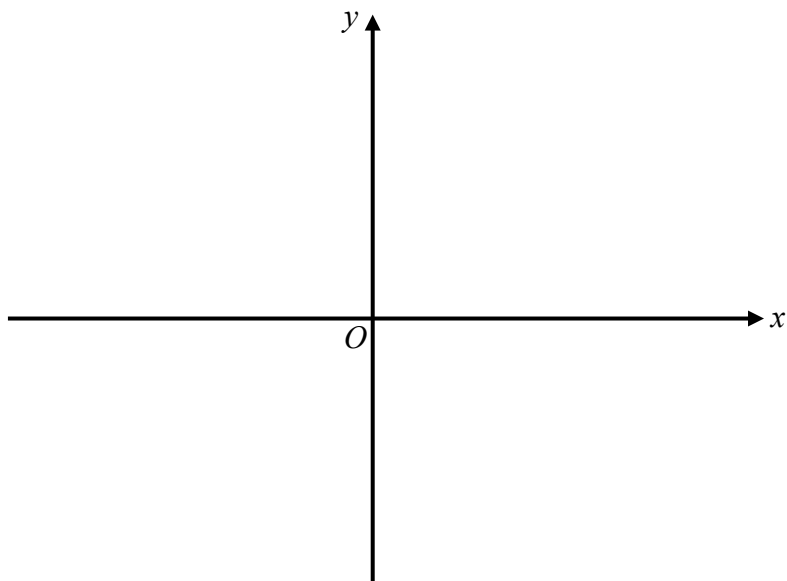
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 [1]

- (c) Find the minimum value of y .

Answer [1]

- (d) Sketch the graph of y on the axes below.
 Indicate clearly the coordinates where the graph crosses the x -axis and the minimum point on the curve.



[2]

19 The **sum** of the first n terms of a linear sequence is $\frac{3}{2}n(n-3)$.

(a) Find the first 3 terms of the sequence.

Answer , , [2]

(b) Find, in terms of n , an expression for the n th term of the sequence.

Answer [1]

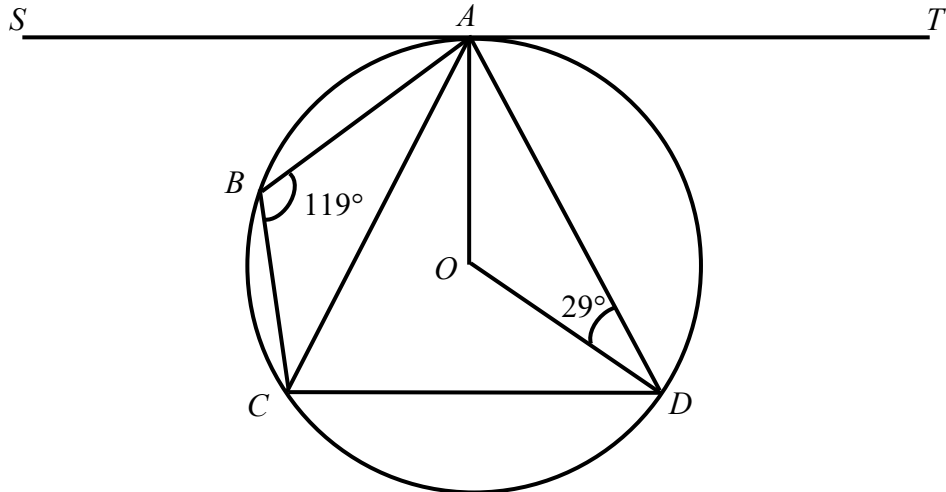
(c) Hence, explain why each term in the sequence is a multiple of 3.

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..... [1]

20



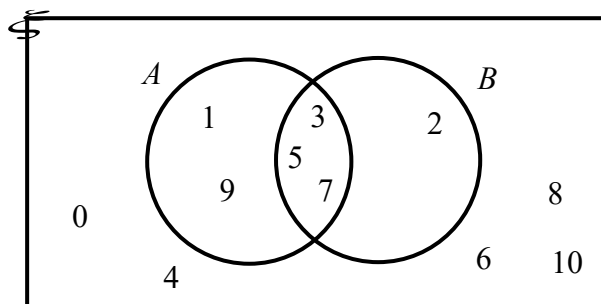
A , B , C and D are points on a circle, centre O .
 ST is a tangent to the circle at A .
 Angle $ABC = 119^\circ$ and angle $ODA = 29^\circ$.

Determine if the lines CD and ST are parallel.
 Give a reason for each step of your answer.

Answer

[4]

- 21 (a) The Venn diagram shows the elements of $\xi = \{\text{integers } x : 0 \leq x \leq 10\}$.



- (i) Underline the correct statement from the list below.

$$\begin{array}{lll} n(\xi) = 10 & A \cup B = \{3, 5, 7\} & A' \cap B' = \{0, 4, 6, 8, 10\} \\ 1 \notin A \cap B' & (A \cap B)' = \{0, 4, 6, 8, 10\} & \end{array} \quad [1]$$

- (ii) On the Venn diagram, shade the region which represents $(A \cup B) \cap (A \cap B)'$. [1]

- (b) $\xi = \{\text{integers } x : 10 < x \leq 20\}$.

$P = \{\text{perfect squares}\}$

$Q = \{\text{perfect cubes}\}$

$R = \{\text{factors of 48}\}$

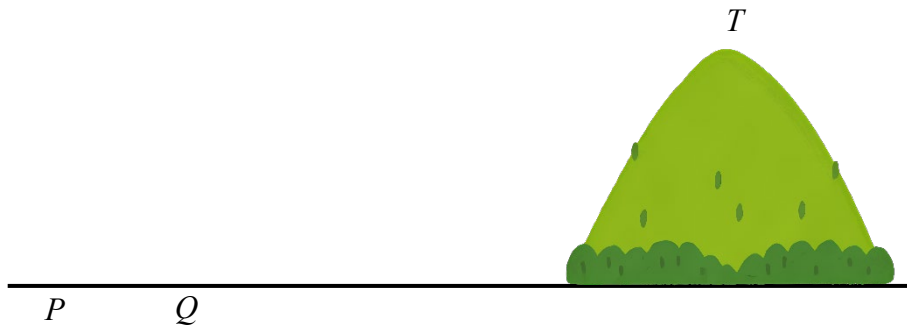
- (i) List the elements in R .

Answer [1]

- (ii) Find the value of $n[(P \cup Q) \cap R']$.

Answer [1]

22



Florian wants to find the height of a hill.

He found that the angle of elevation of the peak of the hill, T , from a point P on horizontal ground is 20.8° and that from another point Q is 21.7° .

Q is 20m closer to the hill than P .

Find the height of the hill in metres.

Answerm [4]

- 23** A shop sells three types of cakes: chocolate (C), lemon (L) and vanilla (V).
 In July, they sold 120 chocolate cakes, 80 lemon cakes and 100 vanilla cakes.
 Each chocolate cake costs \$5 to make and sells for \$8.
 Each lemon cake costs \$4 to make and sells for \$7.
 Each vanilla cake costs \$6 to make and sells for \$9.

(a) Represent this information in a 2×3 matrix, $\mathbf{P}$.

$$\text{Answer } \mathbf{P} = \begin{pmatrix} & \text{C} & \text{L} & \text{V} \\ & & & \end{pmatrix} \begin{array}{l} \text{Cost Price} \\ \text{Sell Price} \end{array} \quad [1]$$

(b) Find the matrix $\mathbf{T} = \mathbf{P} \begin{pmatrix} 120 \\ 80 \\ 100 \end{pmatrix}$.

$$\text{Answer } \mathbf{T} = \quad [2]$$

(c) State what each element of matrix $\mathbf{T}$ represents.

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 [1]

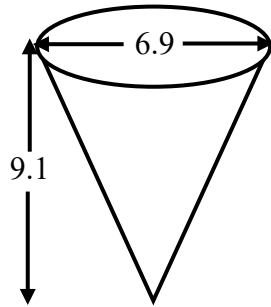
(d) The element of the matrix $\mathbf{V}$, where $\mathbf{V} = \mathbf{QT}$, represents the shop's profit.

Write down the matrix $\mathbf{Q}$.

$$\text{Answer } \mathbf{Q} = \quad [1]$$

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- 24 A company provides conical paper cups for its water dispenser. Each cup has top diameter 6.9 cm and height 9.1 cm.



- (a) Find the volume of one cup.

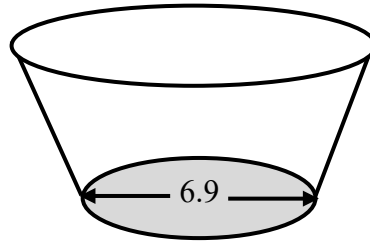
Answercm³ [1]

- (b) The water dispenser has a capacity of 18.9 litres.

Find the maximum number of cups that can be completely filled with one full dispenser.

Answercups [2]

- (c) The company considers replacing the conical cups with frustum-shaped cups.

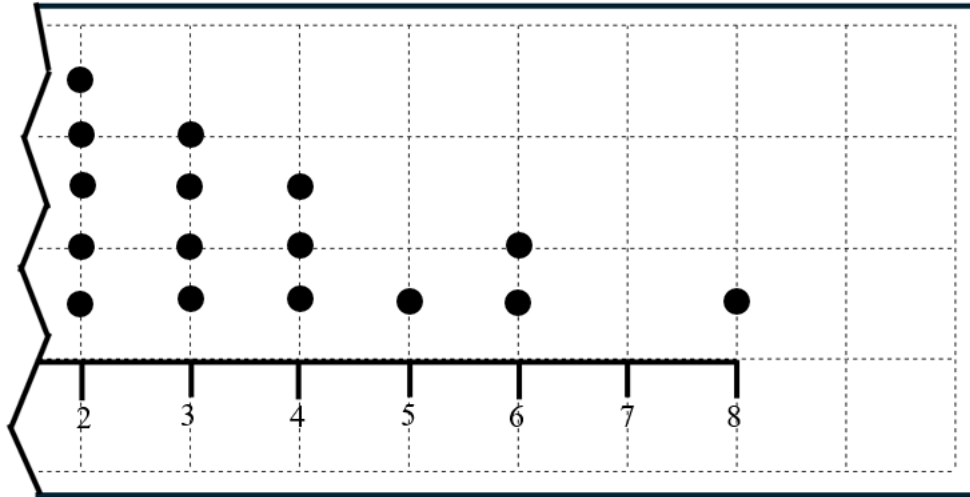


The frustum will be formed by cutting off the top portion of a similar cone, such that its base diameter is 6.9 cm, same as the top diameter of the original cone. The frustum-shaped cups will have the same curved surface area as the conical cups.

Find the volume of a frustum-shaped cup.

Answercm³ [4]

- 25 The number of goals scored by a team of 22 football players in a competition are shown in a dot diagram. The number of goals ranges from 0 to 8. The diagram below shows the dot diagram with a portion of it torn off.



- (a) Find the median number of goals scored.

Answer goals [1]

- (b) A student claimed that the modal number of goals scored cannot be determined.

State whether the student's claim is true or false.

Justify your answer clearly with reason.

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..... [1]

(c) A player is randomly selected from the 22 players.

(i) Find the probability that the student scored 7 goals.

Answer [1]

(ii) Find the probability that the player scored at least 5 goals.

Answer [1]

(iii) Find the probability that the player scored at most 2 goals.

Answer [1]

- 26** A plot of land, $ABCD$, is to be used for a park.
 $AD = 760$ m and angle $BCD = 52^\circ$.
 The sides AB and BC are given below, based on a map scale of 1 : 20 000.



- (a) On the diagram, construct the plot of land, $ABCD$. [2]

- (b) A café is to be built in the park such that it is nearer to point B than A , and at most 1 km from C .

Using appropriate constructions, shade the region inside $ABCD$ where the café can be built. [2]

- (c) A pebbled pathway in the shape of a circular arc is to be built in the park such that every point along the pathway is 400 m from B .

Calculate the length of the pathway in metres.

Answerm [2]

End of Paper