Name: ..... Register no: ..... Class: .....

NGEE ANN SECONDARY SCHOOL

O

PRELIMINARY EXAMINATION

MATHEMATICS

Paper 1

4052/01

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**

Checked by student: ..... Date: .....

This document consists of **25** printed pages and **1** blank page.

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Mathematical Formulae

Compound interest

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

Geometry and Measurement

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

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

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

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

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

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

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

Trigonometry

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

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

Statistics

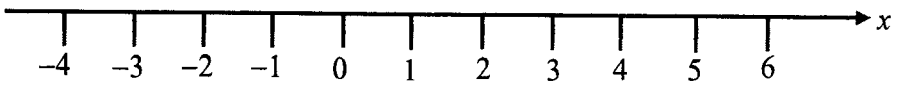
$$\text{Mean} = \frac{\Sigma fx}{\Sigma f}$$

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

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Answer **all** the questions.

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



[1]

---

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

Answer $x =$ ..... [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 $r =$ ..... [2]

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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]

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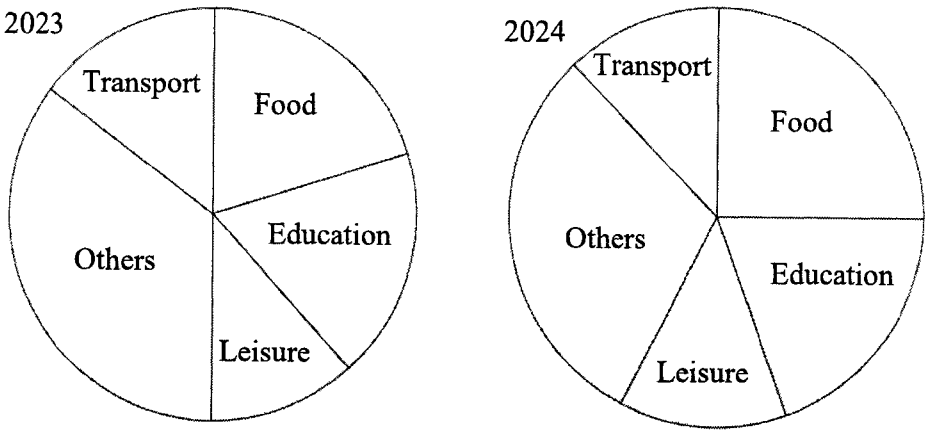
5 James has 600 one-centimetre cubes.
He arranges all the cubes into a cuboid such that the base area of the cuboid is a square.

Find the smallest possible height of the cuboid.

Answer ..... [2]

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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.

.....

.....

..... [1]

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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)**.

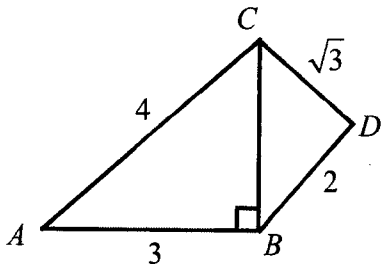
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..... [2]

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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 $ABC = 90°$.

(a) Find the length of BC.

Answer .....cm [2]

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

Answer

[1]

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

Answer ..... [3]

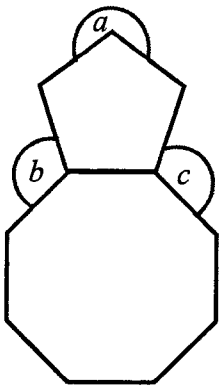
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11 Solve $\dfrac{x-3}{3}-\dfrac{1-x^2}{2-3x}=1$.

Answer ..... [3]

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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]

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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?

Answer .....s [2]

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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]

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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 $x =$ ..... [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.

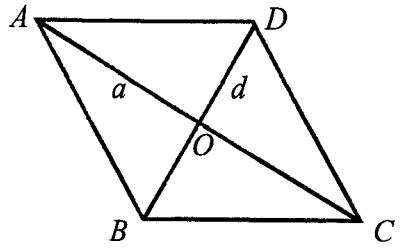
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16 (a)

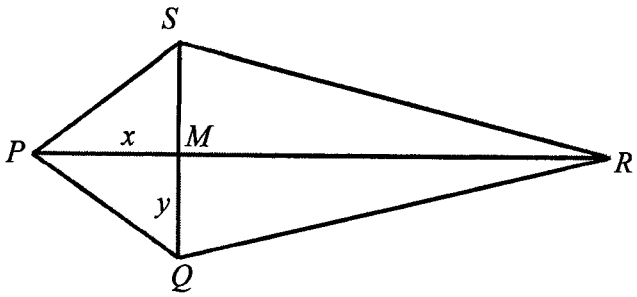


The diagram shows a rhombus $ABCD$.
The diagonals of the rhombus intersect at the point O.
$OA = a$ cm and $OD = d$ cm.

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

Answer .....cm^2 [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.

Answer .....cm^2 [2]

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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]

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18 $y = (x-h)^2 + k$

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

.....

.....

..... [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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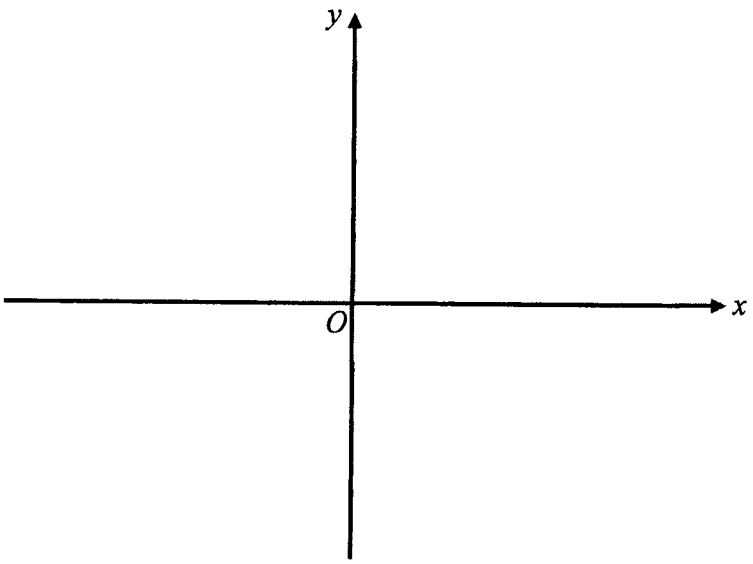
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..... [1]

(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]

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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 nth term of the sequence.

Answer ..... [1]

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

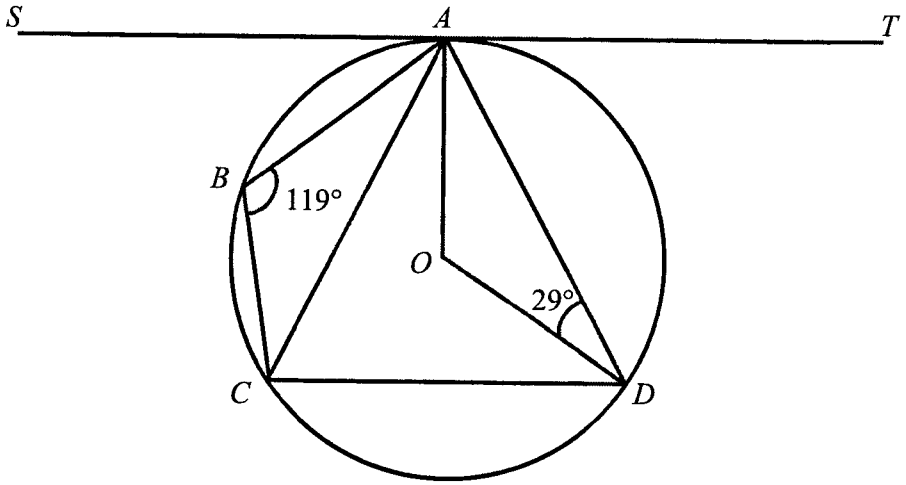
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20



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

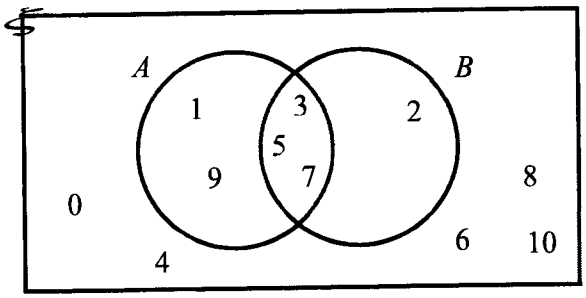
Determine if the lines CD and ST are parallel.
Give a reason for each step of your answer.

Answer

[4]

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



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

$n(\xi) = 10$ $\quad A \cup B = \{3, 5, 7\}$ $\quad A' \cap B' = \{0, 4, 6, 8, 10\}$

$1 \notin A \cap B'$ $\quad (A \cap B)' = \{0, 4, 6, 8, 10\}$ [1]

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

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

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

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

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

(i) List the elements in R.

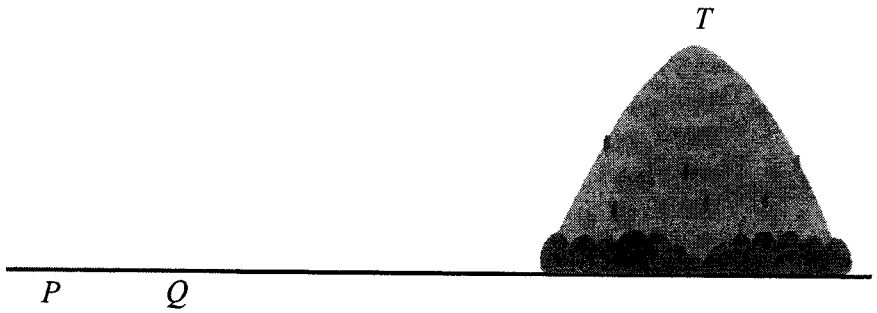
Answer ..... [1]

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

Answer ..... [1]

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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.

Answer .....m [4]

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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, **P**.

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

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

Answer **T** = [2]

(c) State what each element of matrix **T** represents.

.....

..... [1]

(d) The element of the matrix **V**, where **V** = **QT**, represents the shop's profit.

Write down the matrix **Q**.

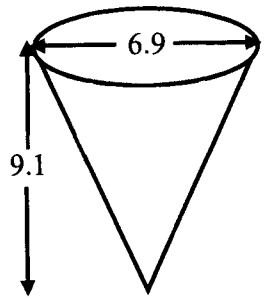
Answer **Q** = [1]

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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.

Answer .....cm^3 [1]

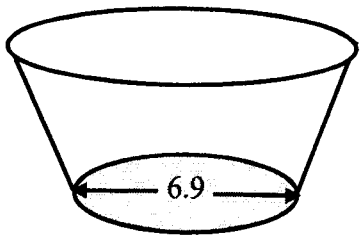
(b) The water dispenser has a capacity of 18.9 litres.

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

Answer .....cups [2]

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



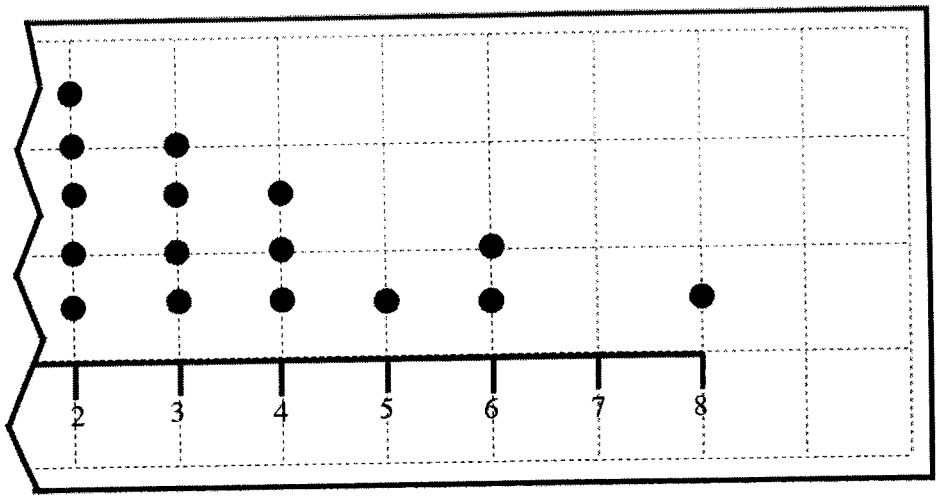
The frustum will be formed by cutting off the top portion of a similar cone, such that its base diameter is 6.9 cm, same as the top diameter of the original cone. The frustrum-shaped cups will have the same curved surface area as the conical cups.

Find the volume of a frustrum-shaped cup.

Answer .....cm^3 [4]

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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.

.....

.....

..... [1]

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(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.

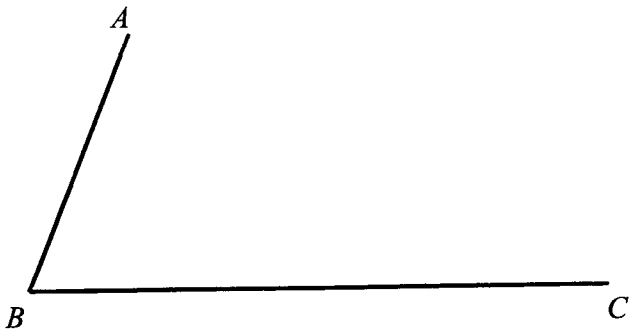
Answer ..... [1]

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

Answer ..... [1]

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26 A plot of land, $ABCD$, is to be used for a park.
$AD = 760$ m and angle $BCD = 52°$.
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.

Answer .....m [2]

End of Paper

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NGEE ANN SECONDARY SCHOOL

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PRELIMINARY EXAMINATION

MATHEMATICS

Paper 2

4052/02

29 August 2025

2 hour 15 minutes

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Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an approved scientific calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

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

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For Examiner's Use

Total	**/90**

Checked by student: ..... Date: .....

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

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

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Answer **all** the questions.

1 **(a)** $x = \dfrac{3h^2(y+b)}{b} - 1$

(i) Find h when $b = 5$, $x = 2$ and $y = 0$.

Answer $h =$ ..... [2]

(ii) Rearrange the formula to make b the subject.

Answer $b =$ ..... [3]

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(b) Solve these simultaneous equations.

$$6x - 3y = 16$$
$$9x + 2y = 11$$

Answer $x =$ .....

$y =$ ..... [3]

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(c) Solve $\frac{19x+3}{2x^2-5x-3}+\frac{2}{x-3}=7$.

Give your solutions correct to two decimal places.

Answer $x =$ ..... or $x =$ ..... [3]

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2 **(a)** Complete the table of values for $y = 2 + \frac{5}{x}$. [1]

x	-3	-2	-1	1	1.5	2	3
y	0.3	-0.5	-3	7		4.5	3.7

(b) On the grid opposite, draw the graph of $y = 2 + \frac{5}{x}$ for $-3 \le x \le 3$. [3]

(c) The equation $2 + \frac{5}{x} = t$ has no solution for $-3 \le x \le 3$.

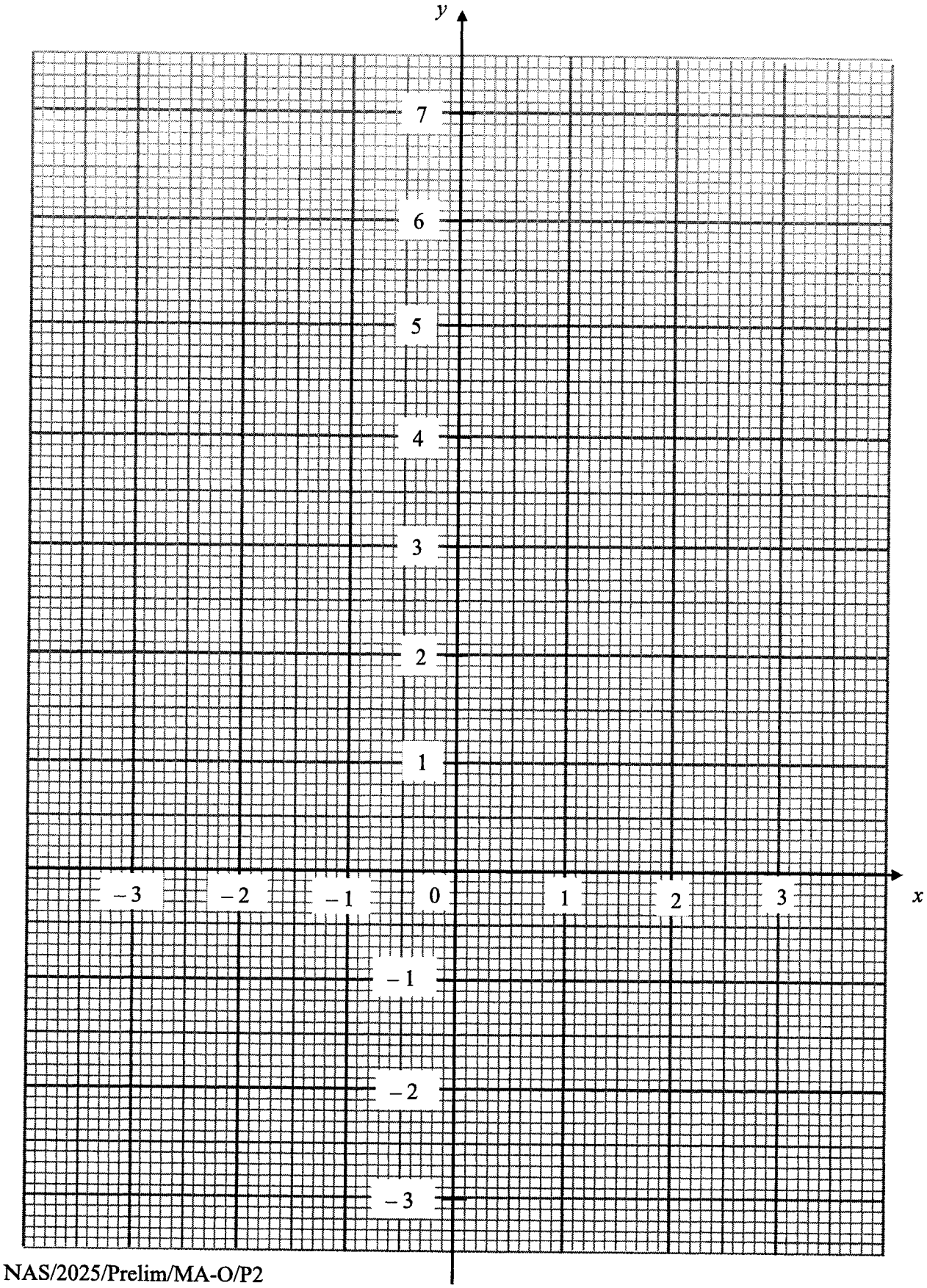
Given that $a < t < b$, use your graph to find the possible values of a and b.

Answer $a =$ ..... $b =$ ..... [2]

(d) By drawing a tangent, find the gradient of the curve at $x = 2$.

Answer ..... [2]

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(e) The points of intersection of the line $4y = 5 - x$ and the curve give the solutions of the equation $Ax^2 - Bx + 20 = 0$.

Find the value of A and B.

Answer $A =$ .....

$B =$ ..... [2]

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3 The front wheel of a tricycle has a circumference of x cm.
The two rear wheels of the tricycle each has a circumference of 50 cm lesser than the front wheel. The tricycle travels 15 m.

(a) Write down an expression, in terms of x, for the number of revolutions that the front wheel makes.

Answer ..... [1]

(b) Write down an expression, in terms of x, for the number of revolutions that each rear wheel makes.

Answer ..... [1]

(c) Each rear wheel makes 2.5 more revolutions than the front wheel.

Form an equation, in terms of x, and show that it simplifies to

$$x^2 - 50x - 30000 = 0.$$

[2]

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(d) Solve the equation $x^2 - 50x - 30000 = 0$.

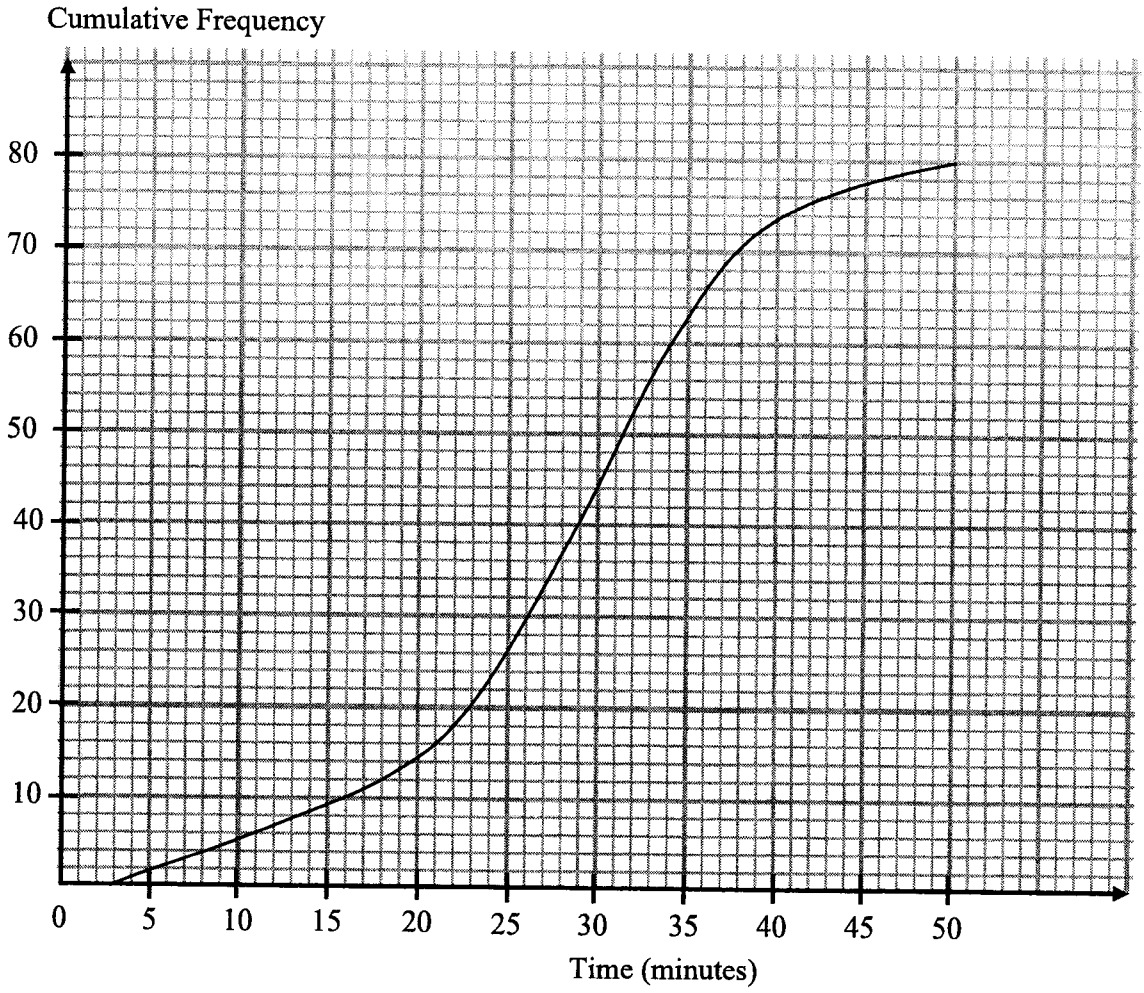
Answer $x =$ .....or $x =$ ..... [3]

(e) Find the diameter of the front wheel of the tricycle.

Answer .....cm [1]

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4 80 passengers took part in a survey on the average waiting time to board Star Cruise. The cumulative frequency curve below shows the distribution of their times.



(a) Use the curve to estimate

(i) the median waiting time,

Answer ..... min [1]

(ii) the interquartile range of the waiting time.

Answer .....min [2]

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(iii) the percentage of the passengers who took at least 30 minutes to board Star Cruise.

Answer .....% [2]

(b) In another survey, the times taken by another 80 passengers to board Diamond Cruise had the same median but higher interquartile range as compared to Star Cruise.

Describe how the cumulative frequency curve for Diamond Cruise will differ compared to the curve shown above.

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..... [1]

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(c) Two passengers are selected at random among all the passengers from Star Cruise.

Calculate the probability that

(i) both passengers waited less than 25 minutes,

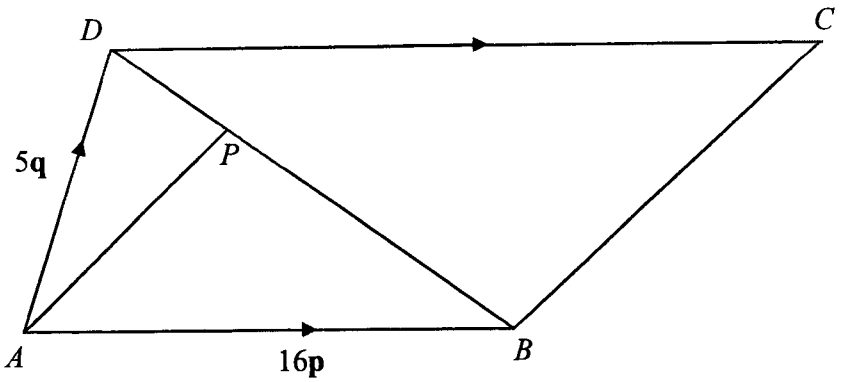
Answer ..... [1]

(ii) one passenger waited less than 25 minutes and another passenger waited at least 36 minutes.

Answer ..... [2]

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5 $ABCD$ is a trapezium.
AB is parallel to DC.
$\overrightarrow{AB} = 16\mathbf{p}$ and $\overrightarrow{AD} = 5\mathbf{q}$.
P is the point on BD such that $DP: DB = 1:4$ and $4AB = 3DC$.



(a) Express in terms of **p** and **q**,

(i) $\overrightarrow{DB}$,

Answer ..... [1]

(ii) $\overrightarrow{AP}$.

Answer ..... [2]

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(b) Show that line BC is parallel to line AP.

Answer

[2]

(c) Find the ratio area triangle APB : area triangle BCD.

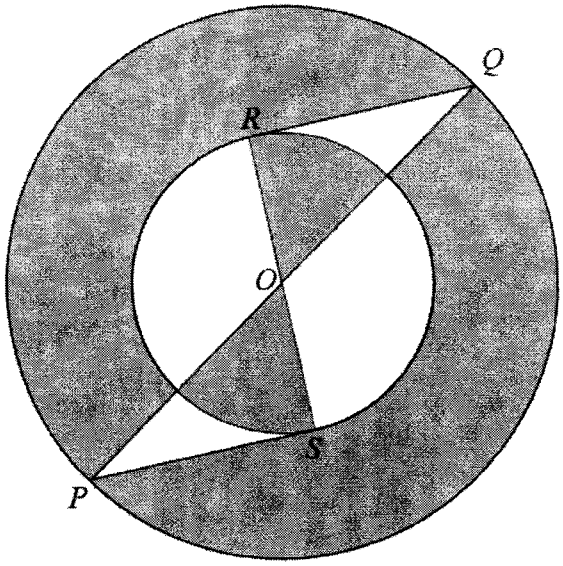
Answer ..... : ..... [3]

(d) Find the ratio area triangle APD : area trapezium $ABCD$.

Answer ..... : ..... [2]

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6 The diagram shows two concentric circles with centre O.
PQ is the diameter of the larger circle and RS is the diameter of the smaller circle.
PS and RQ are tangents to the smaller circle.



(a) Show that the triangle PSO is congruent to triangle QRO.
Give a reason for each statement you make.

Answer

[2]

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(b) The radius of the larger circle is 8 cm and the radius of the smaller circle is 4.36 cm.

(i) Calculate the area of triangle *QRO*.

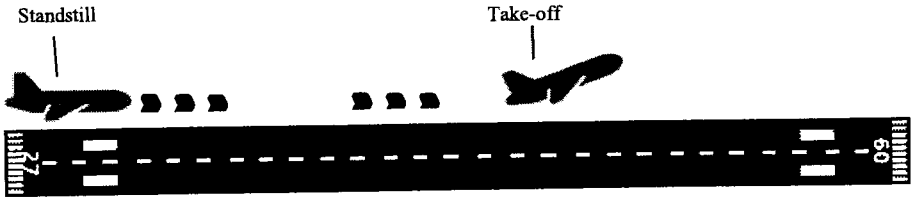
Answer .....cm^2 [3]

(ii) Calculate the shaded area.

Answer .....cm^2 [4]

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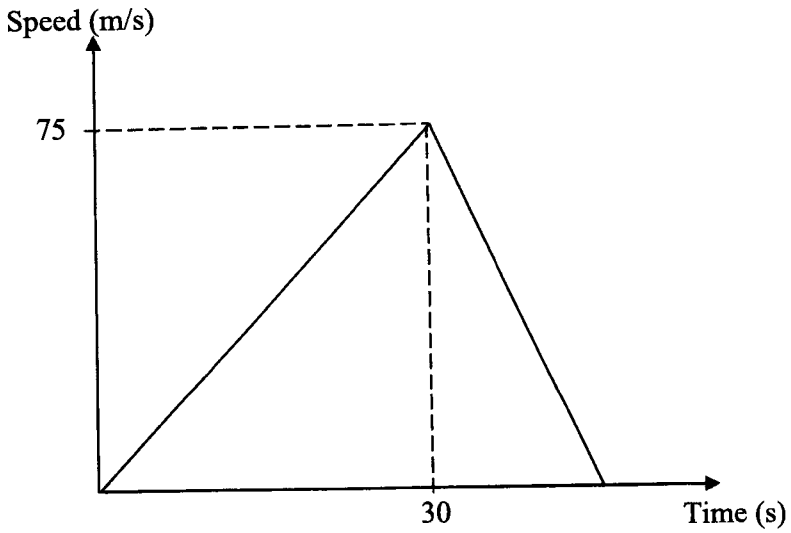
7 During take-off, an aircraft accelerates from standstill to the take-off speed before becoming airborne.



An aircraft can accelerate constantly from standstill on a runway until it reaches a take-off speed of 75 m/s in 30 seconds.

In the event of an emergency, the aircraft can decelerate constantly at 5 m/s^2 on a runway until it comes to a rest.

The speed-time graph below illustrates the journey of the aircraft from standstill to take-off speed and then deceleration till rest.



(a) (i) Calculate the acceleration of the aircraft for the first 30 seconds.

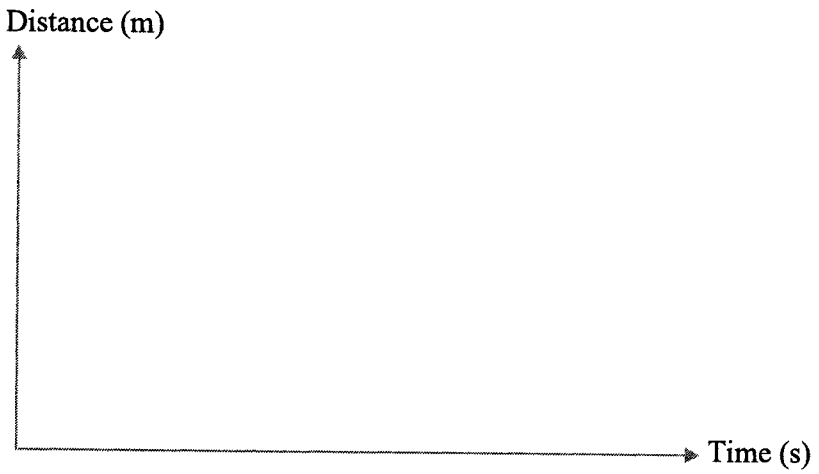
Answer .....m/s^2 [1]

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(ii) Find the time taken for the aircraft to decelerate from the take-off speed until it comes to a rest.

Answer .....s [1]

(iii) Sketch the distance-time graph of the entire aircraft journey until it comes to a rest, indicating clearly the distance travelled.



[2]

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(b) For safety reasons, the pilot needs to determine the take-off decision speed (V_1) before a take-off.

V_1 is the maximum speed which the aircraft can reach before it starts decelerating in case of an emergency.
It will not be safe for the aircraft to decelerate after V_1 as the runway will not be long enough.

(i) If the speed of an aircraft is 70 m/s, determine if the aircraft can decelerate safely in case of an emergency for a runway length of 1600 m.
Assume that the acceleration and deceleration of the aircraft are the same as the values found or given in **(a)**.

Answer

[4]

(ii) If the runway is wet, explain what will happen to V_1.

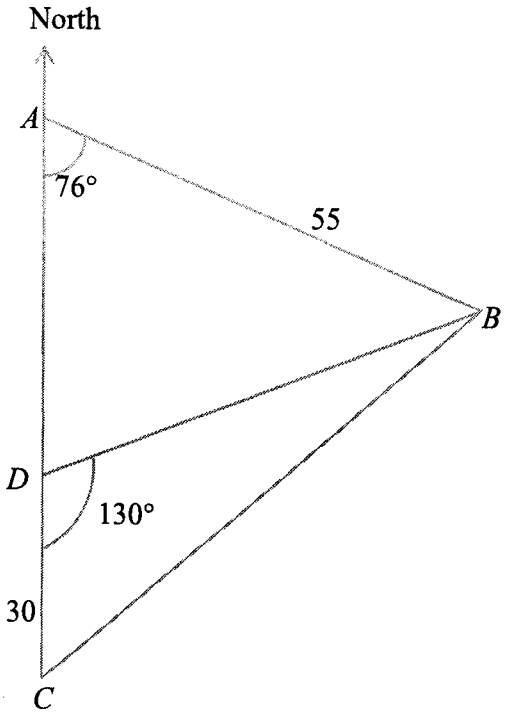
.....

.....

..... [1]

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8 $ABCD$ represents a park on a horizontal field, with A due north of C and D.
$AB = 55$ m and $CD = 30$ m.
Angle $BAD = 76°$ and angle $BDC = 130°$.



(a) Calculate the bearing of D from B.

Answer ..... [2]

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(b) A snake was spotted among the bushes at B and it glided along the path BD towards D.
A pest control at the top of a 10-metre building at A fired a shot from the tranquilizer gun which hit the snake when it is closest to the building.

Find the angle of depression of the snake from the pest control when the shot was fired.

Answer ..... [3]

(c) Find the total area of the park.

Answer ..... m^2 [4]

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(d) Tony claimed that the perimeter of the park is greater than 240 m.

Do you agree with this claim?
Show all your workings.

Answer

[3]

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9 Mr Sim, a Singaporean aged 43, decides to invest in a private condominium that costs $1.3 million.
He does not own any property under his name.
Mr Sim has $100 000 in his current account, $350 000 in his Central Provident Fund (CPF) and a foreign fixed deposit that will mature in June with a value of USD 54 000.

His monthly car instalment is $500.

Mr Sim's latest pay advice shows the following details:

Earnings	Amount	Deductions	Amount
Basic Salary	$9880.00	Employee CPF	$1480.00
		Community Chest donation	$10.00
		CDAC donation	$5.00
Statutory Contributions			
Employer CPF	$1258.00	Employee CPF	$1480.00

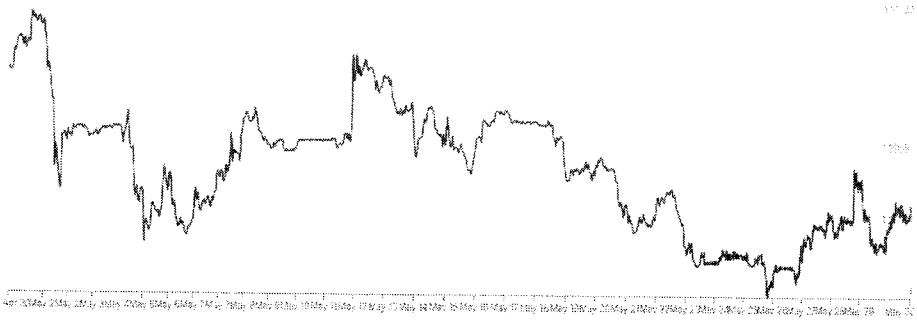
Net Pay is Basic Salary excluding employee CPF and any donations.

(a) Find Mr Sim's net pay.

Answer $..... [1]

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Daily exchange rate from Apr to May 2025



Source:https://www.xe.com/currencycharts/?from=USD&to=SGD&view=1M

Lowest rate on 26 May	1 USD = SGD 1.280108
Highest rate on 1 May	1 USD = SGD 1.31154

(b) Estimate the value of Mr Sim's foreign fixed deposit when it matures in June. Justify your answer and show your calculations clearly.

Answer $..... [2]

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The table below shows the payment schedule, applicable to Mr Sim, for the purchase of a private condominium in Singapore that is launched in July.

Fee payable	Percentage of cost price of condominium	Source of funds
Booking Fee	5%	Cash
Signing of agreement to purchase the condominium	15%	CPF
Stamp duty to be paid by the buyer	Refer below	Cash
Valuation report fee that buyer needs to pay	-	Fixed at $500 (cash)
Legal fees	-	Fixed at $3000 (cash)
First payment to be made once construction commenced	5%	Cash/ CPF
Second payment to be paid before completion of condominium	25%	Cash/ CPF/ Bank loan
Balance payment once condominium is completed	50%	Bank loan

Buyer Stamp Duty Rates

Purchase price or market value of the property	Buyer Stamp Duty rates for residential properties
First $180,000	1%
Next $180,000	2%
Next $640,000	3%
Next $500,000	4%
Next $1,500,000	5%
Remaining amount	6%

(c) Determine the total amount that needs to be paid in cash for the purchase of the $1.3 million condominium.

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Continuation of working space for question **9(c).**

Answer $..... [3]

(d) Mr Sim wishes to deplete his CPF and cash before using loan for all payments.

To qualify for the bank loan, Mr Sim needs to meet the two criteria.
(1) He can only borrow up to 75% of the property value from the bank.
(2) He may only use up to 55% of his basic salary to service both car loan and housing loan.

Assume that the instalment is calculated based on simple interest at the rate of 3.30% p.a. and the loan duration is 20 years, determine if Mr Sim would be able to secure the bank loan.
Justify any decision you make and show your calculation clearly.

Answer

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Continuation of working space for question **9(d).**

.....

..... [6]

End of Paper

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