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中正中学 义顺

CHUNG CHENG HIGH SCHOOL (YISHUN)



2025 Preliminary Examination Secondary Four Express / Five Normal Academic

CANDIDATE
NAME

FORM CLASS /
SUBJECT GROUP

 /

INDEX
NUMBER

MATHEMATICS

4052/01

Paper 1

18 August 2025

2 hours 15 minutes

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number on the work you hand in.

Write in dark blue or black pen.

You may use an HB pencil for any diagrams or graphs.

Do not use 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.

You are reminded of the need for clear presentation in your answers. Up to 2 marks may be deducted for improper presentation.

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.

Q1		Q2		Q3		Q4		Q5		Q6		Q7		Q8	
1		3		2		3		3		2		3		4	
Q9		Q10		Q11		Q12		Q13		Q14		Q15		Q16	
3		2		2		3		6		6		3		3	
Q17		Q18		Q19		Q20		Q21		Q22		Q23		Q24	
4		3		3		3		3		3		4		5	
Q25		Q26						Presentation Deduction		-1 / -2		Total 90			
8		5													

This document consists of 20 printed pages.

Mathematical Formulae*Compound Interest*

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

Measurement

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

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

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

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

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

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

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

Trigonometry

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

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

Statistics

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

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

- 1 Calculate $\frac{9.26}{\sqrt{51.76} - 2.02^3}$, giving your answer correct to 5 significant figures.

-8.8362	
---------	--

Answer [1]

- 2 (a) Express 252 as a product of its prime factors.

$2^2 \times 3^2 \times 7$	
---------------------------	--

Answer [1]

- (b) The highest common factor (HCF) of two numbers is 21.
The lowest common multiple (LCM) of the two numbers is 252.
Both numbers are less than 100.
Find the two numbers.

$A = 3^2 \times 7$ $B = 2^2 \times 3 \times 7$ $\text{LCM} = 252 = 2^2 \times 3^2 \times 7$ $\text{HCF} = 21 = 3 \times 7$ The two numbers are 63 and 84.	
--	--

Answer [2]

- 3 Given that $27^n = 8\sqrt{9^{6n}}$, find the value of 3^n .

$(3^3)^n = 8 \times (3^{12n})^{\frac{1}{2}}$ $3^{3n} = 8 \times 3^{6n}$ $\frac{1}{8} = 3^{6n-3n}$ $3^{3n} = \frac{1}{8}$ $3^n = \sqrt[3]{\frac{1}{8}}$ $= \frac{1}{2}$	
--	--

Answer [2]

- 4 (a) Simplify $(4n)^2 - (4n + a)(4n - a)$.

$= 16n^2 - [(4n)^2 - a^2]$ $= a^2$	
------------------------------------	--

Answer [1]

- (b) Hence, without the use of a calculator, evaluate $75^2 - (78)(72)$.

$= (75)^2 - [(75 + 3)(75 - 3)] \quad \text{M1}$ $= 3^2$ $= 9$	
---	--

Answer [2]

- 5 Cindy invested \$4200 in ABN Bank for 3 years. ABN Bank pays 1.8% per year compound interest. She would have earned the same amount of interest if she had invested the same amount of money for 3 years and 6 months in HKSB Bank which pays $r\%$ per year simple interest.

Calculate the value of r .

$\text{Interest} = 4200 \left(1 + \frac{1.8}{100} \right)^3 - 4200$ $= 230.9068944$ $\frac{4200 \times r \times 3.5}{100} = 230.9068944$ $r = 1.5707952$ $= 1.57$	
--	--

Answer [3]

- 6 Simplify $(4x - 5)(5x^2 + 4x - 7)$.

$=$ $20x^3 + 16x^2 - 28x - 25x^2 - 20x + 35$ $= 20x^3 - 9x^2 - 48x + 35$	
--	--

- 7 Rearrange the formula $\frac{x}{3} = \left(\frac{y}{7z-6w}\right)^{\frac{1}{3}}$ to make z the subject.

$\frac{x^3}{27} = \frac{y}{7z-6w}$ $7x^3z - 6x^3w = 27y$ $7x^3z = 27y + 6x^3w$ $z = \frac{27y + 6x^3w}{7x^3}$	
---	--

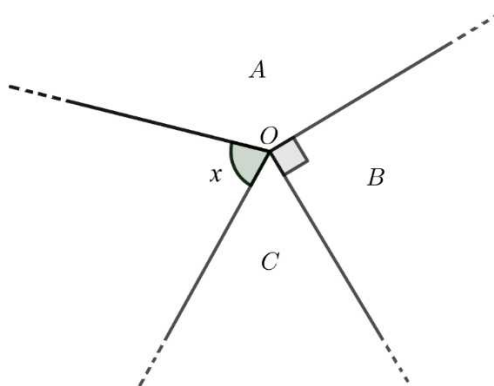
Answer $z = \dots\dots\dots$ [3]

- 8 (a) A polygon has n sides. Two of its exterior angles are 50° and 70° , and the remaining exterior angles are each 16° . Find the value of n .

$50 + 70 + 16(n-2) = 360$ $16n = 272$ $n = 17$	
--	--

Answer $\dots\dots\dots$ [2]

(b)



The diagram shows one interior angle of each of three regular polygons, A , B and C . The polygons fit together at point O , leaving a space marked by angle x . A is a regular nonagon, B is a square and C is an equilateral triangle. Find angle x .

$x = 360 - \left(\frac{(9-2) \times 180}{9} + 90 + 60 \right)$ $= 70^\circ$	
--	--

Answer $\dots\dots\dots$ [2]

9 An area of 1 km^2 is represented by 4 cm^2 on a map.

- (a) Calculate, in km^2 , the actual area of a volcanic crater which is represented by a circle of area 0.3 cm^2 on the map.

$1 \text{ cm}^2 : 0.25 \text{ km}^2$ Actual area = $0.25 \times 0.3 = 0.075 \text{ km}^2$	
--	--

Answer km^2 [1]

- (b) Find the scale of the map in the form $1:n$.

$1 \text{ cm}^2 : 0.25 \text{ km}^2$ $1 \text{ cm} : 0.5 \text{ km}$ $1 : 50\,000$	
--	--

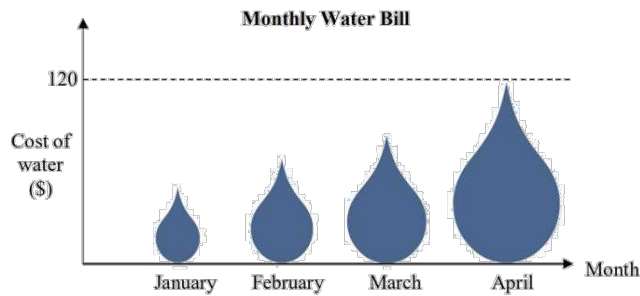
Answer [2]

- 10 The base and the height of a triangle are each reduced by 40% followed by an increase by 50%. Find the percentage reduction in the area of the triangle.

Original area = $\frac{1}{2} \times b \times h = \frac{bh}{2}$ New area = $\frac{1}{2} \times (0.6)(1.5)b \times (0.6)(1.5)h$ $= \frac{0.81bh}{2}$ Percentage reduction = $\frac{1-0.81}{1} \times 100\%$ $= 19\%$	
--	--

Answer% [2]

- 11 Mrs Lim draws this graph to show her monthly water bill for the first four months of the year 2024.



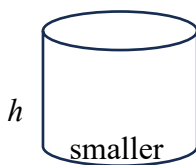
State one aspect of the graph that may be misleading and explain how this may lead to a misinterpretation of the graph.

No equal intervals indicated on the vertical axis and if the values start from 0. Unable to read the cost of water in the months before April.

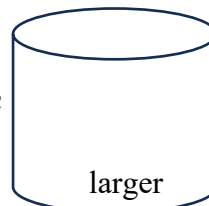
OR

Not clear if the size of the water droplets, is referring to the area of the droplets or the height of the droplets. Unable to determine the annual water bill.

- 12 Starlight Café sells latte drinks in two geometrically similar mugs. The height of the larger mug is 1.5 times the height of the smaller mug, h . Latte in a smaller mug and in a larger mug are sold at \$3.30 and \$13.20 respectively. Mandy thinks that it is more value for money to buy latte in 4 smaller mugs than one larger mug. Is Mandy correct? Justify your decision with calculations.



1.5 h



$$\frac{V_1}{V_2} = \left(\frac{h}{1.5h} \right)^3 = \frac{h^3}{3.375h^3}$$

Volume of 4 small mugs > Volume of 1 large mug

$$4 > 3.375$$

Cost of 4 small mugs = \$3.30 × 4 = \$13.20

Cost of 1 large mug = \$ 13.20

Mandy is correct. For the same amount paid for the latte, more latte is obtained from 4 small mugs of latte than from 1 large latte.

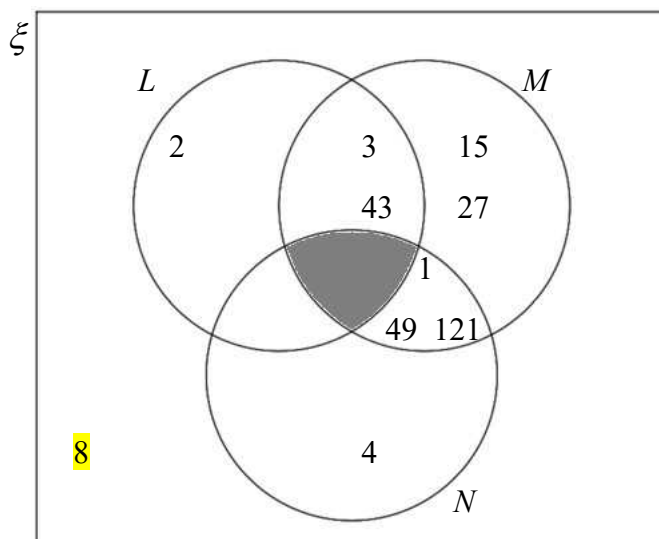
13 $\xi = \{1, 2, 3, 4, 8, 15, 27, 43, 49, 121\}$

$L = \{\text{Prime Numbers}\}$

$M = \{\text{Odd Numbers}\}$

$N = \{\text{Square Numbers}\}$

- (a) Complete the Venn diagram to illustrate this information.
There are no elements in the shaded portion of the diagram.



[2]

- (b) List the elements in $(M \cup L)'$

$\{4, 8\}$	
------------	--

- (c) Find the value of $n((L' \cup N) \cap (L \cup N'))$.

$(L' \cup N) = \{1, 4, 8, 15, 27, 49, 121\}$ $(L \cup N') = \{2, 3, 8, 15, 27, 43\}$ $n((L' \cup N) \cap (L \cup N')) = 3$	
--	--

- (d) The numbers in ξ are each printed on one card.

If a card is picked at random from the ten cards, find the probability that the number printed on the card

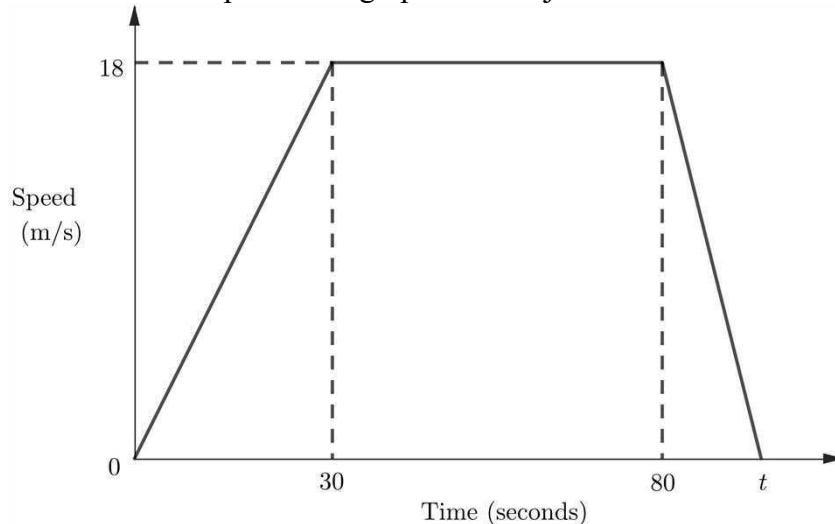
- (i) is a perfect cube,

(1, 8, 27). Thus the probability is $\frac{3}{10}$.	
--	--

- (ii) is a multiple of 3.

(3, 15, 27). Thus the probability is $\frac{3}{10}$.	
---	--

- 14 The diagram below shows the speed-time graph of an object.



- (a) Calculate the speed of the object at 18 seconds. Give your answer in km/h.

$\text{Speed} = \frac{18}{30} \times 18 = 10.8 \text{ m/s}$ $= 38.88 \text{ km/h}$	
--	--

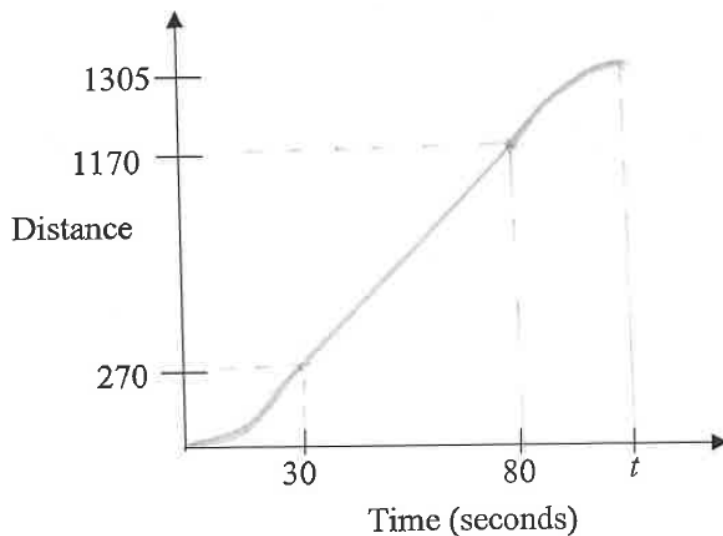
Answerkm/h [2]

- (b) At 80 seconds, the object starts decelerating at a rate that was twice its acceleration from 0 to 30 seconds, before coming to a stop at t seconds.
Calculate the total distance travelled on the journey.

$\text{Distance} = \frac{1}{2} \times 30 \times 18 + 50 \times 18 + \frac{1}{2} \times 15 \times 18$ $= 1305 \text{ m}$	
---	--

- (c) Draw the distance-time graph of the object on the grid given below.
You must label the values on the distance-axis clearly.

[2]



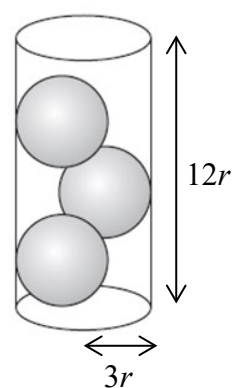
- 15 Tom has 46 blue and 29 red balls. He wants to use all the balls to fill a ball pit. He wants at least 70% of the balls to be blue. Find the smallest number of extra blue balls he needs to add to his ball collection.

$\frac{46+x}{46+29+x} \geq \frac{7}{10}$ $460+10x \geq 525+7x$ $3x \geq 65$ $x \geq 21.666$ Smallest $x = 22$	
---	--

Answer [3]

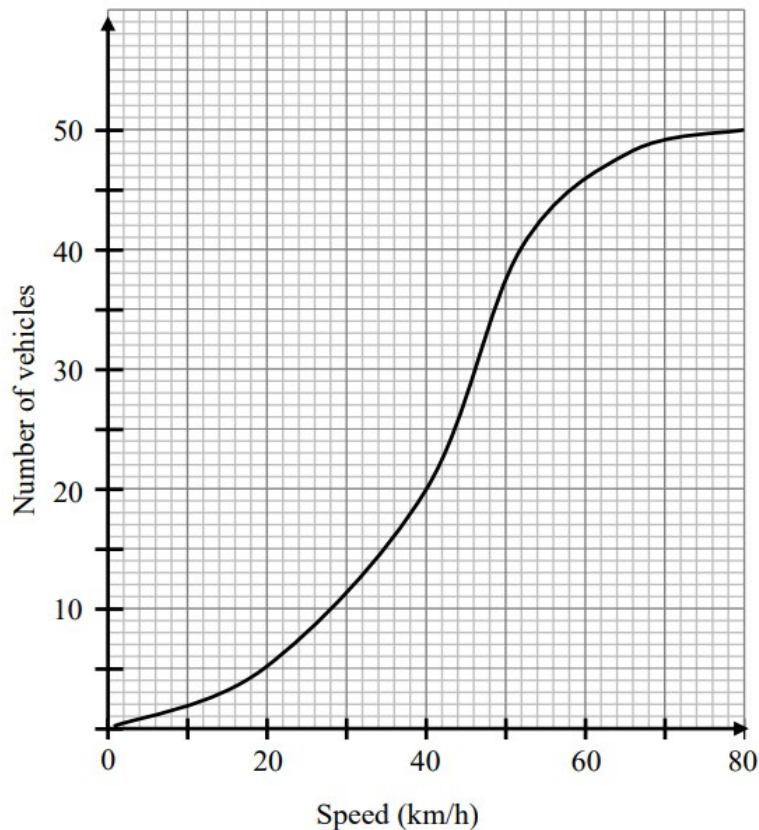
- 16 Three spheres, each of radius $2r$ cm, are placed inside a cylinder. The cylinder has radius $3r$ cm and height $12r$ cm. Water is poured into the cylinder to fill it completely. The volume of water poured into the cylinder is $k\pi r^3 \text{ cm}^3$. Find the value of k .

Vol of 3 spheres + Vol of water = Vol of cylinder $3 \times \left(\frac{4}{3} \pi (2r)^3 \right) + k\pi r^3 = \pi (3r)^3 (12r)$ $32\pi r^3 + k\pi r^3 = 108\pi r^3$ $k\pi r^3 = 76\pi r^3$ $\Rightarrow k = 76$	
---	--



Answer [3]

- 17 The cumulative frequency graph shows the speed of 50 vehicles passing by a narrow road within 5 minutes.



- (a) If 8% of the 50 vehicles received a speeding ticket, find the speed limit on this road.

60 km/h

Answerkm/h [1]

- (b) Find the interquartile range of the speed of the vehicles.

50 – 32 or 50 – 31
=18 =19

Answerkm/h [2]

- (c) It was said that more than 50% of the vehicles are travelling at 45 km/h when passing through the narrow road. Explain, with reason, whether you agree with the statement.

Disagree. 50% of the vehicles are travelling
at a speed less than 44km/h.

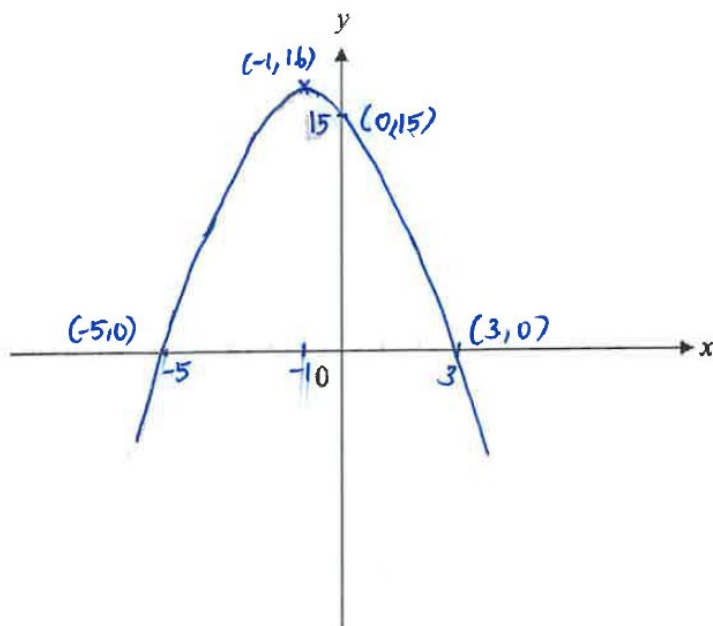
Answer

.....

..... [1]

- 18 Sketch the graph of $y = (x+5)(3-x)$ on the axes below.
Indicate clearly the coordinates of the points where the graph crosses the axes and the turning point of the curve.

[3]

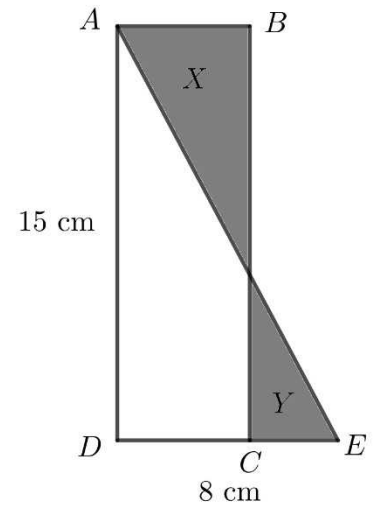


- 19 Given that n is an integer and $n > 1$, decide whether each statement in the table is **true** or **false**.
For each statement write **true** or **false** in the table
If you write **false**, give an example to justify your decision.

[3]

Statement	True or False	Example (if false)
$n^3 > 1$	True	
$\frac{1}{n} > \frac{1}{n^2}$	True	
$(n-1)(n+3)$ is always odd	False	When $n = 3$, $(3-1)(3+3) = 12$, which is even

- 20** The figure shows a rectangle $ABCD$ with $AD = 15$ cm .
 E is on DC produced such that $DE = 8$ cm .
 The area of the shaded part X is 12 cm² more than the area of the shaded part Y .
 Find the length of AB .



Let the unshaded region be Z .
 Area of $X = 12 + \text{Area of } Y$
 Area of $X + \text{Area of } Z = 12 + \text{Area of } Y + \text{Area of } Z$
 Area of $ABCD = \text{Area of } \triangle ADE + 12$
 $AB \times 15 = \frac{1}{2} \times 15 \times 8 + 12$
 $AB = \frac{72}{15} = 4.8$ cm

Answercm [3]

- 21 The table shows the quiz scores for a group of 30 students.

Quiz score, m	Frequency
$0 < m \leq 5$	2
$5 < m \leq 10$	5
$10 < m \leq 15$	15
$15 < m \leq 20$	8

- (a) Calculate an estimate for
(i) the mean scores of the students.

$$\begin{aligned}\text{mean} &= \frac{2.5 \times 2 + 7.5 \times 5 + 12.5 \times 15 + 17.5 \times 8}{30} \\ &= 12\frac{1}{3}\end{aligned}$$

Answer [1]

- (ii) The standard deviation of the quiz scores.

$$\begin{aligned}\text{s.d.} &= \sqrt{\frac{2.5^2 \times 2 + 7.5^2 \times 5 + 12.5^2 \times 15 + 17.5^2 \times 8}{30} - \left(12\frac{1}{3}\right)^2} \\ &= 4.18\end{aligned}$$

Answer [1]

- (b) A student who was sick did a make-up for the quiz.
The new mean mark was 13.

Given that the original median was 12, what can be deduced about the new median?

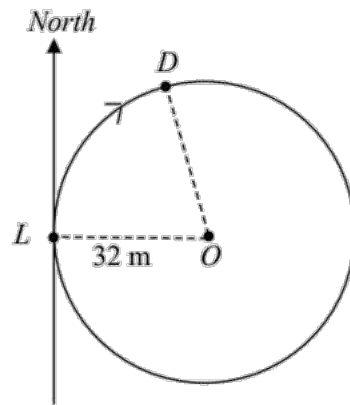
Answer The new median can be either 12 or larger than 12.

OR the new median cannot be lower than 12.

.....

..... [1]

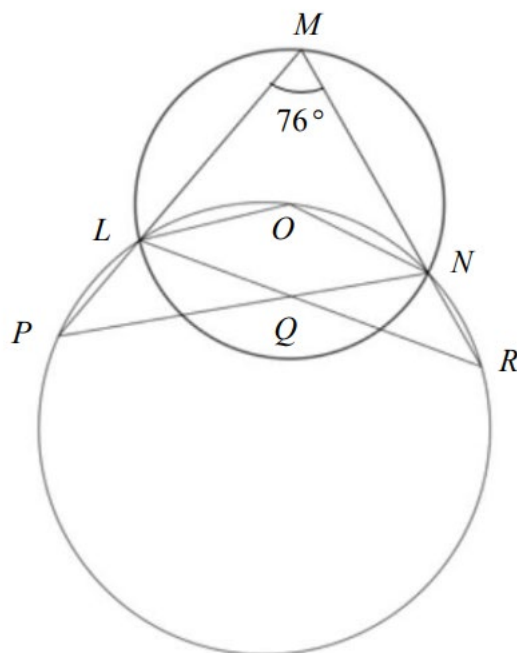
- 22 Alex flew an aerial drone from a landing site L . It flew in a circle of radius 32 metres in a clockwise direction shown in the diagram below. The centre of the circle is due east of L .



Find the bearing of the drone D from L after it travelled 43 metres along the circumference of the circle.

$$\begin{aligned}\frac{\theta}{360^\circ} \times 2\pi(32) &= 43 \\ \theta &= \frac{43 \times 360^\circ}{2\pi(32)} \\ &= 76.991^\circ \\ \angle OLD &= \frac{180^\circ - 76.991^\circ}{2} \\ &= 51.5045^\circ \\ \text{Bearing} &= 090^\circ - 051.5045^\circ \\ &= 038.5^\circ\end{aligned}$$

Answer [3]



The diagram shows two circles with the bigger circle passing through the centre, O , of the smaller circle. The circles intersect at L and N . PLM and MNR are straight lines.

PN and LR intersect at Q . Angle $LMN = 76^\circ$.

Find, giving reason for each answer,

(a) angle QPL ,

$\angle LON = 76^\circ \times 2 = 152^\circ$ (angle at center = 2 x angles at circumference) $\angle QPL = 180^\circ - 152^\circ$ (angles in opposite segment) = 28°	
---	--

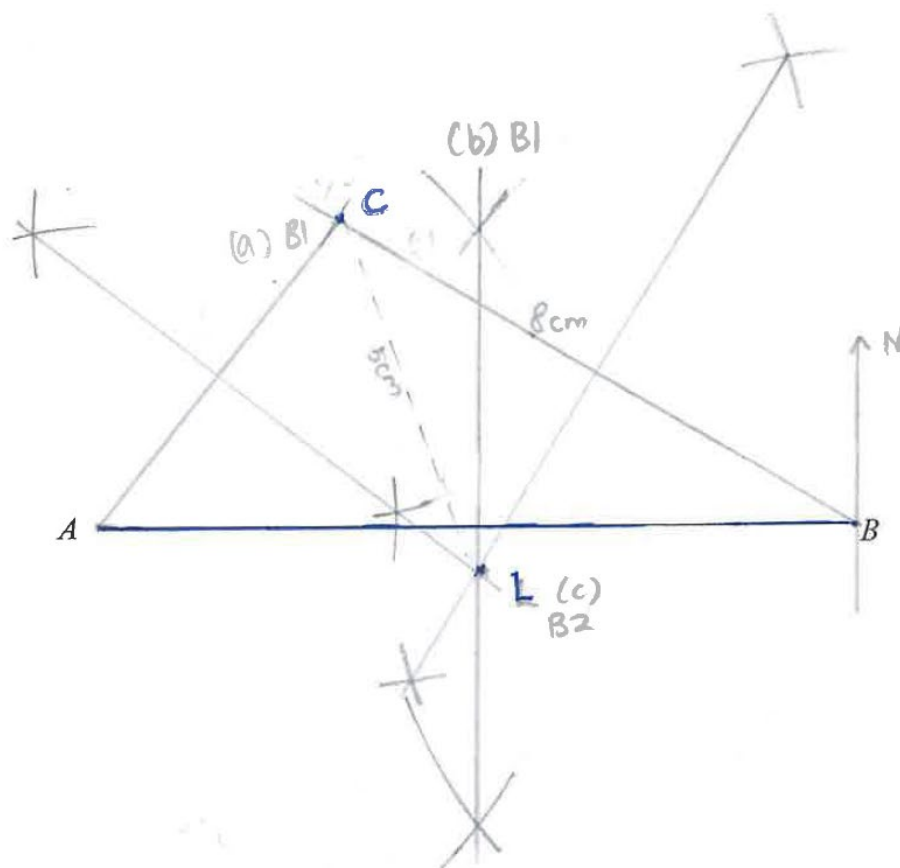
Answer [2]

(b) angle NQR .

$\angle PNR = 76^\circ + 28^\circ$ (exterior angle of triangle) = 104° $\angle NRL = 28^\circ$ (angles in same segment) $\angle NQR = 180^\circ - 104^\circ - 28^\circ$ ($\angle$ sum of Δ) = 48°	
--	--

Answer [2]

- 24 The diagram shown below is part of a model drawing of the neighborhood. Block B is due east of Block A . Block C has a bearing of 300° from B . The distance between Block B and Block C is 8 cm.



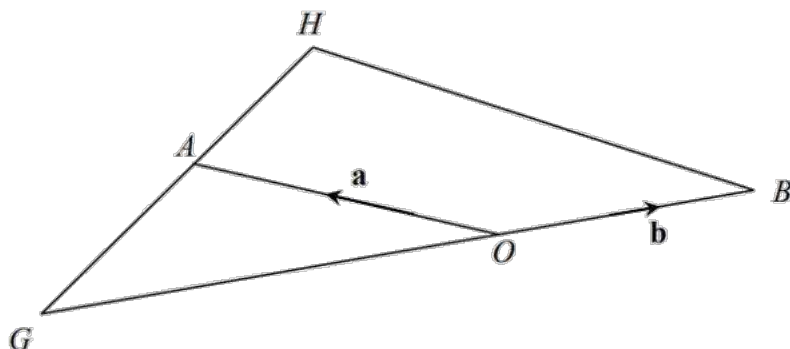
- (a) Mark and label the position of Block C on the model drawing. [1]
 (b) On the same diagram, construct the perpendicular bisector of the line AB . [1]
 (c) A letterbox is to be positioned such that it is equidistant from the three blocks.
 (i) On the same diagram, mark L to represent the position of the letterbox. [2]
 (ii) Given that the actual distance of $AB = 4$ km, calculate the actual distance between Block C and the letterbox, in kilometres.

2 km

Answer [1]

- 25 The position vectors of A and B , relative to O , are $\mathbf{a}$ and $\mathbf{b}$ respectively.

$$GB = 3OB \text{ and } GA = \frac{1}{2}GH.$$



- (a) Express each of the following in terms of $\mathbf{a}$ and $\mathbf{b}$.

(i) $\overrightarrow{GA}$

$= \overrightarrow{GO} + \overrightarrow{OA} = 2\mathbf{b} + \mathbf{a}$	
--	--

Answer [1]

(ii) $\overrightarrow{HB}$

$\begin{aligned} \overrightarrow{GH} &= 2(2\mathbf{b} + \mathbf{a}) \\ \overrightarrow{HB} &= \overrightarrow{HG} + \overrightarrow{GB} \\ &= -4\mathbf{b} - 2\mathbf{a} + 3\mathbf{b} \\ &= -\mathbf{b} - 2\mathbf{a} \end{aligned}$	
---	--

Answer [2]

- (b) Use your answer to (a)(ii) to explain why $OAHB$ is not a trapezium.

Answer $\overrightarrow{OA}$ is not a scalar multiple of $\overrightarrow{HB}$, hence, OA is not parallel to HB and since AH is also not parallel to OB , thus, $OAHB$ is not a trapezium as it has no parallel sides.

..... [1]

(c) Find the ratio of

(i) $\frac{\text{area of triangle } OHB}{\text{area of triangle } GHO},$

$= \frac{\frac{1}{2} \times OB \times h}{\frac{1}{2} \times GO \times h} = \frac{1}{2}$	
---	--

Answer [1]

(ii) $\frac{\text{area of triangle } OHA}{\text{area of } OAHB}.$

$\begin{aligned} \frac{\text{Area of } \triangle OHB}{\text{Area of } \triangle GHO} &= \frac{1}{2} \\ \frac{\text{Area of } \triangle OHA}{\text{Area of } \triangle OHB} &= \frac{1}{1} \\ \frac{\text{Area of } \triangle OHA}{\text{Area of } \triangle GHO} &= \frac{1}{2} \\ \frac{\text{Area of } \triangle OHA}{\text{Area of } OAHB} &= \frac{1}{2} \end{aligned}$	
---	--

Answer [2]

- 26 In sequence A, the first 3 terms are

$$a \quad ar \quad ar^2,$$

where a and r are constants.

In sequence B, the first term is a and the same non-zero number is added each time to obtain the next term.

The first 3 terms of sequence A are equal to the first, third and sixth term of Sequence B respectively.

- (a) Show that $2r^2 - 5r + 3 = 0$.

Answer

Let the same non-zero number be d . Then we have

$$ar = a + 2d$$

$$ar^2 = a + 5d$$

$$d = \frac{ar - a}{2}$$

$$d = \frac{ar^2 - a}{5}$$

Equating the two equations

$$\frac{ar - a}{2} = \frac{ar^2 - a}{5}$$

$$\frac{r - 1}{2} = \frac{r^2 - 1}{5}$$

$$5r - 5 = 2r^2 - 2$$

$$2r^2 - 5r + 5 - 2 = 0$$

$$2r^2 - 5r + 3 = 0$$

[3]

- (b) Find the value of r , justifying your answer.

$$2r^2 - 5r + 3 = 0$$

$$(2r - 3)(r - 1) = 0$$

$$r = \frac{3}{2} \quad \text{or} \quad r = 1$$

r cannot be 1 because the difference between consecutive terms in sequence B is non-zero.

Thus, $r = \frac{3}{2}$.

.....

.....

..... [2]



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CHUNG CHENG HIGH SCHOOL (YISHUN)



2025 Preliminary Examination Secondary Four Express / Five Normal Academic

CANDIDATE
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INDEX
NUMBER

MATHEMATICS

4052/02

Paper 2

19 August 2025

2 hours 15 minutes

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number on the work you hand in.
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For π , use either your calculator value or 3.142.

Question Number	Marks Possible	Marks Obtained
1	11	
2	9	
3	11	
4	9	
5	8	
6	9	
7	12	
8	12	
9	9	
Presentation Deduction		- 1 / - 2
TOTAL	90	

This document consists of **20** printed pages.

Mathematical Formulae*Compound Interest*

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

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

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

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

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

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

Trigonometry

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

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

Statistics

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

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

- 1 (a) Solve the equation $x^2 + 5x - 32 = 0$ by completing the square.
Give your solutions correct to 2 decimal places.

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

- (b) Write as a single fraction in its simplest form $\frac{2x}{x^2 - 4} + \frac{5}{2 - x}$.

Answer $\dots\dots\dots$ [3]

- (c) Solve the inequalities $x + 5 \leq 3 + 2x < 21 - x$.

Answer [3]

- (d) Simplify $\left(\frac{256x^{12}}{y^8}\right)^{-\frac{3}{4}}$.

Answer [2]

2 (a)

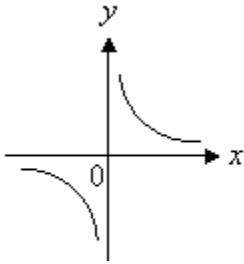


Figure 1

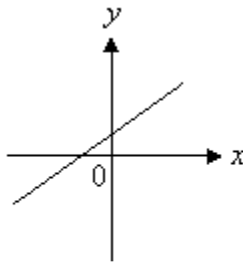


Figure 2

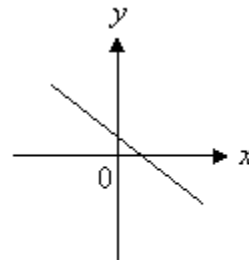


Figure 3

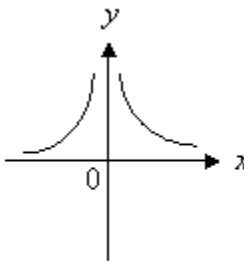


Figure 4

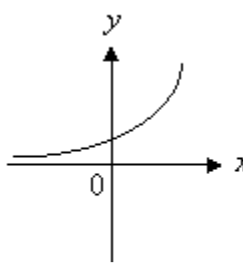


Figure 5

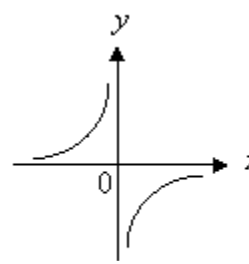


Figure 6

Which of the graphs shown above could be the graph of

(i) $y = 2^x$,

Answer Figure..... [1]

(ii) $y = \frac{3}{x^2}$,

Answer Figure..... [1]

(iii) $x + y = 1$?

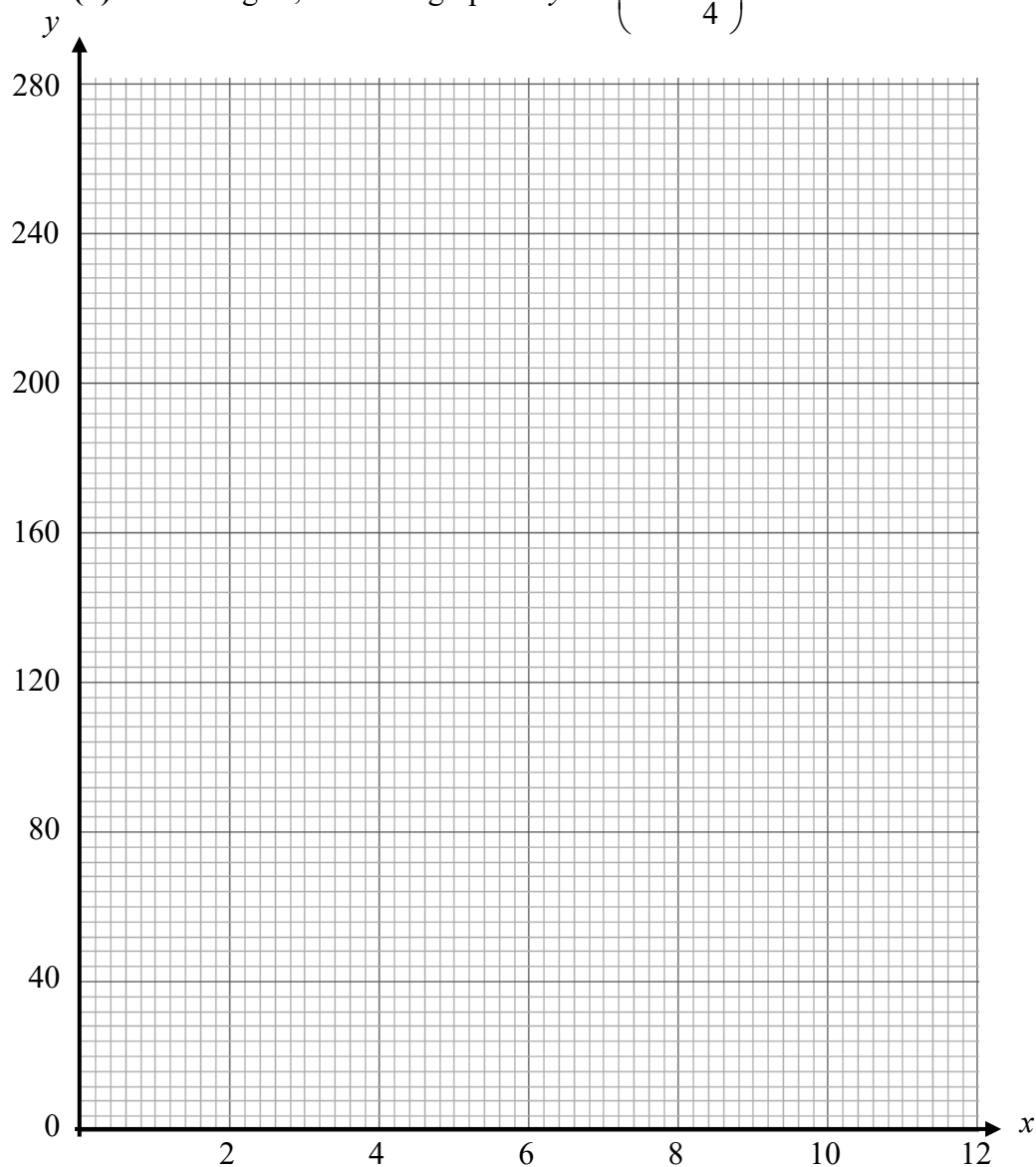
Answer Figure..... [1]

- (b) (i) Complete the table of values for $y = x\left(49 - \frac{x^2}{4}\right)$.

x	0	2	4	6	8	10	12
y	0	96	180		264	240	156

[1]

- (ii) On the grid, draw the graph of $y = x\left(49 - \frac{x^2}{4}\right)$ for $0 \leq x \leq 12$.



[3]

- (iii) The line $y = kx + 120$, where k is a constant, is a tangent to the curve. By drawing a suitable straight line on the graph, find the value of k .

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

- 3 (a) A packet contains a large number of flower seeds that produce white, yellow or red flowers. Half of the seeds produce white flowers and one third produce yellow flowers. The remainder of the seeds produce red flowers.

(i) Two seeds are chosen at random. Find the probability that

- (a) one will produce a yellow flower and one will produce a white flower,

Answer [2]

- (b) neither will produce a red flower.

Answer [2]

- (ii) Three seeds are chosen at random. Find the probability that at most two seeds will produce white flowers.

Answer [2]

- (iii) Given that n seeds are chosen at random, find the probability that all the seeds will produce red flowers.

Answer [1]

- (b) The stem and leaf diagram below shows the marks attained by 23 students in Class X for a Science quiz.

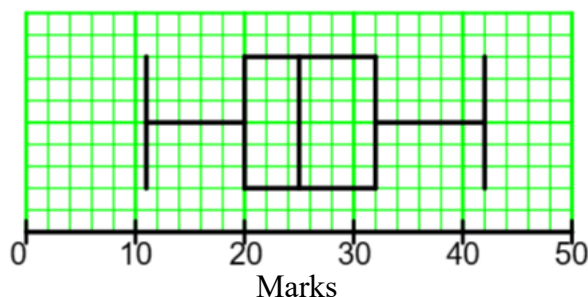
1	5	6	8	9	9	9		
2	0	0	1	1	2	3	4	7
3	3	4	4	5	6	8		
4	0	1	2					

Key : 1 | 5 means 15 marks

- (i) Using the data given, find the median mark.

Answer marks [1]

- (ii) The box-and-whisker plot shows the distribution of the results of students in Class Y for the same Science quiz.



Find the interquartile range.

Answer marks [1]

- (iii) Make two comparisons of the performance of the two classes X and Y for the Science quiz.

1.

.....

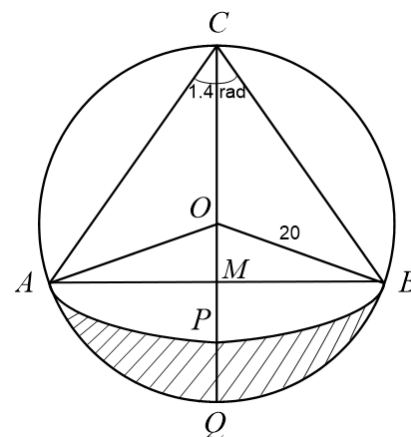
.....

2.

.....

..... [2]

- 4 In the diagram, O is the centre of a circular picture $ACBQ$ of radius 20 m.
 APB is an arc of a circle centre C and radii AC and BC .
 COQ is a diameter of the circular picture $ACBQ$.
 COQ bisects AB at M .



If angle $ACB = 1.4$ radians,

- (a) show that AC is approximately 30.594 m,

Answer

[3]

- (b) calculate the perimeter of the shaded region,

Answer m [3]

- (c) calculate the total cost of painting the sector $OAQB$ if the painting cost is \$0.50 per square metre.

Answer \$ [3]

- 5 Salim owns three cafes A, B and C which sell burgers and salad. The cafes operate 7 days a week. The sales on a weekend are on average half of that on a weekday.

(a) Suggest a reason why sales on a weekend are lower than sales on a weekday.

.....
 [1]

The matrix, $\mathbf{F}$, show the average number of food items that are sold on a weekday.

$$\mathbf{F} = \begin{matrix} & \begin{matrix} \text{Burger} & \text{Salad} \end{matrix} \\ \begin{pmatrix} 120 & 11 \\ 12 & 135 \\ 80 & 92 \end{pmatrix} & \begin{matrix} \text{Cafe A} \\ \text{Cafe B} \\ \text{Cafe C} \end{matrix} \end{matrix}$$

(b) Evaluate the matrix $\mathbf{W} = 6\mathbf{F}$.

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

(c) In all of his three cafes, each burger costs \$12 and each plate of salad costs \$8. Represent the costs of the food items in a 2×1 column matrix $\mathbf{C}$.

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

(d) Evaluate the matrix $\mathbf{R} = \mathbf{WC}$.

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

- (e) State what each of the elements of $\mathbf{R}$ represents.

.....

..... [1]

- (f) All the food items are sold for 40% profit.
By writing down a row matrix $\mathbf{T}$, find $\mathbf{TR}$ which gives the total amount of profit all three cafes made in a week.

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

- 6 A is the point $(4, -2)$ and the line AB is parallel to the line $\frac{1}{2}x - 3y = 9$.
- (a) Find the equation of the line AB .

Answer [2]

- (b) The equation of the line BC is $2x + 9y + 52 = 0$.
Find the x -coordinate of B .

Answer [2]

(c) It is given that $\overrightarrow{AD} = \begin{pmatrix} 3 \\ 3 \end{pmatrix}$ and $\overrightarrow{AE} = \begin{pmatrix} 5 \\ 1 \end{pmatrix}$.

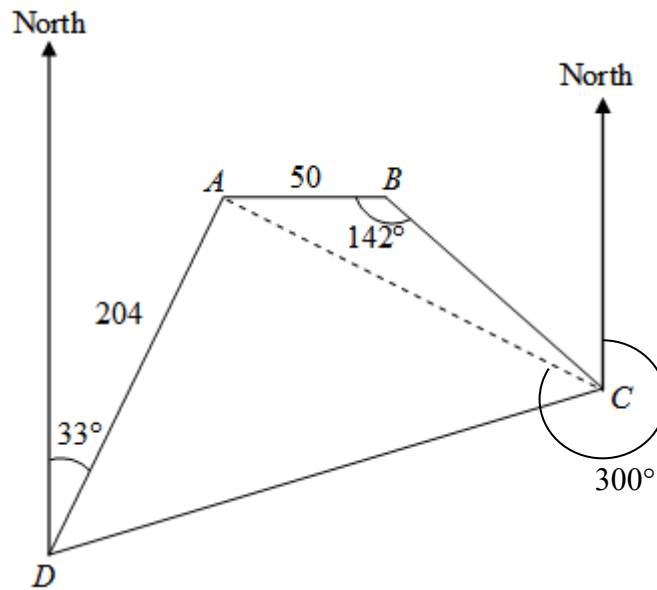
(i) By considering their magnitudes, show that ADE is a right-angled triangle. [3]

Answer

(ii) F is the point $(0, -6)$. Showing your working, determine if F lies on DA extended.

Answer

[2]



The diagram shows a plot of land with points $ABCD$ on level ground.
 The bearing of A from D is 033° and the length of AD is 204 m.
 B is 50 m due east of A .
 Angle $ABC = 142^\circ$ and the bearing of A from C is 300° .

- (a) Find the bearing of C from A .

Answer [1]

- (b) Find angle BAC .

Answer [1]

- (c) Show that the distance AC is 221.19 m, correct to two decimal places.

Answer

- (d) Find the area of triangle ABC .

Answer m^2 [2]

- (e) Find angle DAC .

Answer [1]

- (f) Hence, calculate the distance DC .

Answer m [3]

- (g) A tree, 15 m tall, stands vertically at A .

Find the angle of elevation of the top of the tree from D .

Answer [2]

- 8** StreamGuru is a legal online media services provider that allows users to download music albums over the Internet.

It offers subscribers two choices of StreamGuru Plans, Standard and Elite.

- (a)** Under the Standard Plan, subscribers can download x albums in one hour.

Write an expression, in terms of x , for the time taken, in minutes, to download one album under the Standard Plan.

Answermin [1]

- (b)** Under the Elite Plan, subscribers can download 5 more albums in one hour compared to the Standard Plan.

Write an expression, in terms of x , for the time taken, in minutes, to download one album under the Elite Plan.

Answermin [1]

- (c)** A StreamGuru subscriber can download an album under the Elite Plan 2 minutes faster than under the Standard Plan.

Write an equation in x to represent this information and show that it reduces to

$$x^2 + 5x - 150 = 0 .$$

Answer

[3]

- (d) Solve the equation $x^2 + 5x - 150 = 0$.

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

- (e) How many minutes does it take for a Elite Plan subscriber to download 2 music albums?

Answer $\dots\dots\dots$ min [2]

- (f) Find the percentage of time saved by downloading one music album under the Elite Plan compared to under the Standard Plan.

Answer $\dots\dots\dots$ % [2]

- 9 Irene is looking to buy furniture from EKAYA. She identifies the following items from the catalogue that she needs to purchase, and lists down the approximate amount of time that she will take if she assembles each item.

Item	Retail Price per item (GST included)	Quantity	Approximate time to assemble each item (min)
Bed frame 218 x 155 x 40 cm 36.25 kg	\$249	1	95
Storage solution 12.30 kg	\$119	2	20
Desk with Drawers 140 x 78 x 75 cm 22.10 kg	\$149	1	35
Folding chair 100 x 45 x 47 cm 3.00 kg <i>wall-mountable, requires one hole</i>	\$29	5	10
Bookshelf 80 x 28 x 202 cm 22.50 kg	\$129	1	45
Alarm clock 15 x 13 x 5 cm 0.19 kg	\$19	1	Does not require assembly

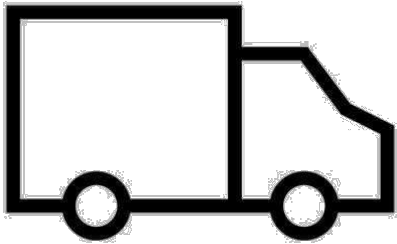
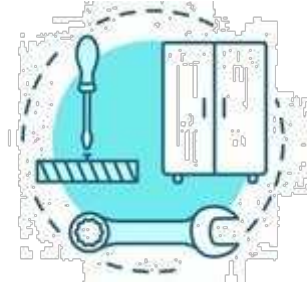
- (a) Calculate the total cost of the furniture that Irene intends to buy.

Answer [1]

Irene has \$1000 EKAYA credits from lucky draw that allows her to make a one-time purchase on the EKAYA online store.

Irene lives on the 4th floor of an old estate that does not have lift access.
 She has back issues and would have difficulties handling weight above 25 kg.
 She also wants to wall-mount all the folding chairs, but she does not have a drill.
 She does not want to pay more than \$110 out of her pocket.
 She does not want to spend more than 80 minutes assembling on her own.

EKAYA

Delivery	Assembly
You can take it home yourself – but you don't have to	You can assemble it yourself – but you don't have to
	
Home delivery is \$35 for orders above 15kg. We'll pick and deliver as many products as you want. Delivery typically takes place within 2-5 days from the date of order. ^ Please note for home delivery, an additional flat rate of \$20 will apply if there is no lift access, or if items cannot fit in the lift at the delivery address located in a building from the 3rd floor onwards. This service is applicable up to the 5th floor only.	Service fees 1. All other furniture that requires assembly: 20% of the original product's retail price. 2. Drilling services are included as part of the assembly services. 3. A \$5 charge per drilled hole applies to products, which require to be wall-mounted and where assembly service has not been booked.

All costs are subject to 9 % GST.

- (b) Suggest how Irene could minimise both the costs spent and the time for assembly for all the furniture purchased.
Justify all the decisions you make and show your calculations clearly.

Answer

.....

.....

..... [8]



中正中学 义顺

CHUNG CHENG HIGH SCHOOL (YISHUN)



2025 Preliminary Examination Secondary Four Express / Five Normal Academic

CANDIDATE
NAME

FORM CLASS /
SUBJECT GROUP

 /

INDEX
NUMBER

MATHEMATICS

4052/02

Paper 2

19 August 2025

2 hours 15 minutes

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number on the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use 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.
You are reminded of the need for clear presentation in your answers.
Up to 2 marks may be deducted for improper presentation.

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.

Question Number	Marks Possible	Marks Obtained
1	11	
2	9	
3	11	
4	9	
5	8	
6	9	
7	12	
8	12	
9	9	
Presentation Deduction		- 1 / - 2
TOTAL	90	

This document consists of **20** printed pages.

Mathematical Formulae*Compound Interest*

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

Measurement

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

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

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

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

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

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

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

Trigonometry

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

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

Statistics

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

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

- 1 (a) Solve the equation $x^2 + 5x - 32 = 0$ by completing the square.
Give your solutions correct to 2 decimal places.

$x^2 + 5x - 32 = 0$ $x^2 + 5x + \left(\frac{5}{2}\right)^2 - \left(\frac{5}{2}\right)^2 - 32 = 0$ $\left(x + \frac{5}{2}\right)^2 - \frac{25}{4} - 32 = 0$ $\left(x + \frac{5}{2}\right)^2 - 38.25 = 0$ $\left(x + \frac{5}{2}\right)^2 = 38.25$ $x + \frac{5}{2} = \pm 6.1847$ $x = -8.68 \text{ or } 3.68$	
--	--

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

- (b) Write as a single fraction in its simplest form $\frac{2x}{x^2 - 4} + \frac{5}{2 - x}$.

$\frac{2x}{(x+2)(x-2)} - \frac{5}{x-2}$ $= \frac{2x - 5(x+2)}{(x+2)(x-2)}$ $= \frac{2x - 5x - 10}{(x+2)(x-2)}$ $= \frac{-3x - 10}{(x+2)(x-2)}$	
--	--

Answer $\dots\dots\dots$ [3]

- (c) Solve the inequalities $x + 5 \leq 3 + 2x < 21 - x$.

$x + 5 \leq 3 + 2x$ and $3 + 2x < 21 - x$ $-x \leq -2$ $3x < 18$ $x \geq 2$ $x < 6$ $\therefore 2 \leq x < 6$	
--	--

Answer [3]

- (d) Simplify $\left(\frac{256x^{12}}{y^8}\right)^{-\frac{3}{4}}$.

$\left(\frac{256x^{12}}{y^8}\right)^{-\frac{3}{4}} = \left(\frac{y^8}{256x^{12}}\right)^{\frac{3}{4}}$ $= \frac{y^6}{64x^9}$	
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Answer [2]

2 (a)

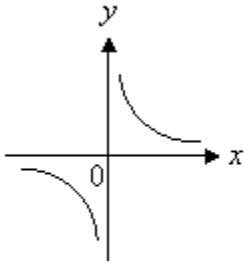


Figure 1

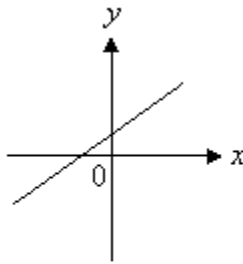


Figure 2

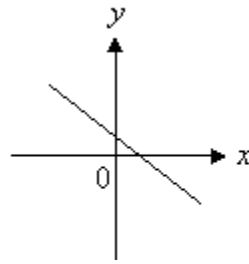


Figure 3

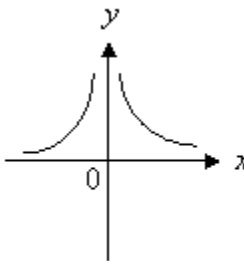


Figure 4

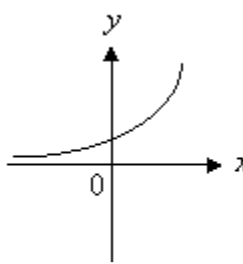


Figure 5

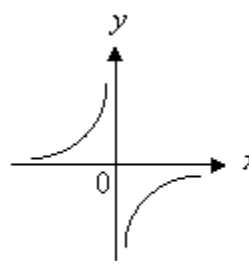


Figure 6

Which of the graphs shown above could be the graph of

(i) $y = 2^x$,

Figure 5	
----------	--

Answer Figure..... [1]

(ii) $y = \frac{3}{x^2}$,

Figure 4	
----------	--

Answer Figure..... [1]

(iii) $x + y = 1$?

Figure 3	
----------	--

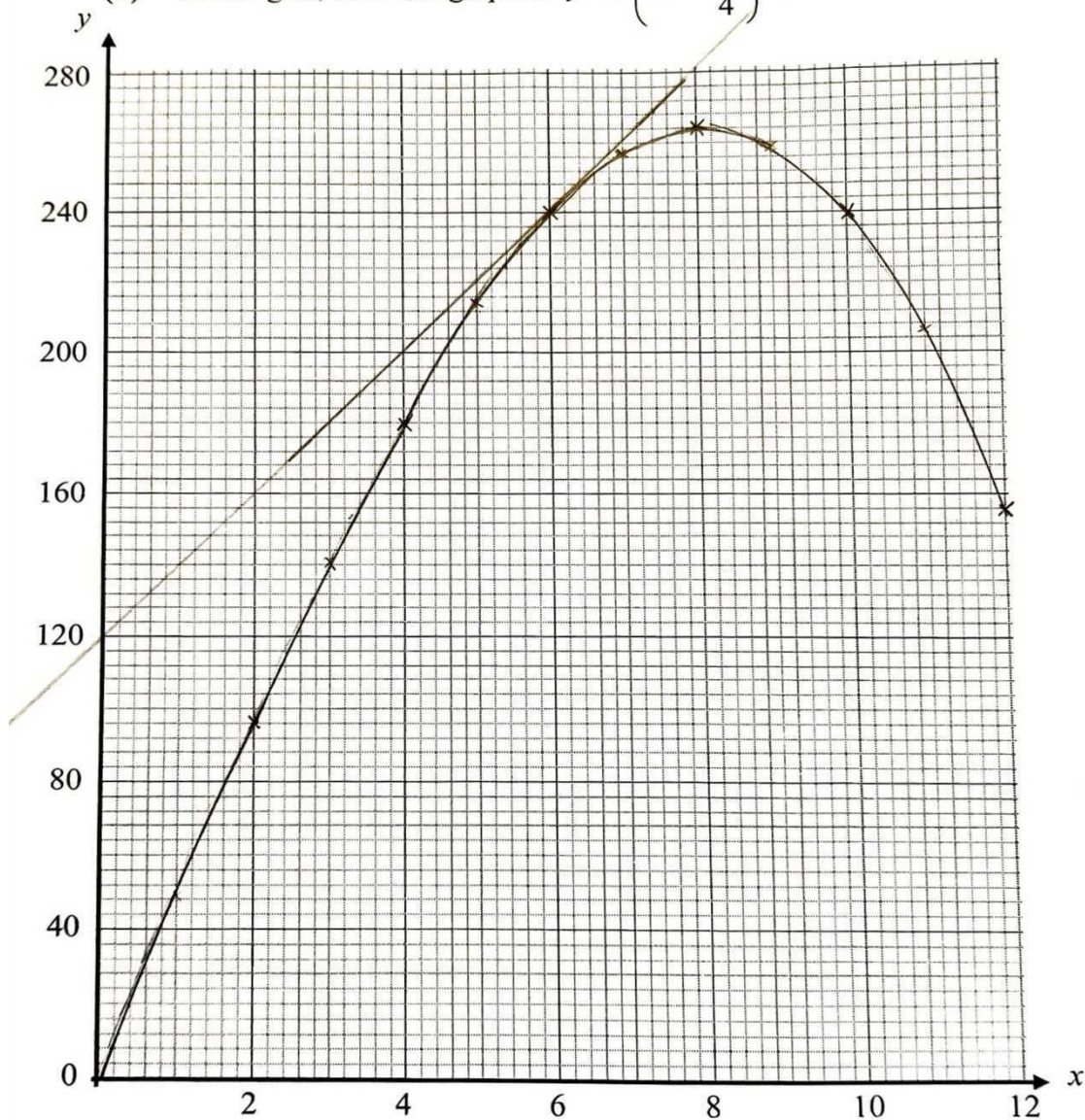
Answer Figure..... [1]

- (b) (i) Complete the table of values for $y = x\left(49 - \frac{x^2}{4}\right)$.

x	0	2	4	6	8	10	12
y	0	96	180	240	264	240	156

[1]

- (ii) On the grid, draw the graph of $y = x\left(49 - \frac{x^2}{4}\right)$ for $0 \leq x \leq 12$.



[3]

- (iii) The line $y = kx + 120$, where k is a constant, is a tangent to the curve. By drawing a suitable straight line on the graph, find the value of k .

$k = \frac{240 - 120}{6 - 0}$ $= 20$	
--------------------------------------	--

Answer [2]

- 3 (a) A packet contains a large number of flower seeds that produce white, yellow or red flowers. Half of the seeds produce white flowers and one third produce yellow flowers. The remainder of the seeds produce red flowers.

(i) Two seeds are chosen at random. Find the probability that

(a) one will produce a yellow flower and one will produce a white flower,

$P(1 \text{ yellow}, 1 \text{ white}) = \left(\frac{1}{2} \times \frac{1}{3}\right) + \left(\frac{1}{3} \times \frac{1}{2}\right)$ $= \frac{1}{3}$	
--	--

Answer [2]

(b) neither will produce a red flower.

$P(\text{neither red}) = \frac{5}{6} \times \frac{5}{6}$ $= \frac{25}{36}$	
--	--

Answer [2]

(ii) Three seeds are chosen at random. Find the probability that at most two seeds will produce white flowers.

$P(\text{at most 2}) = 1 - P(\text{all white})$ $= 1 - \left(\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2}\right)$ $= \frac{7}{8}$	
--	--

Answer [2]

(iii) Given that n seeds are chosen at random, find the probability that all the seeds will produce red flowers.

$P(\text{all red}) = \left(\frac{1}{6}\right)^n$	
--	--

Answer [1]

- (b) The stem and leaf diagram below shows the marks attained by 23 students in Class X for a Science quiz.

1	5	6	8	9	9	9		
2	0	0	1	1	2	3	4	7
3	3	4	4	5	6	8		
4	0	1	2					

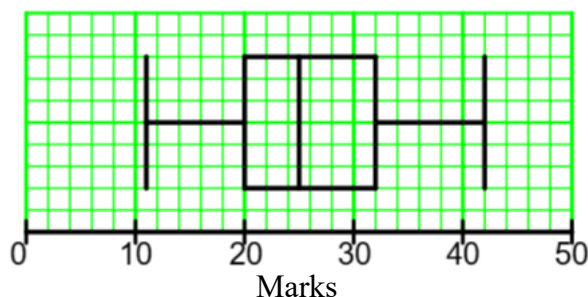
Key : 1 | 5 means 15 marks

- (i) Using the data given, find the median mark.

23

Answer marks [1]

- (ii) The box-and-whisker plot shows the distribution of the results of students in Class Y for the same Science quiz.



Find the interquartile range.

Interquartile range = $32 - 20 = 12$

Answer marks [1]

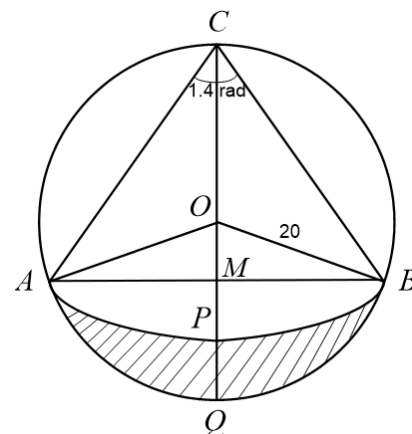
- (iii) Make two comparisons of the performance of the two classes X and Y for the Science quiz.

1. Class Y's students scored better on average, as Class Y has a higher median (25) than that of Class X (23).
2. The marks of Class Y's students are more consistent than that of Class X's, as Class Y (12) has a lower interquartile range than Class X ($35 - 19 = 16$).

.....

..... [2]

- 4 In the diagram, O is the centre of a circular picture $ACBQ$ of radius 20 m.
 APB is an arc of a circle centre C and radii AC and BC .
 COQ is a diameter of the circular picture $ACBQ$.
 COQ bisects AB at M .



If angle $ACB = 1.4$ radians,

- (a) show that AC is approximately 30.594 m,

Answer

$\begin{aligned}\angle AOB &= 2(1.4) \quad (\angle \text{ at centre} = 2\angle \text{ s at circumference}) \\ &= 2.8 \text{ radians} \\ \angle AOC &= (\pi - 1.4) \text{ radians (Adj } \angle \text{ s on a st. line)} \\ AC^2 &= 20^2 + 20^2 - 2 \times 20 \times 20 \times \cos(\pi - 1.4) \\ AC &\approx \sqrt{935.9737} \\ &\approx 30.5936 \\ &\approx 30.594 \text{ m (Shown)}\end{aligned}$	
---	--

[3]

- (b) calculate the perimeter of the shaded region,

$\begin{aligned}\text{Perimeter} &= \text{Arc length } APB + \text{Arc length } AQB \\ &= 30.594 \times 1.4 + 20 \times 2.8 \\ &= 98.831 \\ &\approx 98.8 \text{ m}\end{aligned}$	
---	--

Answer m [3]

- (c) calculate the total cost of painting the sector $OAQB$ if the painting cost is \$0.50 per square metre.

$\begin{aligned}\text{Area of sector } OAQB &= \frac{1}{2} \times 20^2 \times 2.8 \\ &= 560 \text{ m}^2 \\ \text{Total cost} &= \$ (0.50 \times 560) \\ &= \$280\end{aligned}$	
--	--

Answer \$ [3]

- 5 Salim owns three cafes A, B and C which sell burgers and salad. The cafes operates for 7 days a week. The sales on a weekend are on average half of that on a weekday.

(a) Suggest a reason why the sales on a weekend are lower than the sales on a weekday.

The cafés could be located in the CBD/business area/school area with more workers/students visiting the cafés for meals on the weekdays.

OR

the main clientele of the cafes are company workers and students who would get their burgers and salads during the weekdays.

The matrix, $\mathbf{F}$, show the average number of food items that are sold on a weekday.

$$\mathbf{F} = \begin{matrix} & \begin{matrix} \text{Burger} & \text{Salad} \end{matrix} \\ \begin{pmatrix} 120 & 11 \\ 12 & 135 \\ 80 & 92 \end{pmatrix} & \begin{matrix} \text{Cafe A} \\ \text{Cafe B} \\ \text{Cafe C} \end{matrix} \end{matrix}$$

(b) Evaluate the matrix $\mathbf{W} = 6\mathbf{F}$.

$$\mathbf{W} = \begin{pmatrix} 720 & 66 \\ 72 & 810 \\ 480 & 552 \end{pmatrix}$$

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

(c) In all of his three cafes, each burger costs \$12 and each plate of salad costs \$8. Represent the costs of the food items in a 2×1 column matrix $\mathbf{C}$.

$$\mathbf{C} = \begin{pmatrix} 12 \\ 8 \end{pmatrix}$$

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

- (d) Evaluate the matrix $\mathbf{R} = \mathbf{WC}$.

$$\mathbf{R} = \begin{pmatrix} 9168 \\ 7344 \\ 10176 \end{pmatrix}$$

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

- (e) State what each of the elements of $\mathbf{R}$ represents.

The elements represent the amount of money collected from the sales of burgers and salads from café A, B and C respectively in a week.

-

[1]

- (f) All the food items are sold for 40% profit.
By writing down a row matrix $\mathbf{T}$, find $\mathbf{TR}$ which gives the total amount of profit all three cafes made in a week.

$$\begin{aligned} \mathbf{TR} &= \begin{pmatrix} \frac{0.4}{1.4} & \frac{0.4}{1.4} & \frac{0.4}{1.4} \end{pmatrix} \begin{pmatrix} 9168 \\ 7344 \\ 10176 \end{pmatrix} \\ &= \frac{2}{7}(9168 + 7344 + 10176) \\ &= (7625.14) \text{ (2 d.p.)} \end{aligned}$$

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

- 6 A is the point $(4, -2)$ and the line AB is parallel to the line $\frac{1}{2}x - 3y = 9$.

(a) Find the equation of the line AB .

[2]

$\frac{1}{2}x - 3y = 9 \Rightarrow y = \frac{1}{6}x - 3$ Since the lines are parallel, they share the same gradient. $-2 = \frac{1}{6}(4) + c \Rightarrow c = -\frac{8}{3}$ The equation of line AB is $y = \frac{1}{6}x - \frac{8}{3}$.	
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Answer [2]

- (b) The equation of the line BC is $2x + 9y + 52 = 0$.
Find the x -coordinate of B .

[2]

$2x + 9\left(\frac{1}{6}x - \frac{8}{3}\right) + 52 = 0$ $2x + \frac{3}{2}x - 24 + 52 = 0$ $\frac{7}{2}x = -28$ $x = -8$	
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Answer [2]

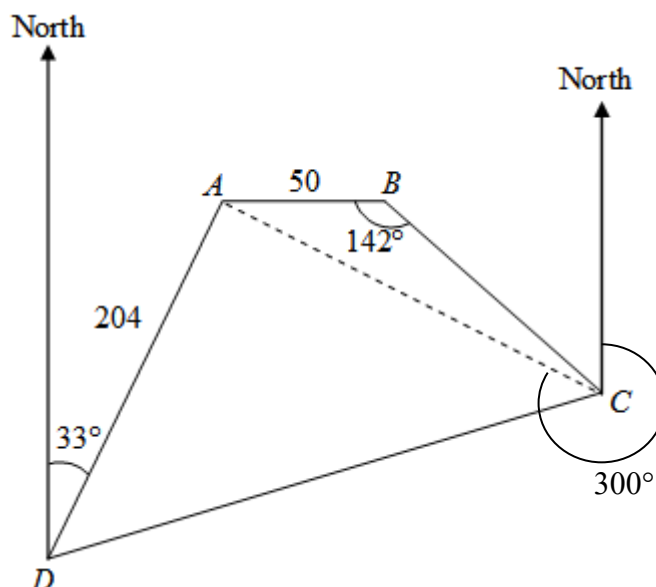
(c) It is given that $\overrightarrow{AD} = \begin{pmatrix} 3 \\ 3 \end{pmatrix}$ and $\overrightarrow{AE} = \begin{pmatrix} 5 \\ 1 \end{pmatrix}$

(i) By considering their magnitudes, show that ADE is a right-angled triangle. [3]

$AD^2 = \left \overrightarrow{AD} \right ^2 = 3^2 + 3^2 = 18$ $AE^2 = \left \overrightarrow{AE} \right ^2 = 5^2 + 1^2 = 26$ $\overrightarrow{DE} = \begin{pmatrix} 5 \\ 1 \end{pmatrix} - \begin{pmatrix} 3 \\ 3 \end{pmatrix} = \begin{pmatrix} 2 \\ -2 \end{pmatrix}$ $DE^2 = \left \overrightarrow{DE} \right ^2 = 2^2 + (-2)^2 = 8$ Since $AD^2 + DE^2 = 18 + 8 = 26$, we have $AD^2 + DE^2 = AE^2$. By the converse of Pythagoras' Theorem, ADE is a right-angled triangle.

(ii) F is the point $(0, -6)$. Showing your working, determine if F lies on DA extended. [2]

Since $\overrightarrow{AD} = \begin{pmatrix} 3 \\ 3 \end{pmatrix}$, the gradient of the line DA is $\frac{3}{3} = 1$. $-2 = 1(4) + c \Rightarrow c = -6$ The equation of the line DA is $y = x - 6$. Since the point F is the y-intercept of the line DA, it lies on DA extended.	
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The diagram shows a plot of land with points $ABCD$ on level ground.
 The bearing of A from D is 033° and the length of AD is 204 m.
 B is 50 m due east of A .
 Angle $ABC = 142^\circ$ and the bearing of A from C is 300° .

- (a) Find the bearing of C from A .

$\begin{aligned} \text{Bearing of } C \text{ from } A &= 180^\circ - (360^\circ - 300^\circ) \\ &= 120^\circ \end{aligned}$	
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Answer [1]

- (b) Find angle BAC .

$\begin{aligned} \angle BAC &= 120^\circ - 90^\circ \\ &= 30^\circ \end{aligned}$	
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Answer [1]

- (c) Show that the distance AC is 221.19 m, correct to two decimal places.

$\begin{aligned} \frac{AC}{\sin 142^\circ} &= \frac{50}{\sin 8^\circ} \\ AC &= \frac{50 \sin 142^\circ}{\sin 8^\circ} \\ &\approx 221.1855 \\ &\approx 221.19 \text{ m (Shown)} \end{aligned}$	
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[2]

- (d) Find the area of triangle ABC .

$\begin{aligned}\text{Area of triangle } ABC &= \frac{1}{2} \times 50 \times 221.19 \sin 30^\circ \\ &= 2764.875 \\ &\approx 2760 \text{ m}^2\end{aligned}$	
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Answer m^2 [2]

- (e) Find angle DAC .

$\begin{aligned}\angle DAC &= 33^\circ + 60^\circ \\ &= 93^\circ\end{aligned}$	
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Answer [1]

- (f) Hence, calculate the distance DC .

$\begin{aligned}DC^2 &= 204^2 + 221.19^2 - 2 \times 202 \times 221.19 \cos 93^\circ \\ DC &= \sqrt{95264.10} \\ &\approx 308.6488 \\ &\approx 309 \text{ m}\end{aligned}$	
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Answer m [3]

- (g) A tree, 15 m tall, stands vertically at A .

Find the angle of elevation of the top of the tree from D .

$\begin{aligned}\text{Let angle of elevation be } \theta. \\ \tan \theta &= \frac{15}{204} \\ \theta &= \tan^{-1} \left(\frac{15}{204} \right) \\ &\approx 4.20536 \\ &\approx 4.2^\circ \text{ (to 1 d.p.)}\end{aligned}$	
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Answer [2]

- 8** StreamGuru is a legal online media services provider that allows users to download music albums over the Internet.

It offers subscribers two choices of StreamGuru Plans, Standard and Elite.

- (a)** Under the Standard Plan, subscribers can download x albums in one hour.

Write an expression, in terms of x , for the time taken, in minutes, to download one album under the Standard Plan.

$\frac{60}{x}$	
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Answermin [1]

- (b)** Under the Elite Plan, subscribers can download 5 more albums in one hour compared to the Standard Plan.

Write an expression, in terms of x , for the time taken, in minutes, to download one album under the Elite Plan.

$\frac{60}{x+5}$	
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Answermin [1]

- (c)** A StreamGuru subscriber can download an album under the Elite Plan 2 minutes faster than under the Standard Plan.

Write an equation in x to represent this information and show that it reduces to

$$x^2 + 5x - 150 = 0.$$

$\frac{60}{x} - \frac{60}{x+5} = 2$ $60(x+5) - 60x = 2x(x+5)$ $60x + 300 - 60x = 2x^2 + 10x$ $2x^2 + 10x - 300 = 0$ $x^2 + 5x - 150 = 0 \text{ (Shown)}$	
--	--

[3]

- (d) Solve the equation $x^2 + 5x - 150 = 0$.

$x^2 + 5x - 150 = 0$ $(x - 10)(x + 15) = 0$ $x = 10$ or $x = -15$	
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Answer $x = \dots\dots\dots$ or $\dots\dots\dots$ [3]

- (e) How many minutes does it take for a Elite Plan subscriber to download 2 music albums?

Amount of time under Elite Plan for 2 music albums $= \frac{60}{10 + 5} \times 2$ $= 8 \text{ minutes}$	
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Answer $\dots\dots\dots$ min [2]

- (f) Find the percentage of time saved by downloading one music album under the Elite Plan compared to under the Standard Plan.

Percentage of time saved $= \frac{6 - 4}{6} \times 100\%$ $= 33\frac{1}{3}\%$	
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Answer $\dots\dots\dots$ % [2]

- 9 Irene is looking to buy furniture from EKAYA. She identifies the following items from the catalogue that she needs to purchase, and lists down the approximate amount of time that she will take if she assembles each item.

Item	Retail Price per item (GST included)	Quantity	Approximate time to assemble each item (min)
Bed frame 218 x 155 x 40 cm 36.25 kg	\$249	1	95
Storage solution 12.30 kg	\$119	2	20
Desk with Drawers 140 x 78 x 75 cm 22.10 kg	\$149	1	35
Folding chair 100 x 45 x 47 cm 3.00 kg <i>wall-mountable, requires one hole</i>	\$29	5	10
Bookshelf 80 x 28 x 202 cm 22.50 kg	\$129	1	45
Alarm clock 15 x 13 x 5 cm 0.19 kg	\$19	1	Does not require assembly

- (a) Calculate the total cost of the furniture that Irene intends to buy.

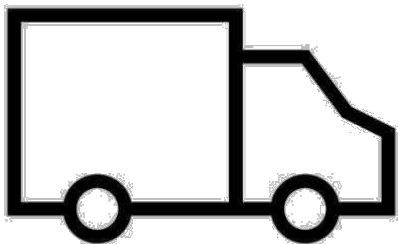
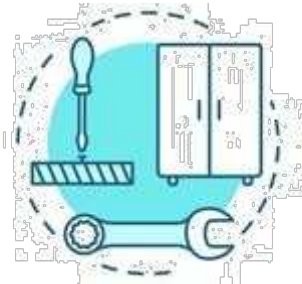
$249 + 119 \times 2 + 149 + 29 \times 5 + 129 + 19 = \929	
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Answer \$ [1]

Irene has \$1000 EKAYA credits from lucky draw that allows her to make a one-time purchase on the EKAYA online store.

Irene lives on the 4th floor of an old estate that does not have lift access.
 She has back issues and would have difficulties handling weight above 25 kg.
 She also wants to wall-mount all the folding chairs, but she does not have a drill.
 She does not want to pay more than \$110 out of her pocket.
 She does not want to spend more than 80 minutes assembling on her own.

EKAYA

Delivery	Assembly
You can take it home yourself – but you don't have to	You can assemble it yourself – but you don't have to
	
Home delivery is \$35 for orders above 15kg. We'll pick and deliver as many products as you want. Delivery typically takes place within 2-5 days from the date of order. ^ Please note for home delivery, an additional flat rate of \$20 will apply if there is no lift access, or if items cannot fit in the lift at the delivery address located in a building from the 3rd floor onwards. This service is applicable up to the 5th floor only.	Service fees 1. All other furniture that requires assembly: 20% of the original product's retail price. 2. Drilling services are included as part of the assembly services. 3. A \$5 charge per drilled hole applies to products, which require to be wall-mounted and where assembly service has not been booked.

All costs are subject to 9 % GST.

- (b) Suggest how Irene could minimise both the costs spent and the time for assembly for all the furniture purchased.
Justify all the decisions you make and show your calculations clearly.

Answer

Total cost of furniture: \$929

Since Irene has difficulties handling weight above 25 kg, then both delivery and lifting services are essential.

- Delivery: \$35
- Lifting (no lift access): \$20

In order to minimise cost and time, we can do a cost per min analysis.

Item	Assembly cost (20%)	Time (min)	Cost/min	Remarks
Bedframe	$249 \times 0.2 = 49.80$	95	-	$> 80 \text{ min} \rightarrow$ assembly service
Storage solution	$119 \times 0.2 \times 2 = 47.60$	$20 \times 2 = 40$	1.19	
Desk with drawers	$149 \times 0.2 = 29.80$	35	0.851	
Folding Chair	$29 \times 0.2 \times 5 = 29$	$10 \times 5 = 50$	0.58	
Bookshelf	$129 \times 0.2 = 25.80$	45	0.573	

Considering that the cost of drilling (separate) is \$25 + 50 min of self-assembly, paying \$29 for assembly (\$4 more to save 50 min) is recommended: **use assembly service for folding chairs.**

For the remaining 3 items, we do a breakdown as below:

	Storage and Desk	Desk and Bookshelf	Storage and Bookshelf
Pay for remaining	25.80 (bookshelf)	47.60 (storage)	29.80 (desk)
Time needed	$40 + 35$ $= 75 \text{ min}$	$35 + 45$ $= 80 \text{ min}$	$40 + 45$ $= 85 \text{ min} > 80$

Irene should choose to assemble the storage solutions and desk with drawers by herself. Because she would pay the least and spend the least amount of time to assemble.

In summary,

Services acquired: Delivery (\$35) + Lifting (\$20)

Assembly: Bedframe (\$49.80) + Chairs (\$29) + Bookshelf (\$25.80)

Total spending = $929 + (35 + 20 + 49.8 + 29 + 25.8) \times 1.09 - 1000$

$= \$102.96 < \110

Time needed = $75 \text{ min} < 80 \text{ min}$

.....

 [8]