

Visit
FREETESTPAPER.com
for more papers



Website: freetestpaper.com



[Facebook.com/freetestpaper](https://www.facebook.com/freetestpaper)



[Twitter.com/freetestpaper](https://www.twitter.com/freetestpaper)



CREST SECONDARY SCHOOL
SECONDARY FOUR
PRELIMINARY EXAMINATION

NA

Name: _____ () Class: _____

MATHEMATICS (SYLLABUS A)

4045/01

Paper 1

Wednesday 14 August 2024

2 hours

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your class, index number and name on all 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 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 in the space below the question.

Omission of essential working will result in loss of marks.

The total number of marks for this paper is 70.

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

70

This document consists of **15** printed pages and **1** blank page.

Setter: Ms Liew Jia Meng

[Turn over

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

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

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

Statistic

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

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

Answer **all** questions.

1 Write 0.002195

(a) correct to 3 significant figures,

Answer [1]

(b) in standard form.

Answer [1]

2 Given that $2^5 \times 32 = 2^x$, find x .

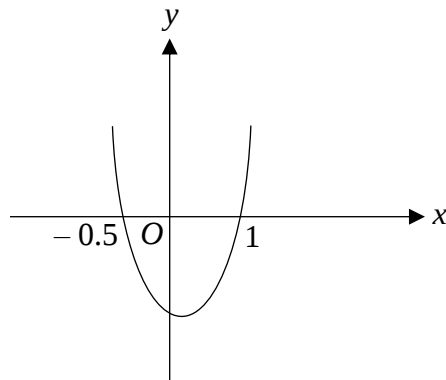
Answer $x =$ [2]

3 Find the largest integer y satisfying $-3y > 15$.

Answer $y =$ [2]

[Turn over

- 4 The diagram shows the sketch of $y = ax^2 + bx + c$.



- (a) State the value of a .

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

- (b) Write down the equation of the line of symmetry.

Answer $\dots\dots\dots$ [1]

- 5 In a sale, the price of a 10 kg sack of rice is reduced from \$35.90 to \$29.90.
Calculate the percentage decrease.

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

- 6 Find the length of the straight line joining $(0, 6)$ and $(4, -2)$.

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

- 7 (a) Express 3780 in index notation.

Answer [1]

- (b) Hence, find the smallest value of m such that $3780m$ is a perfect cube.

Answer [1]

- 8 Three trains leave the depot every 3, 5 and 9 minutes respectively.
Given that the three trains left the depot at 07 30 at the same time, find the next time that they will leave the depot together again.

Answer [2]

[Turn over

- 9 Solve these simultaneous equations.

$$5x - 2y = 19$$

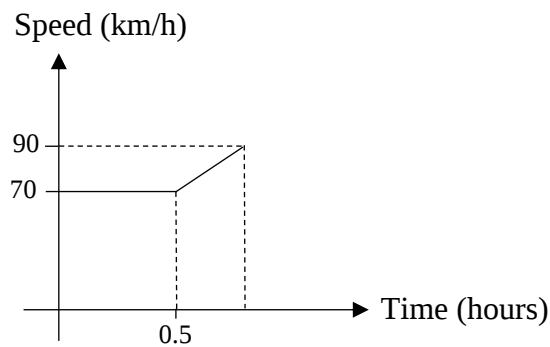
$$x + 3y = -3$$

Show your working.

Answer $x = \dots\dots\dots$

$y = \dots\dots\dots$ [3]

10



The diagram shows the speed-time graph of a car for part of a journey. It moves at a constant speed of 70 km/h for a duration of 0.5 hour before accelerating to 90 km/h in the next t hours.

Give that the distance travelled is 51 km, find the total time taken for this part of the journey.

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

11 A map is drawn to a scale of 1 : 35 000.

- (a)** Two schools are 20 cm apart on the map.
Find the actual distance between the two schools, in kilometres.

Answer km [1]

- (b)** A town has an area of 2.1 km².
Find the area of the town on the map.

Answer cm² [2]

12 Solve $\frac{7-5x}{3-2x} = x+1$.

Answer $x =$ [3]

[Turn over

- 13** In a science experiment, the growth rate R of a bacteria is inversely proportional to the square of the concentration of nutrient C .

(a) Given that $R = 10$ units when $C = 0.5$ units, write a formula for R in terms of C .

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

(b) Find C when $R = 40$.

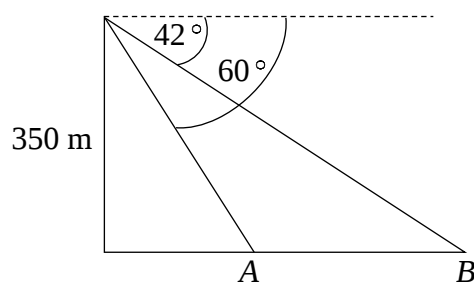
Answer $C = \dots\dots\dots$ [1]

- 14** Elliot invested a sum of money in a bank that paid compound interest at 6% per annum. At the end of 2 years, he had a total of \$1685.40.

What was his initial sum of investment?

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

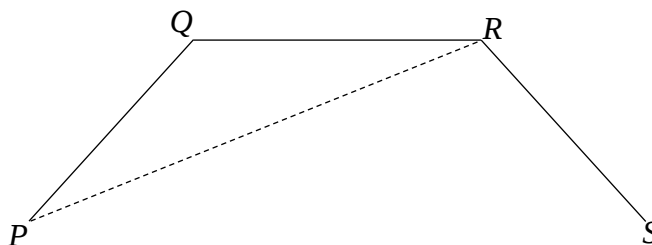
- 15 From the top of a cliff standing at 350 m high, Ted observes two boats, A and B whose angles of depression are 60° and 42° respectively.



Find the distance between the two boats.

Answer m [3]

- 16 The diagram shows part of an 8-sided regular polygon.



Calculate

- (a) angle PQR ,

Answer [1]

- (b) angle QPR ,

Answer [1]

- (c) the exterior angle of the polygon.

Answer [1]

- 17 The ages of the members in a country club, in years, are shown in the stem-and-leaf diagram below.

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

Key: 2 | 1 represents 21 years old

- (a) How many members are there?

Answer [1]

- (b) Calculate the percentage of the members who are at least 50 years old.

Answer % [1]

- (c) In the club, members who are under the age of 40 are categorised under the Junior membership.

Find the probability of members who are not under the Junior membership.

Answer [1]

18 Jen exchanges 750 dollars (\$) for 89 250 Japanese Yen (¥).

(a) Complete the exchange rate.

Answer \$1 = ¥ [1]

(b) A luggage costs \$349 in Singapore.
An identical luggage costs 33 201 ¥ in Japan.

Jen says that it is cheaper to buy the luggage in Singapore.
Do you agree? Explain your answer.

Answer
..... [3]

19 A box contains apples, pears and oranges.
The ratio of apples to pears is 5 : 4.
The ratio of pears to oranges is 6 : 1.

(a) Find the ratio of apples to pears to oranges. Give your answer in its simplest form.

Answer : : [2]

(b) The box contains 6 oranges. Find the total number of fruits.

Answer [2]

20

$$x^2 + 4x + 3 = (x + a)^2 + b$$

- (a) Find the value of a and the value of b .

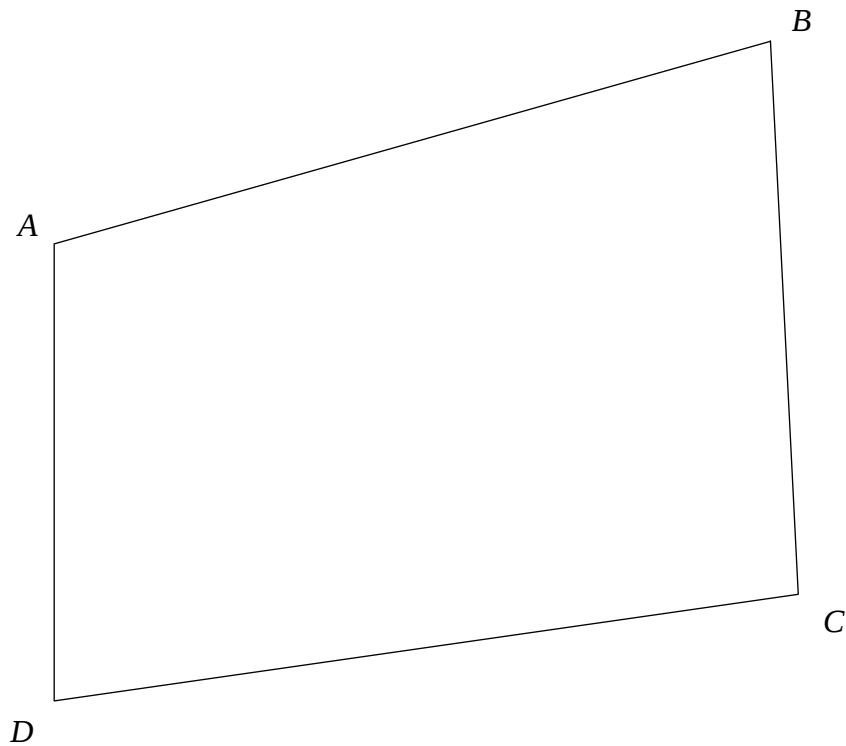
Answer $a = \dots\dots\dots$

$b = \dots\dots\dots$ [2]

- (b) Hence, solve $x^2 + 4x + 3 = 0$.

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

- 21 The diagram shows a quadrilateral $ABCD$.



- (a) Construct the perpendicular bisector of AB . [1]
- (b) The point P lies on the perpendicular bisector of AB . It is also on the bisector of angle BCD . Use construction to find this point and label it P . [2]
- (c) Measure angle APB .

Answer [1]

- 22 The table below shows the distance of students' residential places from the school.

Distance (km)	1	2	3	4	5
Frequency	3	10	8	x	4

- (a) If the mode is 2, find the largest possible value of x .

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

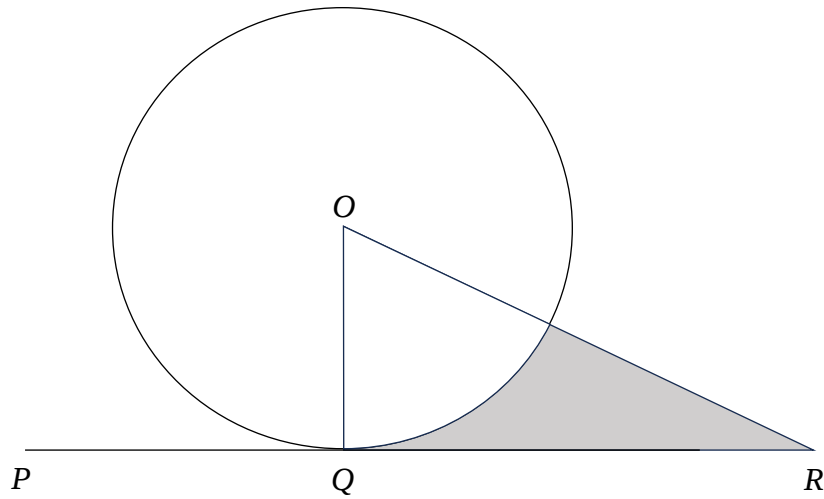
- (b) If the median is 3, find the smallest possible value of x .

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

- (c) If the mean is 3, find the value of x .

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

- 23 The radius of a circle, centre O , is 5 cm. PR is a straight line and is tangent to the circle at point Q .



Given that $OR = 13$ cm,

- (a) show that angle $QOR = 1.18$ radians.

[2]

Answer

- (b) Calculate the perimeter of the shaded region.

Answer cm [3]

- (c) Calculate the area of the shaded region.

Answer cm^2 [2]

BLANK PAGE

2024 4NA Mathematics Prelim Paper 1

Marking Scheme

Qns	Workings	Mark Allocation
1a	0.00220	B1
1b	2.195×10^{-3}	B1
2	$2^5 \times 32 = 2^x$ $2^5 \times 2^5 = 2^x$ $5 + 5 = x$ $x = 10$	M1 convert $32 = 2^5$ A1
3	$-3y > 15$ $y < \frac{15}{-3}$ $y < -5$ Largest integer: $y = -6$	M1 A1
4a	$y = (2x + 1)(x - 1)$ $y = 2x^2 - x - 1$ $a = 2$	B1
4b	$\frac{-0.5+1}{2} = 0.25$ $x = 0.25$	B1
5	$\$35.90 - \$29.90 = \$6$ $\frac{6}{35.90} \times 100\%$ $= 16.7130919\%$ $= 16.7\%$	M1 A1 Accept $16\frac{256}{359}\%$
6	$\sqrt{(4-0)^2 + (-2-6)^2}$ $= 8.94427191$ $= 8.94$	M1 A1
7a	$3780 = 2^2 \times 3^3 \times 5 \times 7$	B1
7b	$3780m = 2^2 \times 3^3 \times 5 \times 7 \times m$ $m = 2 \times 5^2 \times 7^2$ $m = 2450$	B1
8	$LCM = 3^2 \times 5$ $LCM = 45$ After 45 minutes, the next timing will be 0815.	M1 A1

9	$5x - 2y = 19$ ----- (1) $x + 3y = -3$ ----- (2) (2) $\times 5$: $5x + 15y = -15$ ----- (3) (3) $-$ (1) $(5x + 15y) - (5x - 2y) = -15 - 19$ $17y = -34$ $y = -2$ $x + 3(-2) = -3$ $x - 6 = -3$ $x = 3$	M1 Substitution/Elimination B1 B1
10	$70 \times 0.5 + \frac{1}{2}(70 + 90)(t) = 51$ $35 + 80(t) = 51$ $80(t) = 16$ $t = 0.2$ $0.2 + 0.5 = 0.7$	M1 M1 A1
11a	$1:35000$ $20:700000$ $\frac{700000}{100000} = 7 \text{ km}$	B1
11b	$1 \text{ cm} : 0.35 \text{ km}$ $1 \text{ cm}^2 : 0.1225 \text{ km}^2$ $\frac{2.1}{0.1225} = 17.142857 = 17.1 \text{ cm}^2$ or $17\frac{1}{7} \text{ cm}^2$	M1 A1
12	$7 - 5x = (x + 1)(3 - 2x)$ $7 - 5x = 3x - 2x^2 + 3 - 2x$ $2x^2 - 6x + 4 = 0$ $(2x - 2)(x - 2) = 0$ $2x - 2 = 0$ OR $x - 2 = 0$ $x = 1$ OR $x = 2$	M1 expansion M1 factorise A1

13a	$R = \frac{k}{C^2}$ $10 = \frac{k}{(0.5)^2}$ $k = 2.5$ $R = \frac{2.5}{C^2}$	M1 A1
13b	$R = \frac{2.5}{C^2}$ $40 = \frac{2.5}{C^2}$ $C^2 = \frac{2.5}{40}$ $C^2 = 0.0625 / \frac{1}{16}$ $C = 0.25 / \frac{1}{4}$	B1
14	$P \left(1 + \frac{r}{100} \right)^n = 1685.40$ $P \left(1 + \frac{6}{100} \right)^2 = 1685.40$ $P(1.1236) = 1685.40$ $P = \frac{1685.40}{1.1236}$ $P = 1500$	M1 M1 A1
15	Let x m be the distance from cliff to A and y m be the distance from cliff to B. $\tan 60^\circ = \frac{350}{x}$ $x = \frac{350}{\tan 60^\circ}$ $x = 202.0725942$ $\tan 42^\circ = \frac{350}{y}$ $y = \frac{350}{\tan 42^\circ}$ $y = 388.7143802$ $388.7143802 - 202.0725942$ $= 186.641786$	M1 tangent M1

	$= 187 \text{ m}$	A1
16a	$\frac{180(8-2)}{8} = 135$	B1
16b	$\frac{180-135}{2} = 22.5$	B1
16c	$\frac{360}{8} = 45$	B1
17a	20 members	B1
17b	35%	B1
17c	$1 - \frac{9}{20} = \frac{11}{20}$	B1
18a	$89250 \div 750 = 119$	B1
18b	$33201 \div 119 = 279$ $349 - 279 = 70$ I do not agree with Jen. The same luggage cost \$70 cheaper (or 8330 ¥ more expensive) in Japan than in Singapore.	M1 ecf/convert \$349 to JPY M1 difference A1 disagree
19a	$5 : 4 = 15 : 12$ $6 : 1 = 12 : 2$ $15 : 12 : 2$	M1 for either ratio A1
19b	$\frac{6}{2} \times 29 = 87$	M1 for 1 unit – 3 A1
20a	$x^2 + 4x + 3 = (x+2)^2 - 2^2 + 3$ $x^2 + 4x + 3 = (x+2)^2 - 1$ $a = 2, b = -1$	B1 each
20b	$x^2 + 4x + 3 = 0$ $(x+2)^2 - 1 = 0$ $(x+2)^2 = 1$ $x+2 = 1 \quad \text{or} \quad x+2 = -1$ $x = -1 \quad \text{or} \quad x = -3$	M1 A1
22a	9	B1
22b	$3 + 10 - 7 - 4 = 2$	B1
22c	$\frac{1(3) + 2(10) + 3(8) + 4(x) + 5(4)}{3+10+8+x+4} = 3$ $\frac{67+4x}{25+x} = 3$ $67+4x = 75+3x$ $x = 75-67$ $x = 8$	M1 A1

23a	$\cos \angle QOR = \frac{5}{13}$ $\angle QOR = \cos^{-1} \frac{5}{13}$ $\angle QOR = 1.176005207$ $\angle QOR = 1.18 \text{ rad}$	M1 A1
23b	$QR^2 = OR^2 - OQ^2$ $QR^2 = 13^2 - 5^2$ $QR = 12$ Arc length = $(5)(1.176005207)$ $= 5.880026035$ Perimeter = $12 + 5.880026035 + (13 - 5)$ $= 25.88002604$ $= 25.9 \text{ cm}$	M1 Pythagoras M1 Accept $(5)(1.18) = 5.9$ A1
23c	Area of triangle QOR $= \frac{1}{2}(12)(5)$ $= 30$ Sector area $= \frac{1}{2}(5)^2 (1.176005207)$ $= 14.70006509$ Area of shaded region $= 30 - 14.70006509$ $= 15.29993491$ $= 15.3 \text{ cm}^2$	M1 Sector Area A1



CREST SECONDARY SCHOOL
SECONDARY FOUR
PRELIMINARY EXAMINATION

NA

Name: _____ () Class: _____

MATHEMATICS (SYLLABUS A)

4045/02

Paper 2

Thursday 15 August 2024

2 hours

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your class, index number and name on all 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 staples, paper clips, glue or correction fluid.

Section A

Answer **all** the questions.

Section B

Answer **one** question.

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 in the space below the question.

Omission of essential working will result in loss of marks.

The total number of marks for this paper is 70.

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

70

This document consists of **19** printed pages and **1** blank page.

Setter: Ms Liew Jia Meng

[Turn over

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

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

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

Statistic

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

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

Section A (62 marks)Answer **all** the questions in this section.

1 Calculate the value of $\frac{\sqrt{(-4)^2 + 3^3 \times 2}}{5}$.

Answer [1]

2 Simplify $\frac{3mn}{14n^2} \div \frac{12m^2n}{7n}$.

Answer [2]

3 Factorise.
(a) $16x^2 - 49$

Answer [1]

(b) $12ab - 16bc + 3a - 4c$

Answer [2]

[Turn over

- 4 The height of Mount Everest is 8 848m. On a particular day, the temperature at Mount Everest base camp was 5°C and the temperature at the summit was -20°C .

(a) Find the difference in temperature between the base camp and summit within a day.

Answer $^{\circ}\text{C}$ [1]

(b) What is the rate of temperature change?

Answer $^{\circ}\text{C/m}$ [2]

- 5 Stacey operates a home-based bakery, specialising in madeleines. She recorded the number of madeleines sold each day in the month of January. The results are shown in the table.

Number of madeleines sold, x	Frequency
$0 \leq x < 20$	2
$20 \leq x < 30$	11
$30 \leq x < 40$	9
$40 \leq x < 50$	6
$50 \leq x < 80$	3

(a) Calculate an estimate for the mean and the standard deviation.

(i) Mean

Answer Mean = [1]

(ii) Standard Deviation

Answer Standard deviation = [2]

(b) Stacey forgot to include a corporate order in her table. The order was for 60 madeleines. She expected the estimated mean to increase after she updated the table to include this order. Explain whether Stacey is correct.

Answer
 [1]

- 6 These are the first five terms of a sequence.

28 24 20 16 12

- (a) Find the next two terms of the sequence.

Answer , [1]

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

Answer [1]

- (c) Donovan says that -42 is a term in this sequence. Is he correct?
Show your working.

Answer

[2]

- 7 There are 12 pink, 7 purple and 1 white ball in a bag.
2 balls are drawn at random, without replacement.

Find the probability that

- (a) the 2 pink balls are drawn,

Answer [1]

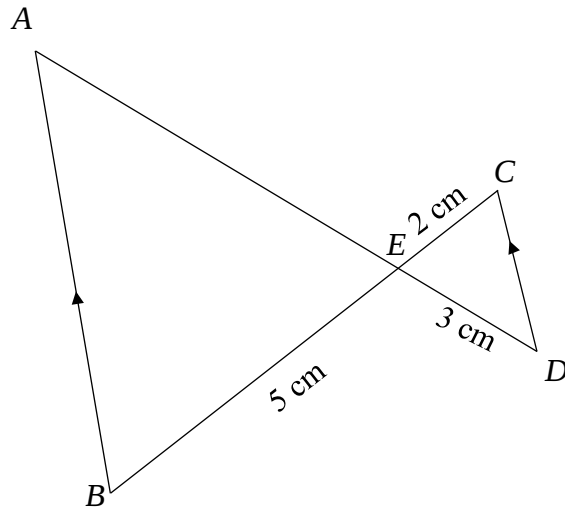
- (b) exactly 1 purple ball is drawn,

Answer [2]

- (c) none of them is white.

Answer [2]

8



AB is parallel to CD .

E is on BC such that $BE = 5$ cm, $CE = 2$ cm, and $DE = 3$ cm.

- (a) Name a pair of similar triangles and explain your reasons for the similarity.

Answer Triangles and are similar because

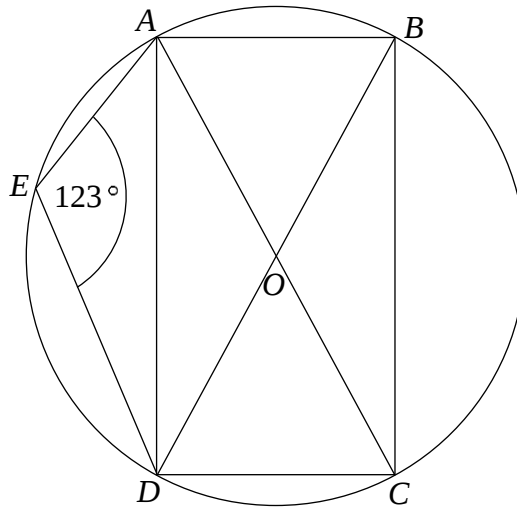
.....

[2]

- (b) Find the length of AD .

Answer cm [3]

[Turn over]



A, B, C, D and E lie on a circle, centre O .
 Angle $AED = 123^\circ$.

Find

(a) Angle ABD

Answer Angle $ABD = \dots\dots\dots$ Reason $\dots\dots\dots$

$\dots\dots\dots$ [2]

(b) Angle CBD

Answer Angle $CBD = \dots\dots\dots$ Reason $\dots\dots\dots$

$\dots\dots\dots$ [2]

(c) Angle CAD

Answer Angle $CAD = \dots\dots\dots$ Reason $\dots\dots\dots$

$\dots\dots\dots$ [2]

- 10** The table below is for $y = 2^x$.

x	-1.5	-1	-0.5	0	0.5	1	1.5	2
y	0.35		0.71	1	1.41	2	2.83	4

- (a)** Complete the table. [1]

- (b)** Draw the graph of $y = 2^x$ for $-1.5 \leq x \leq 2$, on the graph provided behind. [2]

- (c)** Is it possible to find a value of x when $y = 0$? Explain your answer.

Answer

.....

..... [1]

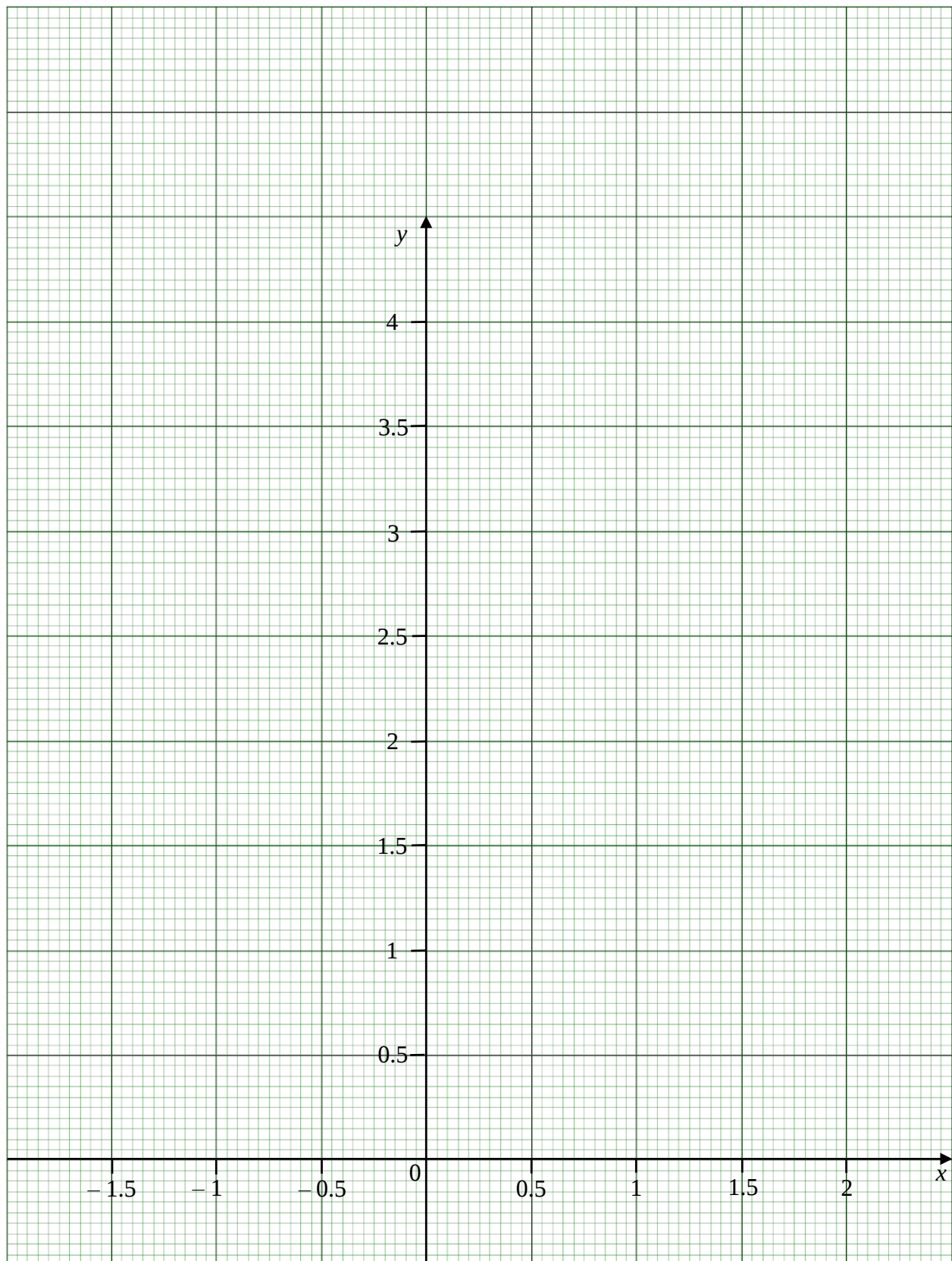
- (d)** Use your graph to find the value of x when $y = 3.5$.

Answer $x =$ [1]

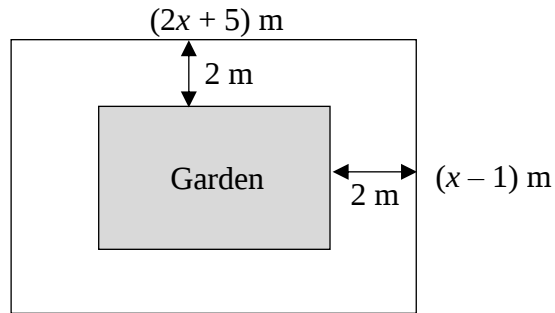
- (e)** By drawing a suitable tangent, find the gradient of the curve when $x = -0.5$.

Answer [2]

[Turn over]



- 11** A rectangular plot of land measures $(2x+5)$ m by $(x-1)$ m.
A path of 2 m wide runs around the perimeter of a garden.



The area of the garden is 110 m^2 .

- (a)** Write an equation, in terms of x , for the area of garden.
Show that it reduces to $2x^2 - 9x - 115 = 0$.

Answer

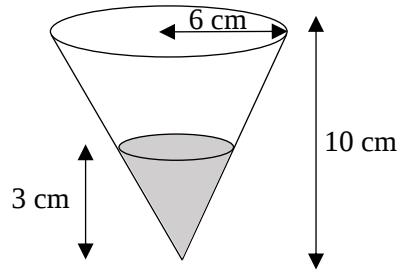
[3]

- (b)** Solve the equation $2x^2 - 9x - 115 = 0$ and hence, find the length and breadth of the garden.

Answer Length = m

Breadth = m [4]

12



The diagram shows an upright conical container of radius 6 cm and height 10 cm, filled with water to a height of 3 cm.

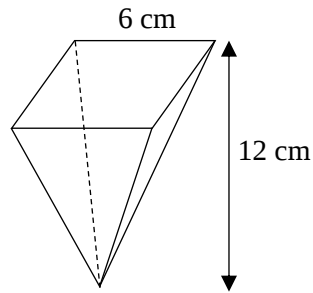
- (a) Find the radius of the water in the container.

Answer cm [2]

- (b) Find the surface area of container in contact with the water.

Answer cm^2 [3]

- (c) The water in the conical container was poured into a square-based pyramid container with length 6 cm and height 12 cm.



Given that the water was filled to a certain height in the container, find the volume of square-based pyramid, not filled by water.

Answer cm^3 [3]

[Turn over

- 13 The Central Provident Fund Board (CPF Board) in Singapore manages a compulsory saving scheme for all employees to provide financial security to individuals in their retirement years. Both employer and employee contribute a portion of the employee's salary to this fund.

The table below shows the current CPF contribution rates for Singaporeans and Singapore Permanent Residents (SPRs) across the different age groups.

Employee's age (years)	Contribution rates from 1 January 2024 (monthly wages > \$750)		
	By employer (% of wage)	By employee (% of wage)	Total (% of wage)
55 and below	17	20	37
Above 55 to 60	15	16	31
Above 60 to 65	11.5	10.5	22
Above 65 to 70	9	7.5	16.5
Above 70	7.5	5	12.5

**Image obtained from Central Provident Fund Board (<https://www.cpf.gov.sg/>)*

- (a) Alex starts working at age 25 and earns a monthly wage of \$4,000. Calculate the **total** CPF contribution, made by both Alex and his employer, in the **first** year.

Answer \$ [2]

- (b) He receives a 10% increment in his monthly wage every year. Considering the CPF contribution rate for his age group, calculate the total CPF savings after working for 3 full years.

Answer \$ [3]

[Turn over]

- (c) After 3 years of employment, Alex is keen to purchase a property and below are the prices.

3-room resale flat	3-bedder condominium
\$350 000	\$1 500 000

Given that Alex must have sufficient CPF savings to cover the 5% down payment for the property purchase, suggest which property would be a better choice for him.

Show your workings clearly.

[2]

Answer

.....

.....

.....

.....

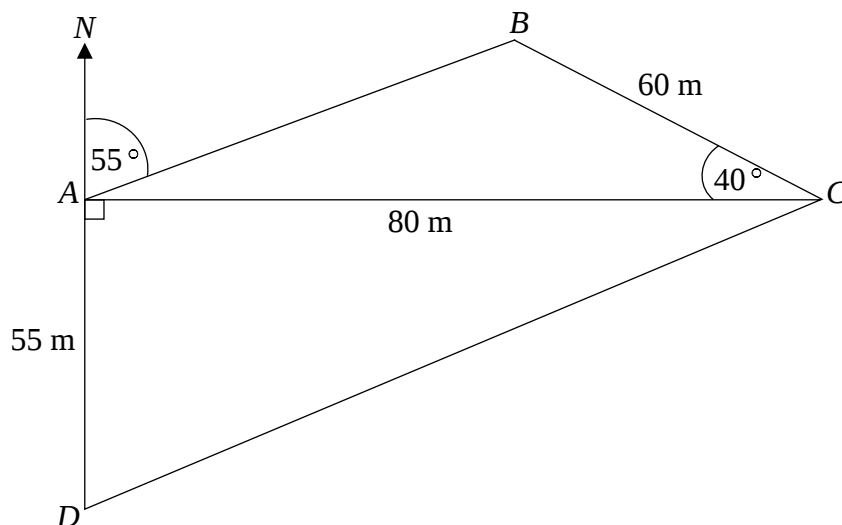
.....

BLANK PAGE

Section B (8 marks)

Answer **one** question from this section. Each question carries 8 marks.

- 14** The diagram shows a school field, $ABCD$, on horizontal ground. A is on a bearing of 55° from North, angle $ACB = 40^\circ$, $AC = 80$ m, $AD = 55$ m, and $BC = 60$ m.



- (a)** Find bearing of A from B .

Answer [2]

- (b)** Find the length of AB .

Answer m [2]

[Turn over]

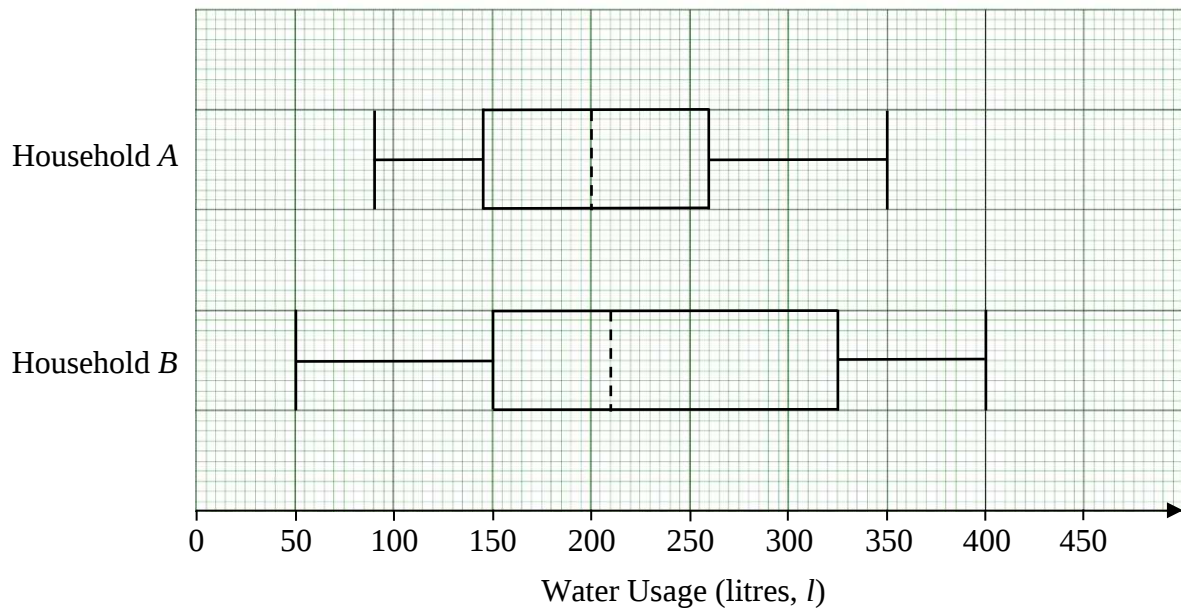
- (c) Calculate the area of the school field, $ABCD$. Round off to 3 significant figures.

Answer m^2 [2]

- (d) A lamppost of height 15 m stood at point D .
Find the angle of elevation from point A to lamppost.

Answer [2]

- 15 The box-and-whisker plots show the average daily water usage, in litres, of two households, *A* and *B*.



- (a) Which household, *A* or *B*, has a higher range of water usage?
Show your workings clearly.

Answer Household [2]

- (b) Use the diagram to estimate the median for household *B*.

Answer [1]

- (c) Use the diagram to estimate the interquartile range for household *B*.

Answer [2]

[Turn over]

- (d) Comparing the daily water usage patterns in both households, which household has a more consistent usage pattern? Explain your answer clearly.

Answer

[1]

- (e) On average, Household A takes about 65 litres of water to wash one load of laundry in a washing machine. Calculate the percentage of daily water usage attributed to laundry.

Answer % [2]

END OF PAPER

2024 4NA Mathematics Prelim **Paper 2**

Marking Scheme

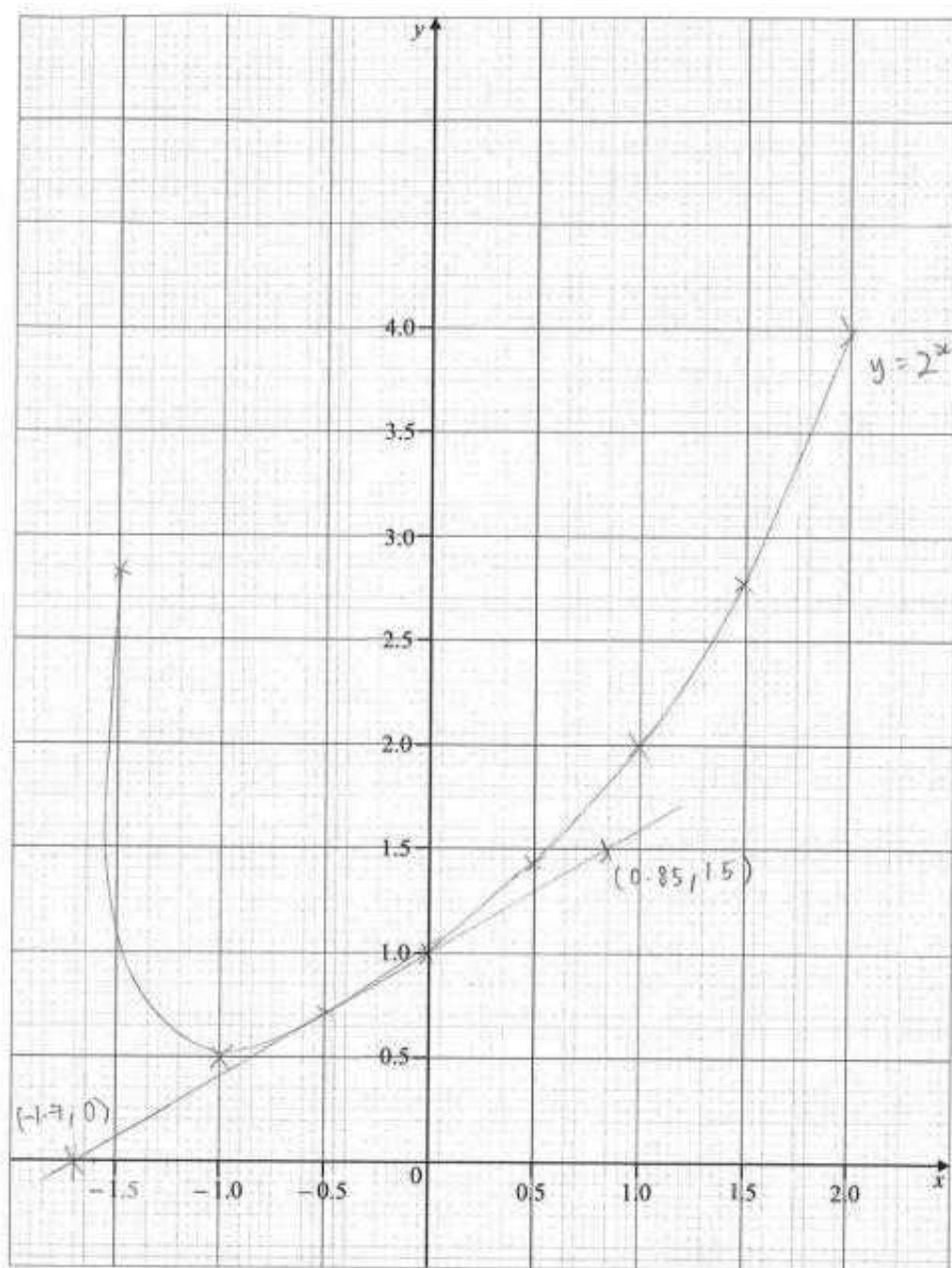
Qns	Workings	Mark Allocation
1	$1.673320053 = 1.67$	B1
2	$\frac{3mn}{14n^2} \div \frac{12m^2n}{7n}$ $= \frac{3mn}{14n^2} \times \frac{7n}{12m^2n}$ $= \frac{1}{8m}$	M1 A1
3a	$16x^2 - 49 = (4x - 7)(4x + 7)$	B1
3b	$12ab - 16bc + 3a - 4c$ $= 4b(3a - 4c) + 3a - 4c$ $= (3a - 4c)(4b + 1)$	M1 common factor A1
4a	$5 - (-20) = 25$	B1
4b	$-25 \div 8848$ $= -0.002825497288$ $= -0.00283$	M1 A1
5a	$\frac{2(10) + 11(25) + 9(35) + 6(45) + 3(65)}{31}$ $= 34.67741935$ $= 34.7 / \frac{1075}{31}$ $\sqrt{\frac{2(10)^2 + 11(25)^2 + 9(35)^2 + 6(45)^2 + 3(65)^2}{31} - \left(\frac{1075}{31}\right)^2}$ $= 13.49644421$ $= 13.5$	B1 Mean M1 A1 S.D
5b	She is correct as the corporate order of 60 madeleines is greater than the estimated mean, hence including this value in the calculation will increase the estimated mean.	B1
6a	8, 4	B1
6b	$28 - 4(n - 1)$ $= 28 - 4n + 4$ $= 32 - 4n$	B1

6c	$32 - 4n = -42$ $4n = 32 + 42$ $4n = 74$ $n = \frac{74}{4}$ $n = 18\frac{1}{2}$ Donovan is incorrect. As <u>n is not an integer</u> , -42 is not a term in the sequence.	M1 A1
7a	$\frac{12}{20} \times \frac{11}{19} = \frac{33}{95}$	B1
7b	$\left(\frac{12}{20} \times \frac{7}{19}\right) + \left(\frac{7}{20} \times \frac{12}{19}\right) + \left(\frac{7}{20} \times \frac{1}{19}\right) + \left(\frac{1}{20} \times \frac{7}{19}\right)$ $= \frac{91}{190}$	M1 A1
7c	$\left(\frac{12}{20} \times \frac{7}{19}\right) + \left(\frac{7}{20} \times \frac{12}{19}\right) + \left(\frac{12}{20} \times \frac{11}{19}\right) + \left(\frac{7}{20} \times \frac{6}{19}\right)$ $= \frac{9}{10}$	M1 A1
8a	Triangles ABE and DCE . Given AB parallel to CD , angle $ABE = DCE$ (alternate angles), angle $BAE =$ angle CDE (alternate angles), and angle $AEB =$ angle DEC . Given that there are at least 2 pair of corresponding angles in both triangles with different corresponding length, triangles ABE and DCE are similar.	B1 B1 for each pair of corresponding angles
8b	$\frac{CE}{BE} = \frac{DE}{AE}$ $\frac{2}{5} = \frac{3}{AE}$ $AE = 7.5$ $AD = 7.5 + 3 = 10.5$	M1 corresponding ratios M1 value of EA A1 value of AD
9a	Angle $ABD = 180^\circ - 123^\circ = 57^\circ$ Reason: angles in opposite segment	B1 value B1 reason
9b	Angle $CBD = 90^\circ - 57^\circ = 33^\circ$ Reason: right angled triangle in semi-circle	B1 value B1 reason
9c	Angle $CAD = 33^\circ$ Reason: angles in same segment	B1 value B1 reason

11a	$(2x+5-4)(x-1-4)=110$ $(2x+1)(x-5)=110$ $2x^2-10x+x-5=110$ $2x^2-9x-5=110$ $2x^2-9x-5-110=0$ $2x^2-9x-115=0$	M1 M1 expansion A1
11b	$2x^2-9x-115=0$ $x = \frac{-(-9) \pm \sqrt{(-9)^2 - 4(2)(-115)}}{2(2)}$ $x = \frac{9 \pm \sqrt{81+920}}{4}$ $x = 10.15964601 \text{ or } -5.65964601(\text{rej})$ $2x+1 = 2(10.15964601)+1 = 21.31929202=21.3$ $(x-5) = 10.15964601-5 = 5.15964601=5.16$	M1 quadratic formula M1 x values B1 B1
12a	$\frac{r}{6} = \frac{3}{10}$ $r = \frac{3}{10} \times 6$ $r = 1.8$	M1 by similarity A1
12b	Slant height of water $= \sqrt{3^2 + 1.8^2} = 3.498571137$ Curved surface area/surface area in contact with water $= \pi(1.8)3.498571137$ $= 19.78395369$ $= 19.8$	M1 slant height/ ecf M1 A1
12c	$\frac{1}{3}\pi(1.8)^2 3 = 10.1787602$ $\frac{1}{3}(6)^2 12 - 10.1787602$ $= 133.821$ $= 134$	M1 vol of water M1 A1
13a	$\frac{37}{100} \times 4000 = 1480$ $1480 \times 12 = 17760$	M1 A1

13b	2nd year/ age 26: $\frac{110}{100} \times 4000 = 4400$ $12 \left(\frac{37}{100} \times 4400 \right) = 19536$ 3rd year/ age 27: $\frac{110}{100} \times 4400 = 4840$ $12 \left(\frac{37}{100} \times 4840 \right) = 21489.60$ Total contribution for 3 years $= 17760 + 19536 + 21489.60$ $= 58,785.60$	M1 Calculate 10% annual increment M1 A1
13c	$\frac{5}{100} \times 350000 = 17500 < 58785.60$ $\frac{5}{100} \times 1500000 = 75000 > 58785.60$ $58785.60 - 17500 = 41285.60$ Since $17500 < 58785.60$, Alex has sufficient CPF savings to cover the down payment for a 3-room resale flat only. Hence, 3 room resale flat is a better choice.	M1 downpayment (ecf) A1
14a	$180^\circ - 55^\circ = 125^\circ$ $360^\circ - 125^\circ = 235^\circ$	M1 A1
14b	$AB^2 = 60^2 + 80^2 - 2(60)(80)\cos 40^\circ$ $AB^2 = 2645.973346$ $AB = 51.43902552$ $AB = 51.4$	M1 A1
14c	$\frac{1}{2}(60)(80)\sin 40^\circ + \frac{1}{2}(55)(80)$ $= 3742.690263$ $= 3740$	M1 Area of triangle A1
14d	$\tan \theta = \frac{15}{55}$ $\theta = \tan^{-1} \frac{15}{55}$ $\theta = 15.2551187$ $\theta = 15.3^\circ$	M1 A1
15a	Household A: $350 - 90 = 260$ Household B: $400 - 50 = 350$ <u>Household B</u> has a higher range.	B1 calculate range B1

15b	210	B1
15c	$325 - 150$ $= 175$	M1 A1
15d	Household <i>A</i> is more consistent in the daily usage of water as the <u>interquartile range is smaller</u> than that of household <i>B</i> .	B1
15e	$\frac{65}{200} \times 100\%$ $= 32.5\%$	M1 A1



(a) $\frac{1}{2} / 0.5$ B1

(b) points plotted correctly B1
smooth curve B1

(c) No real value of x when $y = 0$.

2^x is always positive

(d) 1.8

(e) Draw tangent B1

0.588 B1