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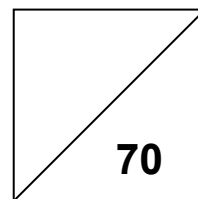
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Name: _____ ()

Class: _____



GREENDALE SECONDARY SCHOOL Preliminary Examination 2023

MATHEMATICS SYLLABUS A

4045/01
Paper 1
14 August 2023
Secondary 4 Normal Academic
2 hours

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

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

Write in dark blue or black pen.

You may use a soft pencil for any diagrams or graphs.

Do not use staples, paper clips, highlighters, 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 may result in loss of marks.

The total of the 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.

Question	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10a	Q10b	Q11	Q12	Q13
Strand														
Marks														

Question	Q14	Q15	Q16a	Q16b	Q17	Q18	Q19	Q20	Q21	Q22	Q23
Strand											
Marks											

This document consists of 19 printed pages.

Mathematical Formulae

Compound interest

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

Mensuration

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

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

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

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

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

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

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

Trigonometry

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

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

Statistics

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

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

Answer **all** the questions.

1 Solve $\frac{3}{5}(x+2) = -(x-1)$.

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

- 2 A 12 m string is cut in the ratio of 4:3:5.
The shortest length is x cm.

Calculate x .

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

- 3 Find the least prime value of y which satisfies $1 - y < -10$.

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

- 4 A red box contains three cards bearing the numbers 1, 2 and 3.
A blue box contains four cards bearing numbers A , B , C and D .
A card is chosen at random from each box.

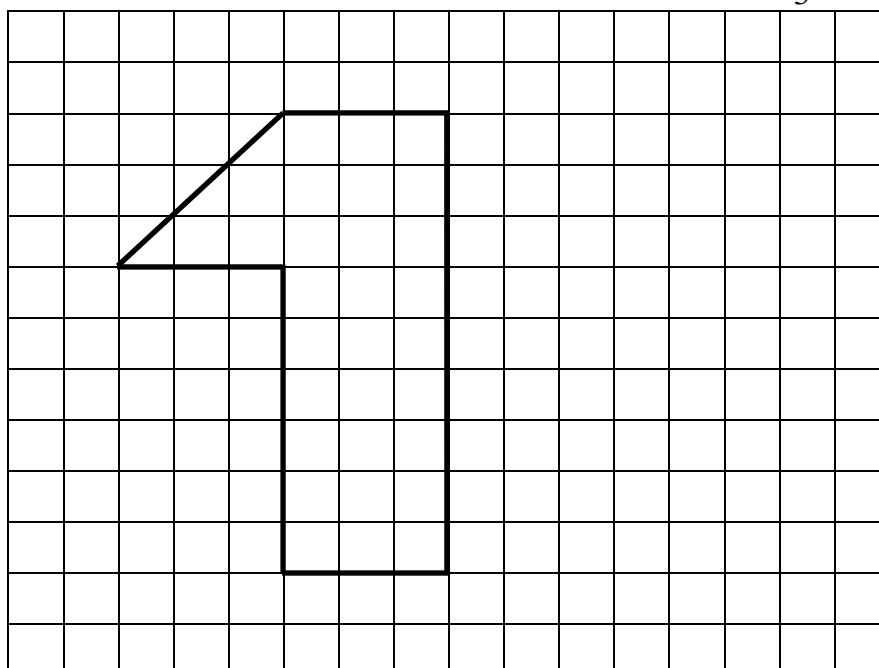
Complete the table to show all possible outcomes. You may not need to use all the rows in the table.

Answer

Red box	Blue box
1	A
1	B

[1]

- 5 Draw a reduction of the figure below using the scale factor of $\frac{1}{3}$.



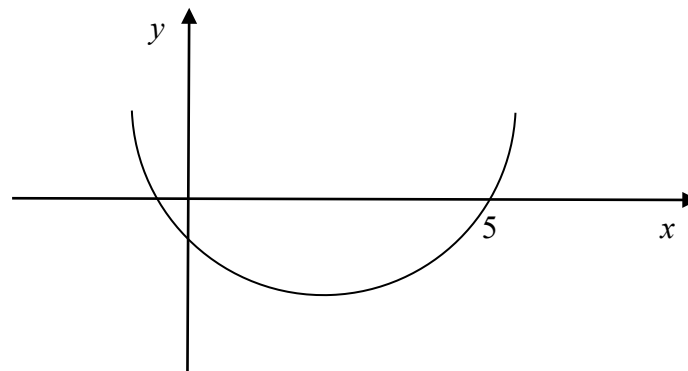
[2]

- 6 Sandy can type 15 characters every 5 seconds using her mobile phone.
How many characters can Sandy type every minute?

Answer [2]

- 7 The diagram below shows the graph of $y = x^2 + bx + c$, where b and c are constants.

$x = 2$ is the line of symmetry and the curve passes through the point $(5, 0)$.



Find the values of b and c .

Answer $b = \dots\dots$, $c = \dots\dots$ [2]

- 8** The height, h cm of a solid is inversely proportional to the square of its base radius, r cm.

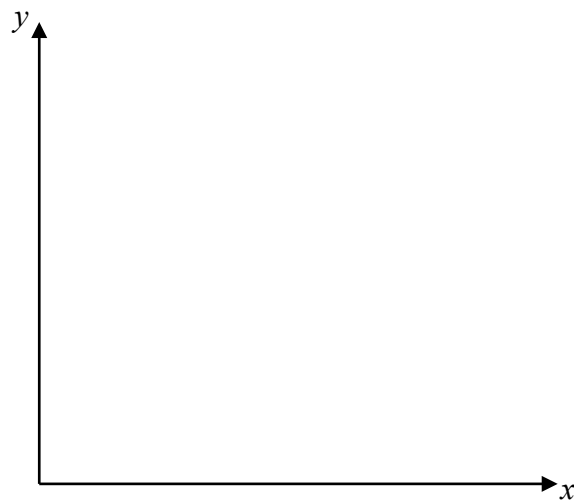
(a) Given that $h = 8$ when $r = 10$, find h when $r = 4$.

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

- (b)** Complete the graph below given that y is directly proportional to x .

Answer

[1]



9 $P = 2 \times 5^3 \times 7$ and $Q = 2 \times 5^a \times 7^2$ where a is an integer greater than 1.

- (a) Find the value of a if the lowest common multiple (LCM) of P and Q is $2 \times 5^4 \times 7^2$.

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

- (b) Find the largest perfect cube that is a factor of both P and Q .

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

-
- 10 (a) $x^2 + 4x - 9 = (x + h)^2 + k$.
Find the values of h and k .

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

- (b) State the y -coordinate of the minimum point of the curve
 $y = x^2 + 4x - 9$.

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

11 **(a)** $x^{-2} \times x^{\frac{1}{3}} = x^n$

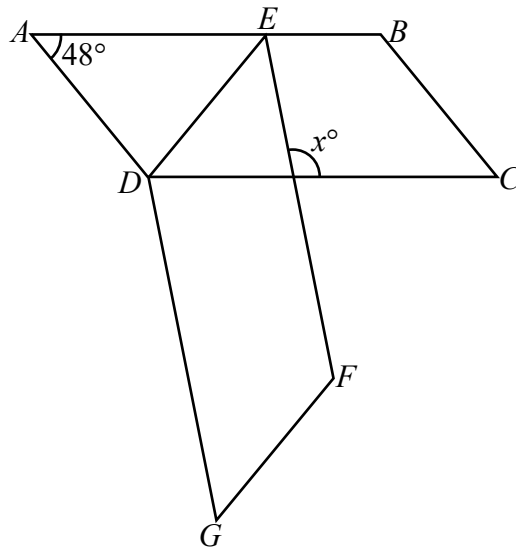
Find the value of n .

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

(b) Simplify $\sqrt{\frac{y^8}{y^2}}$.

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

- 12 $ABCD$ and $EFGD$ are congruent parallelograms, where E is a point on AB .



Find x .

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

13 The first 4 terms of a sequence are

$-17 \quad -11 \quad -5 \quad 1$

(a) Write down, in terms of n , the n^{th} term of the sequence.

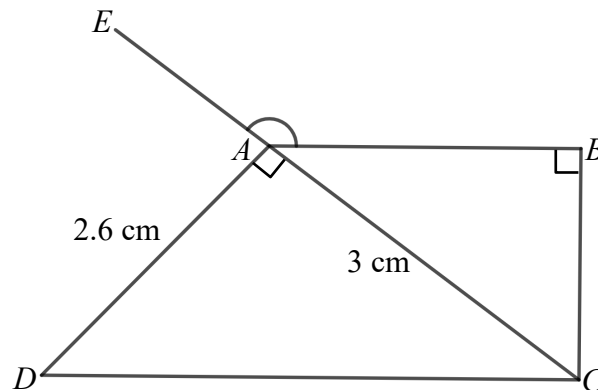
Answer [1]

(b) Find the smallest k value such that the k^{th} term is greater than 50.

Answer $k =$ [1]

14 $ABCD$ is a trapezium.

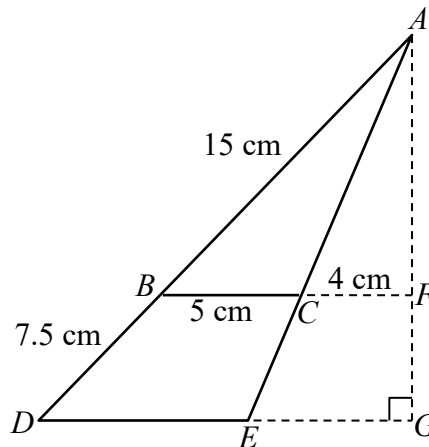
E is produced from the line CA , where $CA = 3$ cm and $DA = 2.6$ cm.



Find obtuse angle EAB .

Answer $^{\circ}$ [3]

- 15** ABC and ADE are similar triangles.
 $AB = 15$ cm, $BD = 7.5$ cm, $BC = 5$ cm and $CF = 4$ cm.



Find the area of triangle ADE .

Answer cm^2 [4]

16 (a) Expand $(2x-3)^2$.

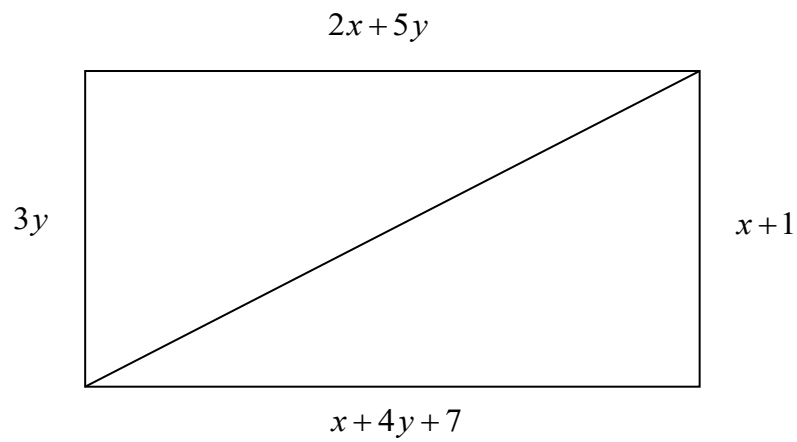
Answer [1]

(b) $1 - \frac{2x}{2x-3} = \frac{ax+b}{(2x-3)^2}$.

Find the values of a and b .

Answer $a = \dots\dots\dots$, $b = \dots\dots\dots$ [2]

- 17 The diagram below shows a rectangle with the dimensions given in terms of x and y .



By first finding the values of x and y , find the length of the diagonal.

Answer [5]

- 18** The table below shows the amount of time spent studying by a group of students in one particular week.

Time (h hours)	Frequency
$0 < h \leq 2$	0
$2 < h \leq 4$	1
$4 < h \leq 6$	4
$6 < h \leq 8$	8
$8 < h \leq 10$	9
$10 < h \leq 12$	2
$12 < h \leq 14$	1

- (a)** Calculate an estimate of the mean time spent studying in that week.

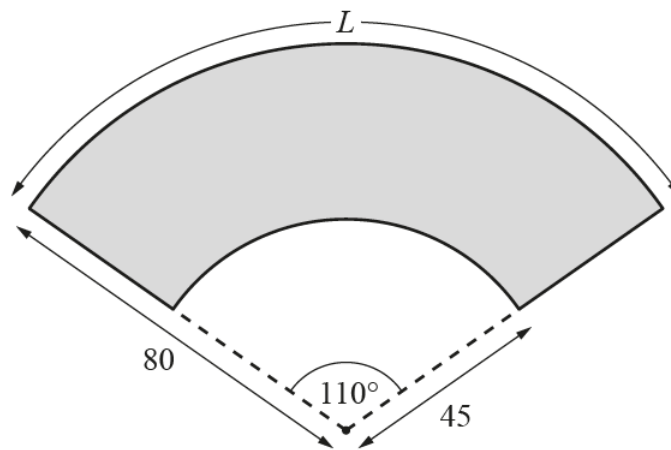
Answerhours [3]

- (b)** Explain why this is only an estimate of the mean time that the students spent studying that week.

Answer

_____ [1]

19



A display notice is made by removing a sector of a circle from a larger sector.
Both sectors have an angle of 110° .
The radii of the sectors are 80 cm and 45 cm.

- (i) Calculate arc length L .

Answer $L = \dots\dots\dots$ cm [2]

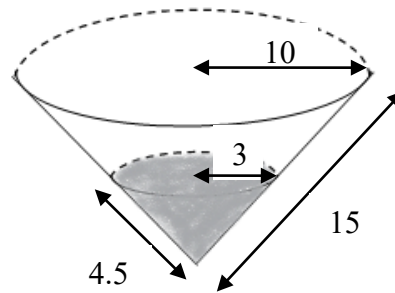
- (ii) Calculate the area of this display notice.

Answer $\dots\dots\dots$ cm² [3]

- 20** Points $A(4, -5)$, $B(-m, 2m)$ and $C(-16, 5)$ lie on a straight line.
Find the value of m .

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

21 (a)



The diagram above shows an inverted cone, with radius 10 cm and slant length 15 cm. Water is poured into the cone such that the slant length is 4.5 cm and the radius of the top circular surface is 3 cm.

Find the curved surface area of the cone that does not touch the water.

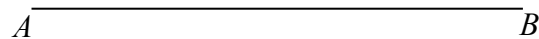
Answer cm^2 [2]

- (b) Another cone, with radius r cm and a vertical height h cm, has the same volume of a sphere with radius r cm. Find h in terms of r .

Answer $h =$ [2]

22 ABC is a triangle with angle $CAB = 98^\circ$ and $BC = 9.8$ cm.

- (a) Construct triangle ABC .
 AB had been drawn for you.



[2]

- (b) Construct the bisector of angle CAB .

[1]

- (c) Shade the area within triangle ABC , 2 cm from A and nearer to AB than CA .

[2]

23

Ticket Type (Local Resident)	Soft Opening (For visit from 8 – 26 May 2023)	For visit on/after 27 May 2023
Adult	\$34.20	\$43.20
Child Ages 3 to 12	\$20.70	\$29.70
Senior Citizen Ages 60 and above	\$20.00	\$20.00

*Local Residents can enjoy 20% off total cost with WildPass.

The table shows the cost of tickets for the Mandai Bird Paradise.

- (a) Mr and Mrs Tan buy 2 adults and 2 children tickets for the Mandai Bird Paradise on 20 May 2023.

Find the total cost of the 4 tickets.

Answer \$ [2]

- (b) Mr Lim who is a WildPass holder decides to visit Mandai Bird Paradise with his 56 years old mother and 60 years old father on 1 June 2023.

Find the total cost Mr Lim pays for the tickets.

Answer \$ [3]

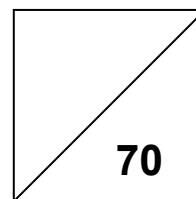
- (c) Calculate the percentage increase on an adult ticket after the soft opening period.

Answer% [1]

END OF PAPER

Name: _____ ()

Class: _____



GREENDALE SECONDARY SCHOOL Preliminary Examination 2023

Mathematics Syllabus A

4045/02

Paper 2

15 August 2023

Secondary 4 Normal Academic

2 hours

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your index number and name in the spaces 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.

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.

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Omission of essential working will result in loss of marks.

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 For π , use either your calculator value or 3.142.

Qn	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9a,b	Q9c	Q10	Q11 a	Q11 b	Q12
Strand														
Marks														

Mathematical Formulae

Compound interest

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

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

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

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Statistics

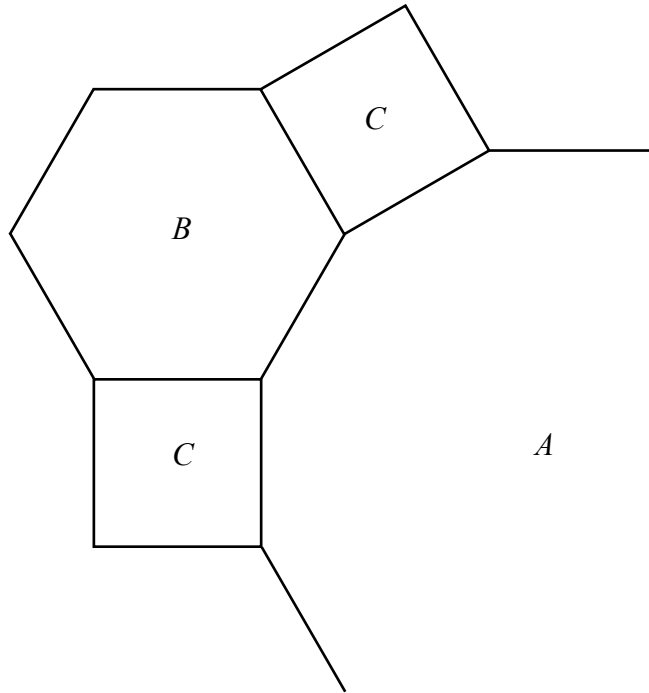
$$\text{Mean} = \frac{\sum fx}{\sum f}$$

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

Section A (62 marks)

Answer **all** questions in this section.

- 1** The diagram shows part of a n -sided regular polygon A .
 B is a regular hexagon and C is a square.



Find n .

Answer $n = \dots\dots\dots$ [4]

- 2 The heights of a group of 14 students were measured.
The results are shown in the stem-and-leaf diagram.

15		6				
16		0	2	4	7	8
17		1	2	2	4	8
18		1	3			
19		0				

Key 16|2 means 162 cm

- (a) Find the
(i) range of the heights,

Answercm [1]

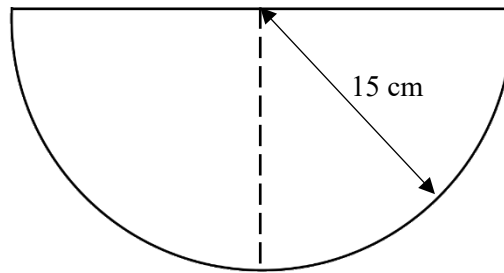
- (ii) median height.

Answercm [1]

- (b) A new student, John, joined the group and his height was measured and added to the data.
As a result, his height would increase the range by 1 cm but decrease the median.
What is John's height?

Answercm [1]

3



The diagram shows the cross-section of a hemispherical bowl of radius 15 cm with a divider in the middle. Water is poured into the left side of the bowl so that only half of the hemispherical bowl is completely filled with water.

Find the area of the water in contact with the bowl and the divider.

Answer cm^2 [4]

- 4 (a) Calculate $\sqrt{(-6)^2 + 4(-7)^2}$.

Answer [1]

- (b) Write the following numbers in order of size, largest first.

$$-3.\dot{2}, \quad \frac{22}{7}, \quad -\pi, \quad 3.142$$

Answer , , , [2]
largest smallest

- (c) The Mariana ocean trench, the world's deepest ocean trench, has an approximate depth of 10 994 m, while the Hikurangi ocean trench has an approximate depth of 3 750 m.

- (i) Write 10 994 in standard form.

Answer [1]

- (ii) Find the difference in depth between the two ocean trenches.
Give your answer in standard form.

Answer m [2]

5 (a) Map A is drawn to a scale of 1 : 200 000 .

(i) The length of a cycling path measures 3.5 km.

Calculate the length of the cycling path on the map in centimetres.

Answer cm [2]

(ii) The area of a forest measures 8 cm² on the map.

Calculate the actual area of the forest in square kilometres.

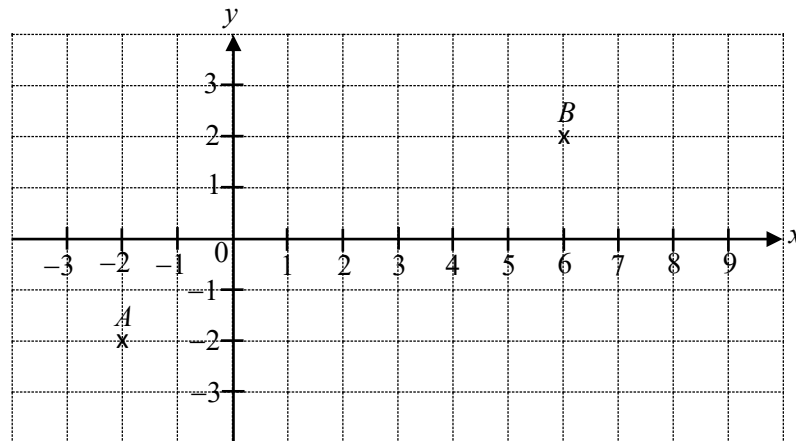
Answer km² [3]

(b) The actual distance representing a length on the map is 20% shorter on Map B .

State the map scale of Map B in terms 1 : n .

Answer 1: [1]

- 6 A is the point $(-2, -2)$ and B is the point $(6, 2)$.



- (a) Find the equation of the line AB .

Answer [1]

- (b) Draw the line $y = 3$.

[1]

- (c) X is the point of intersection of the line AB and $y = 3$.

- (i) Write down the coordinates of X .

Answer (.....,) [1]

- (ii) Calculate the length of AX .

Answer $AX =$ units [1]

- (d) C is the point $(8, -2)$.

$ABCD$ is a rectangle.

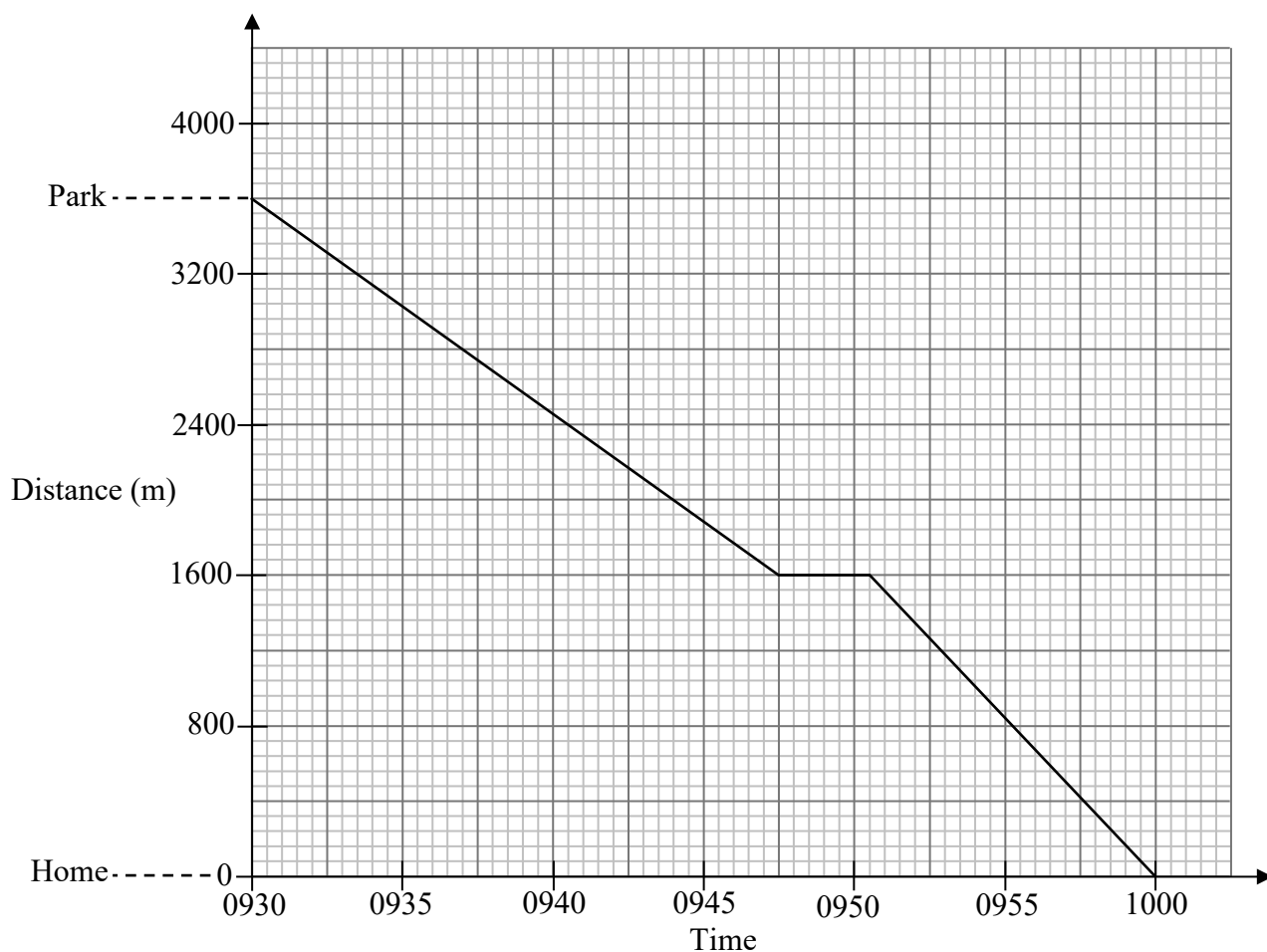
- (i) Find the coordinates of D .

Answer (.....,) [1]

- (ii) Calculate the area of $ABCD$.

Answer square units [1]

- 7 Lim runs from the park back home.
The distance-time graph shows his journey.



He met a friend on his way home and stopped to talk.

- (a) Find the number of minutes he stopped for.

Answer minutes [1]

- (b) Find the average speed of Lim for his whole journey in km/h.

Answer km/h [3]

- (c) Lim's brother, Mark, leaves home at 0934 and runs at a constant speed to the park.
He takes 25 minutes to reach the park.

Complete the grid to show Mark's journey.

[1]

- (d) Find the distance Mark is away **from the park** when he passes Lim.

Answer m [1]

- 8 (a) Complete the table of values of $y = 3 + \frac{2}{x}$.

x	0.5	1	1.5	2	2.5	3	3.5	4
y	7	5	4.3	4		3.7	3.6	

[2]

- (b) On the grid, plot the graph of $y = 3 + \frac{2}{x}$ for $0.5 \leq x \leq 4$.



[3]

- (c) Use the graph to find the value of x when $y = 5.6$.

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

- (d) Draw the tangent to the curve at $x = 1$ to find the gradient of the curve at that point.

Answer [2]

- (e) Explain why the graph $y = 3 + \frac{2}{x}$ has no y -intercept.

Answer

[1]

- 9 (a) It is given $h = \frac{2a}{m + n^2}$.

Find the value of h when $a = 0.5$, $m = -0.238$, $n = -1.1$.

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

- (b) Rearrange $h = \frac{2a}{m + n^2}$ to make n the subject.

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

- (c) Solve $x(2x+1) = 5$.

Answer $\dots\dots\dots$ [4]

- 10 Every household in Singapore was given a free home recycling box, known as a Bloobox as shown in Figure 1, in April this year. The initiative by the National Environment Agency (NEA) aims to encourage every household to set up a home recycling corner and start the habit of recycling at home.



Figure 1

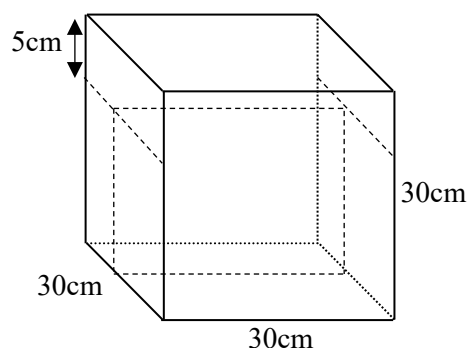


Figure 2

Credits: <https://sg.news.yahoo.com/singapore-household-free-bloobox-recycling-041953957.html>

The Bloobox can be modelled after a cube with 30 cm side shown in Figure 2. There is a divider that separates the box into two compartments so that user can further sort their recyclables.

- (a) (i) Calculate the total volume of one Bloobox.

Answer cm^3 [2]

- (ii) Assuming that the thickness of the plastic is negligible, calculate the total area of plastic needed to manufacture one Bloobox including the divider that separates the box.

Answer cm^2 [2]

Bloobins are placed around the estate for households to deposit their recyclables.

There are two types of Bloobins available for John, the block manager, to decide which type is more suitable for his block.

There are 16 storeys in his block and a total of 6 units in each storey.

Some assumptions made:

1. Every household recycles once every day.
2. Bloobox is filled to the brim at the end of the day.

The dimensions of the two types of Bloobins are given below.

	Type A	Type B
		
Dimension (m)	$1.2 \times 0.5 \times 1.2$	$1.2 \times 1.2 \times 2.0$
Remarks	Filled up to 100% of its capacity	Filled up to 95% of its capacity
	Bins will be emptied every day	

Credits: <https://mothership.sg/2021/11/big-blue-recycling-bin-singapore/>

(b) Should John request for two Type A Bloobin or one Type B Bloobin for his block?

Show all your calculations.

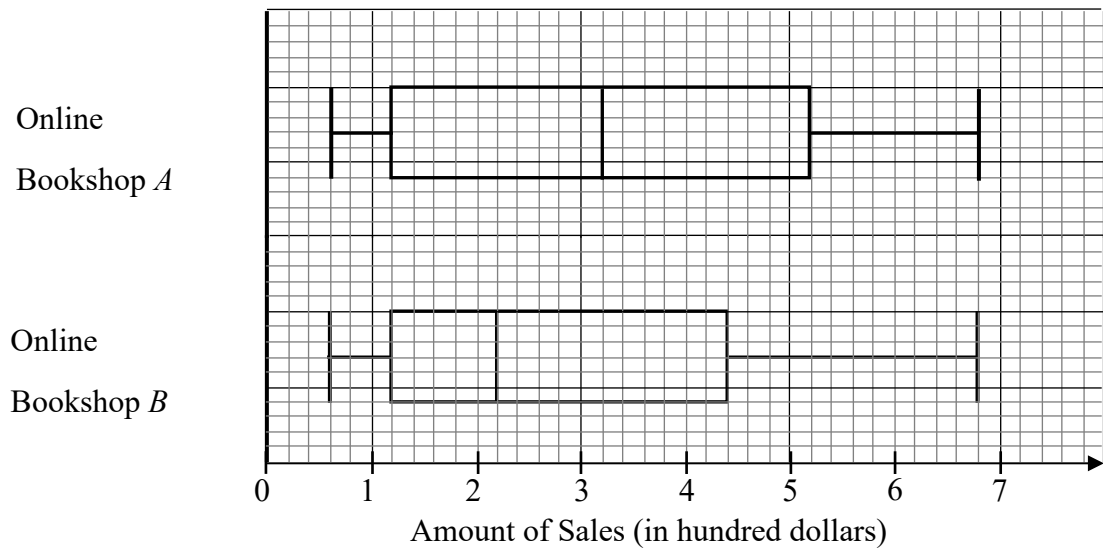
Answer

Section B (8 marks)

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

- 11 (a)** An author of an electronic book (e-book) wants to test the sales of an e-book at two different online bookshops, *A* and *B*.

The results are summarised in the box-and-whisker plots below



- (i)** Find the median sales at online bookshop *A*.

Answer \$..... [1]

- (ii)** Which online bookshop has a greater amount of sales?
Give a reason for your answer.

Answer

[1]

- (iii)** Find the interquartile range of the amount of sales for online bookshop *A*.

Answer \$..... [1]

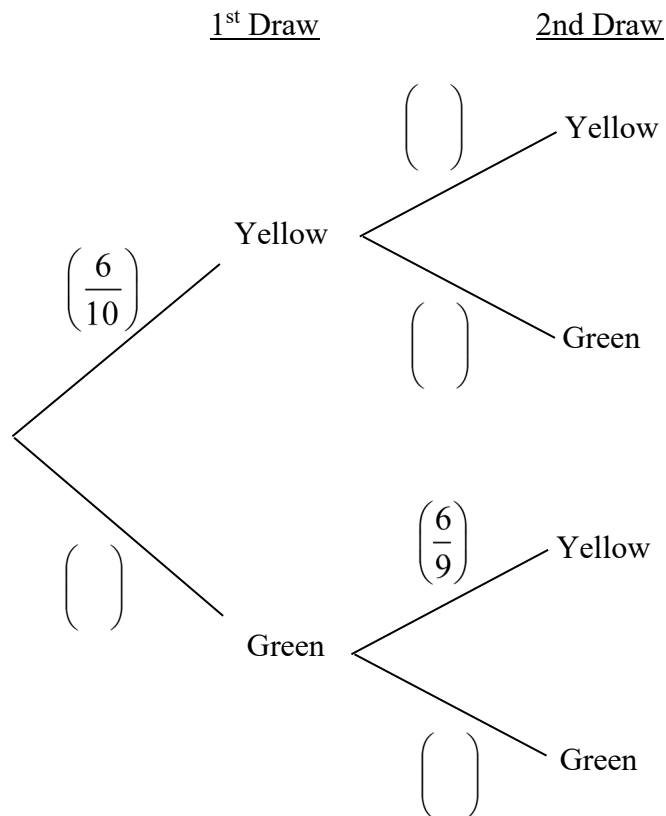
- (iv)** Which online bookshop has a more consistent amount of sales?
Give a reason for your answer.

Answer

[1]

- (b) Andy buys 10 capsicums from the market to make pizzas. 6 of them are yellow and the remaining 4 are green.
Two capsicums are to be chosen at random, one after the other.

- (i) Complete the probability tree diagram.

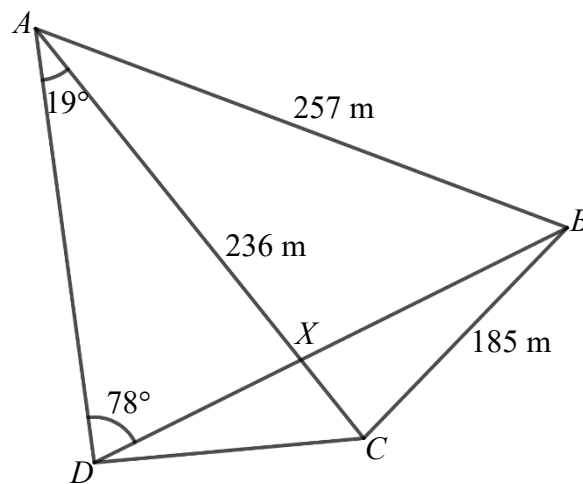


[2]

- (ii) Find the probability that at least one capsicum is green.

Answer [2]

12 $ABCD$ is a piece of land.



$AB = 257\text{ m}$, $BC = 185\text{ m}$ and $AC = 236\text{ m}$.

Angle $DAC = 19^\circ$ and angle $ADB = 78^\circ$.

X is the point of intersection of AC and BD , where XC is $\frac{1}{4}$ of AC .

(a) Calculate the angle ABC .

Answer $^\circ$ [3]

(b) Calculate DX .

Answer m [2]

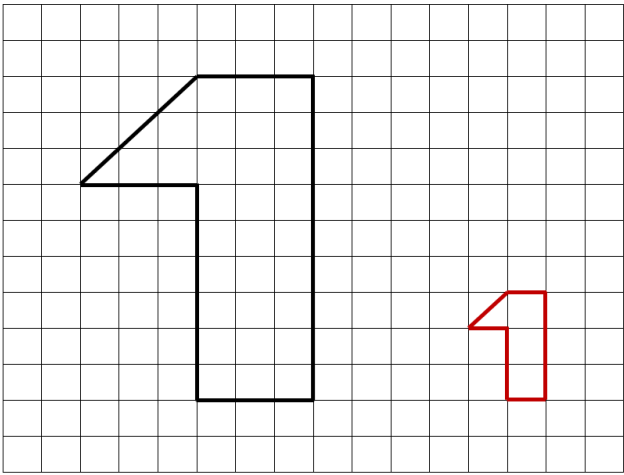
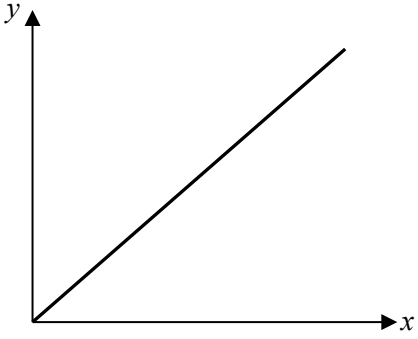
- (c) The bearing of B from D is 056° .
Find the bearing of C from A .

Answer $^\circ$ [3]

END OF PAPER

Suggested Marking Scheme 4NA Prelim P1 2023

1		$\frac{3}{5}(x+2) = -(x-1)$ $3x+6 = -5x+5$ $8x = -1$ $x = -\frac{1}{8}$																										
2		12units $\rightarrow$ 1200cm 3units $\rightarrow$ 300cm																										
3		$1-y < -10$ $-y < -11$ $y > 11$ Smallest prime = 13																										
4		<table><tr><th>Red box</th><th>Blue box</th></tr><tr><td>1</td><td>A</td></tr><tr><td>1</td><td>B</td></tr><tr><td>1</td><td>C</td></tr><tr><td>1</td><td>D</td></tr><tr><td>2</td><td>A</td></tr><tr><td>2</td><td>B</td></tr><tr><td>2</td><td>C</td></tr><tr><td>2</td><td>D</td></tr><tr><td>3</td><td>A</td></tr><tr><td>3</td><td>B</td></tr><tr><td>3</td><td>C</td></tr><tr><td>3</td><td>D</td></tr></table>	Red box	Blue box	1	A	1	B	1	C	1	D	2	A	2	B	2	C	2	D	3	A	3	B	3	C	3	D
Red box	Blue box																											
1	A																											
1	B																											
1	C																											
1	D																											
2	A																											
2	B																											
2	C																											
2	D																											
3	A																											
3	B																											
3	C																											
3	D																											

5		
6		5 seconds → 15 characters 60 seconds → 180 characters
7		$y = (x+1)(x-5)$ $y = x^2 - 4x - 5$ $b = -4, c = -5$
8	(a)	$h = \frac{k}{r^2}$ $8 = \frac{k}{(10)^2}$ $k = 800$ $h = \frac{800}{r^2}$ $h = \frac{800}{(4)^2}$ $h = 50$
	(b)	
9	(a)	$a = 4$
	(b)	$5^3 = 125$

10	(a)	$x^2 + 4x - 9$ $= (x+2)^2 - 9 - 4$ $h = 2, k = -13$
	(b)	-13
11	(a)	$x^{-2} \times x^{\frac{1}{3}} = x^n$ $x^{-\frac{5}{3}} = x^n$ $n = -\frac{5}{3}$
	(b)	$\sqrt{\frac{y^8}{y^2}}$ $= \sqrt{y^6}$ $= y^3$
12		$\angle AED = 48^\circ$ (base angle of isosc. Δ) $\angle DEF = 48^\circ$ (congruent) $x^\circ = 48^\circ + 48^\circ$ (alt. $\angle$ s) $x = 96$
13	(a)	$6n - 23$
	(b)	$6n - 23 > 50$ $6n > 73$ $n > 12.2$ $k = 13$
14		$\tan \angle DCA = \frac{2.6}{3}$ $\angle DCA = \tan^{-1}\left(\frac{2.6}{3}\right)$ $\angle CAB = \angle DCA$ (alt. $\angle$ s) Obtuse $\angle EAB = 180^\circ - \tan^{-1}\left(\frac{2.6}{3}\right)$ $= 139.1^\circ$

15		$AF = \sqrt{15^2 - 9^2}$ $= 12$ $\frac{DE}{5} = \frac{22.5}{15}$ $DE = 7.5$ $\frac{AG}{12} = \frac{22.5}{15}$ $AG = 18$ Area of triangle ADE $= \frac{1}{2}(7.5)(18)$ $= 67.5 \text{ cm}^2$			
16	(a)	$(2x - 3)^2 = 4x^2 - 12x + 9$			
	(b)	$1 - \frac{2x}{2x - 3}$ $= \frac{2x - 3 - 2x}{2x - 3}$ $= \frac{-3}{2x - 3}$ $= \frac{-3(2x - 3)}{(2x - 3)^2}$ $= \frac{-6x + 9}{(2x - 3)^2}$ $a = -6, b = 9$			
17		$2x + 5y = x + 4y + 7$ $x + y = 7$ $x + 1 = 3y$ $3y - 1 + y = 7$ $y = 2$ $x = 5$ Length = 20 Breadth = 6 $BD = \sqrt{20^2 + 6^2} = 20.9$			
18	(a)	Time (h hours)	Mid- value x	Frequency f	fx

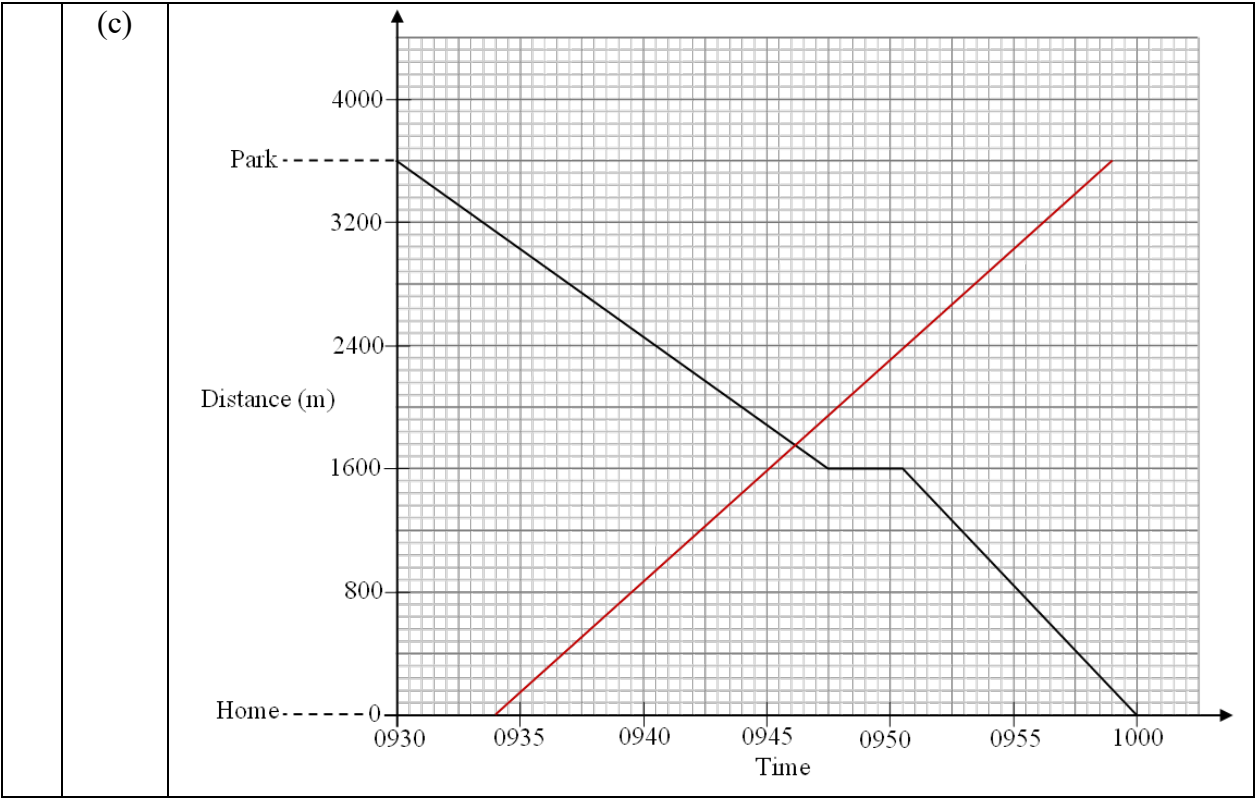
		<table><tr><td>$0 < h \leq 2$</td><td>1</td><td>0</td><td>0</td></tr><tr><td>$2 < h \leq 4$</td><td>3</td><td>1</td><td>3</td></tr><tr><td>$4 < h \leq 6$</td><td>5</td><td>4</td><td>20</td></tr><tr><td>$6 < h \leq 8$</td><td>7</td><td>8</td><td>56</td></tr><tr><td>$8 < h \leq 10$</td><td>9</td><td>9</td><td>81</td></tr><tr><td>$10 < h \leq 12$</td><td>11</td><td>2</td><td>22</td></tr><tr><td>$12 < h \leq 14$</td><td>13</td><td>1</td><td>13</td></tr><tr><td>Total</td><td></td><td>25</td><td>195</td></tr></table>	$0 < h \leq 2$	1	0	0	$2 < h \leq 4$	3	1	3	$4 < h \leq 6$	5	4	20	$6 < h \leq 8$	7	8	56	$8 < h \leq 10$	9	9	81	$10 < h \leq 12$	11	2	22	$12 < h \leq 14$	13	1	13	Total		25	195
$0 < h \leq 2$	1	0	0																															
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$12 < h \leq 14$	13	1	13																															
Total		25	195																															
	(b)	Estimated mean = $\frac{195}{25}$ = 7.8 The time is given in a range and we are not able to determine the exact amount of time spent studying for each student.																																
19	i	$L = \frac{110^\circ}{360^\circ} \times 2\pi(80)$ $L = 153.5889...$ $L = 154cm$																																
	ii	Area of big sector = $L = \frac{110^\circ}{360^\circ} \times \pi(80)^2$ Area of small sector = $L = \frac{110^\circ}{360^\circ} \times \pi(45)^2$ Area of display = $\frac{110^\circ}{360^\circ} \times \pi(80)^2 - \frac{110^\circ}{360^\circ} \times \pi(45)^2$ = 4199.698513 = 4200 cm²																																

20		$m_{AB} = m_{AC}$ $\frac{2m - (-5)}{-m - 4} = \frac{5 - (-5)}{-16 - 4}$ $\frac{2m + 5}{-m - 4} = -\frac{1}{2}$ $2(2m + 5) = -1(-m - 4)$ $4m + 10 = m + 4$ $3m = -6$ $m = -2$
21	(a)	$\pi(10)(15) - \pi(3)(4.5)$ $= 429 \text{ cm}^2$
	(b)	$\frac{1}{3}\pi r^2 h = \frac{4}{3}\pi r^3$ $h = 4r$
22	(a)	Construct triangle: $\angle CAB = 98^\circ$ $BC = 9.8 \text{ cm}$ (with construction arc)
	(b)	Construct angle bisector for $\angle CAB$
	(c)	Construct arc 2 cm from A Shade correct region
23	(a)	Total Cost $= 2(\$34.20) + 2(\$20.70)$ $= \$109.80$
	(b)	Total cost (before Wildpass discount) $= 2(\$43.20) + (\$20.00)$ $= \$106.40$ Total cost he pays $= \frac{80}{100} \times \106.40 $= \$85.12$
	(c)	Percentage increase $= \frac{43.20 - 34.20}{34.20} \times 100$ $= 26.3\%$

Suggested Marking Scheme 4NA Prelim P2 2023

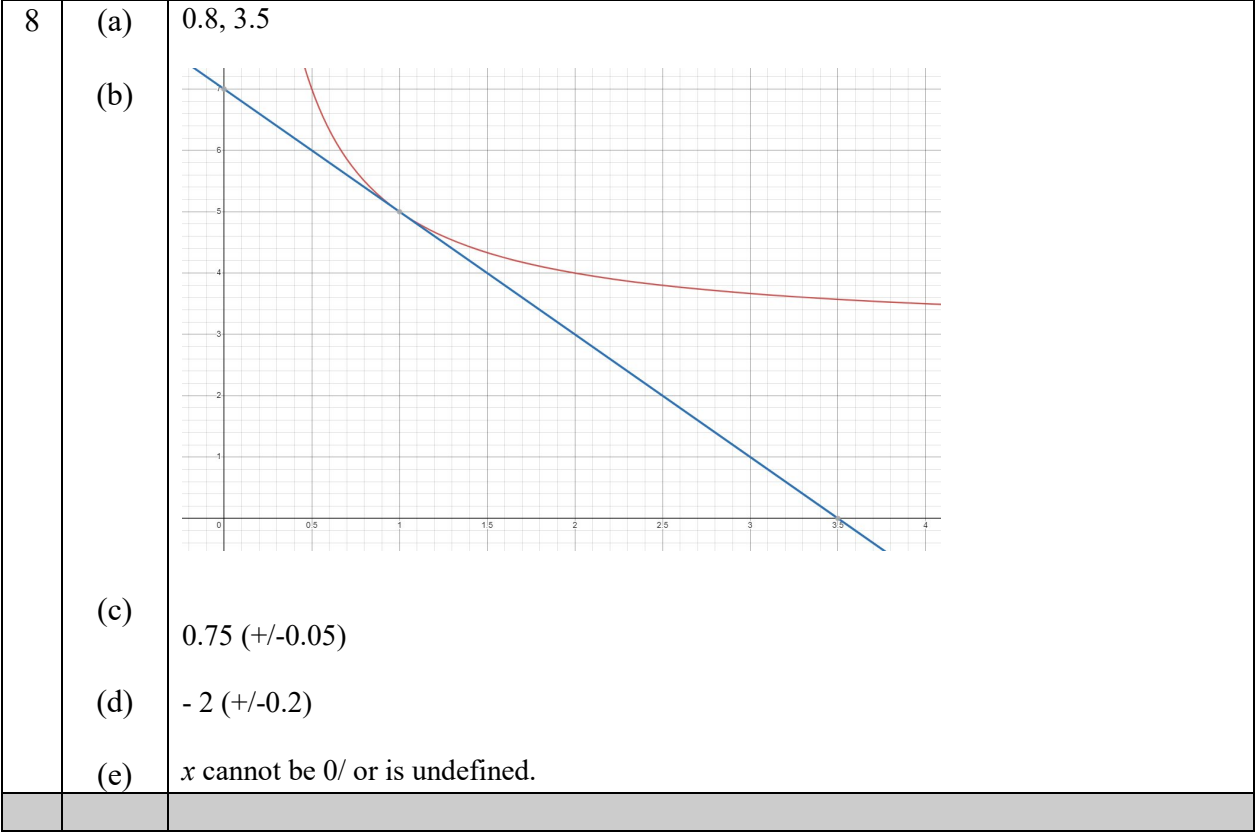
1		$\text{Int. } \angle \text{ of } B = \frac{(6-2) \times 180^\circ}{6}$ $= 120^\circ$ $\text{Int. } \angle \text{ of } A = 360^\circ - 120^\circ - 90^\circ$ $= 150^\circ$ $\text{Ext. } \angle \text{ of } A = 180^\circ - 150^\circ$ $= 30^\circ$ $n = \frac{360^\circ}{30^\circ}$ $= 12$
2	(a)(i)	$190 - 156 = 34 \text{ cm}$
	(a)(ii)	Median $= \frac{171+172}{2}$ $= 171.5 \text{ cm}$
	(b)	Since the range is increased by 1, this means John is either 155 or 191 but since the median is decreased, this means that John's height is lower than the median thus he is 155 cm.
3		Area of water in contact with the bowl $= \frac{1}{2} \left(2\pi(15)^2 \right) + \frac{1}{2} \left(\pi(15)^2 \right)$ $= 1060.286625$ $= 1060 \text{ cm}^2$
4	(a)	$\sqrt{(-6)^2 + 4(-7)^2}$ $= 15.2315\dots$ $= 15.2$
	(b)	$\frac{22}{7}, 3.142, -\pi, -3.\dot{2}$
	(ci)	$10994 = 1.0994 \times 10^4$
	(cii)	$10994 - 3750$ $= 7244$ $= 7.244 \times 10^3 \text{ m}$

5	(ai)	$1 : 200000$ $1\text{cm} : 2\text{km}$ Length of cycling path $= 3.5 \div 2$ $= 1.75\text{cm}$
	(aii)	$1\text{cm} : 2\text{km}$ $1\text{cm}^2 : 4\text{km}^2$ Actual Area $= 8 \times 4$ $= 32\text{km}^2$
	(b)	$\frac{80}{100} \times 200000 = 160000$ $1 : 160000$
6	(a)	$m = \frac{1}{2}$ $y = \frac{1}{2}x - 1$
	(b)	Draw horizontal line $y = 3$
	(c)(i)	(8, 3)
	(c)(ii)	$AX = \sqrt{10^2 + 5^2}$ $= \sqrt{125}$ $= 11.2 \text{ units}$
	(d)(i)	(0, -6)
	(d)(ii)	Area $= 2 \times \frac{1}{2}(10)(4)$ $= 40 \text{ units}^2$
7	(a)	3 minutes
	(b)	Average speed $= \frac{3600 \text{ m}}{30 \text{ min}}$ $= \frac{(3600 \div 1000) \text{ km}}{(30 \div 60) \text{ h}}$ $= 7.2 \text{ km/h}$

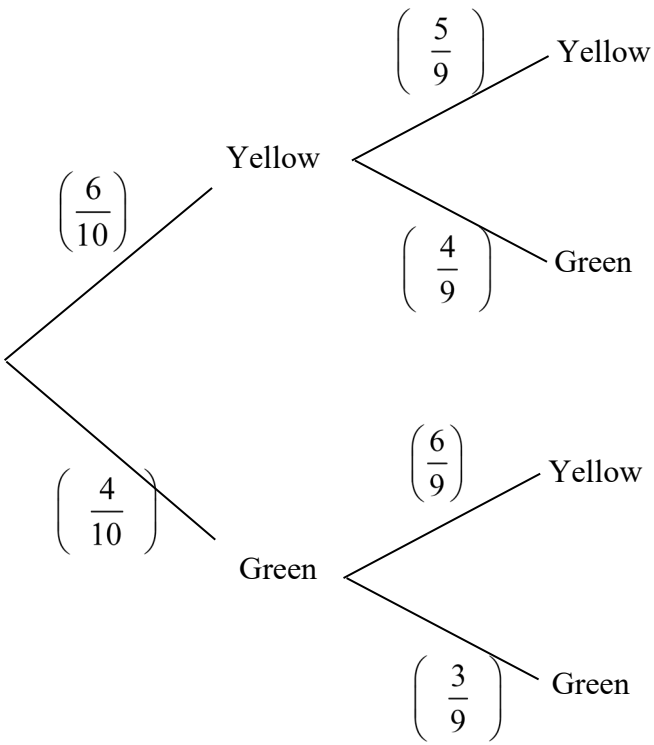


(d)

Distance away from park
= 3600 – 1760 = 1840 m



9	(a)	$h = \frac{2a}{m + n^2}$ $h = \frac{2(0.5)}{-0.238 + (-1.1)^2}$ $h = 1.03$
	(b)	$h = \frac{2a}{m + n^2}$ $hm + hn^2 = 2a$ $hn^2 = 2a - hm$ $n^2 = \frac{2a - hm}{h}$ $n = \pm \sqrt{\frac{2a - hm}{h}}$
	(c)	$x(2x + 1) = 5$ $2x^2 + x - 5 = 0$ $x = \frac{-1 \pm \sqrt{1 - 4(2)(-5)}}{2(2)}$ $= -1.85 \text{ or } 1.35$
10	(ai)	Total volume of one Bloobox $= 30 \times 30 \times 30$ $= 27000\text{cm}^3$
	(aii)	Total SA of Bloobox $= (30 \times 30 \times 5) + (30 \times 25)$ $= 5250\text{cm}^2$
	(b)	Maximum volume of Type A $= 120 \times 50 \times 120$ $= 720\,000\text{cm}^3$ Maximum volume of Type B $= \frac{95}{100} \times 120 \times 120 \times 200$ $= 2\,736\,000\text{cm}^3$ Maximum volume of recyclables on the same day $= 27\,000 \times 6 \times 16$ $= 2\,592\,000\text{cm}^3$ Maximum volume of 2 Type A $= 120 \times 50 \times 120 \times 2$ $= 1\,440\,000\text{cm}^3$

		John should request for 1 Type B Bloobin as it is enough to collect all the recyclables from the households in his block.
11	(ai)	Median = \$320
	(aii)	Online bookshop <i>A</i> because it has a greater median than online bookshop <i>B</i> .
	(aiii)	Lower quartile = 120 Upper quartile = 520 Inter-quartile range = $520 - 120 = \$400$
	(aiv)	For online bookshop <i>B</i> , lower quartile = 120 upper quartile = 440 Inter-quartile range = $440 - 120 = \$320$ Online bookshop <i>B</i> has a more consistent amount of sales because it has a lower interquartile range.
	(bi)	<u>1st Draw</u> <u>2nd Draw</u>  <pre> graph LR Root(()) --- 6/10 Y1[Yellow] Root --- 4/10 G1[Green] Y1 --- 5/9 Y2[Yellow] Y1 --- 4/9 G2[Green] G1 --- 6/9 Y3[Yellow] G1 --- 3/9 G3[Green] </pre>
	(bii)	P (at least 1 green) = $1 - P(\text{no green})$ = $1 - \frac{6}{10} \times \frac{5}{9}$ = $\frac{2}{3}$

12	(a)	$\cos \angle ABC = \frac{257^2 + 185^2 - 236^2}{2(257)(185)}$ $\angle ABC = \cos^{-1}\left(\frac{44578}{95090}\right)$ $= 62.0^\circ$
	(b)	$\frac{DX}{\sin 19^\circ} = \frac{\frac{3}{4} \times 236}{\sin 78^\circ}$ $DX = \frac{177}{\sin 78^\circ} \times \sin 19^\circ$ $= 58.9 \text{ m}$
	(c)	$\angle ADN = 78^\circ - 56^\circ$ $= 22^\circ$ $\angle NAD = 180^\circ - 22^\circ \quad (\text{int. } \angle\text{s})$ $= 158^\circ$ $\text{Bearing of } C \text{ from } A = 158^\circ - 19^\circ$ $= 139^\circ$