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YUHUA SECONDARY SCHOOL

PRELIMINARY EXAMINATION 2018

4N	CANDIDATE NAME			
	CLASS		INDEX NUMBER	

MATHEMATICS SYLLABUS A

4045/01

Paper 1

2 Aug 2018
2 hours

Candidates answer on the Question Paper.

Setter: Mdm Chan May Foon

READ THESE INSTRUCTIONS FIRST

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

Write in dark blue or black pen.

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

Do not use staples, paper clips, glue or correction fluid.

Answer **all** questions.

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

If working is needed for any question it must be shown with the answer.

Omission of essential working will result in loss of marks.

The total of the marks for this paper is 80.

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 degree to one decimal place.

For π , use either your calculator value or 3.142.

TOTAL MARKS	80
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This document consists of **21** printed pages, inclusive of this page.

[Turn over

MATHEMATICAL FORMULAE*Compound interest*

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

Mensuration

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

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

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

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

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

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

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

Trigonometry

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

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

Statistics

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

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

3

Answer **all** the questions.

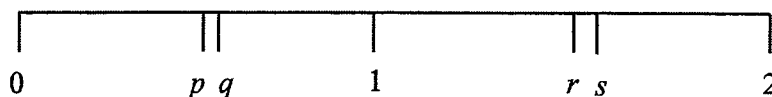
- 1 By writing each number correct to 1 significant figure, estimate the value of

$$\sqrt{\frac{45.31 \times 0.528}{99.821}}$$

You **must** show your working.

Answer [2]

- 2 The numbers p , q , r and s are represented on the number line shown below.



The values of p , q , r and s are listed below.

$$\frac{8}{5}, 0.6, \frac{5}{8}, \frac{\pi}{2}$$

Find p , q , r and s .

Answer $p =$

$q =$

$r =$

$s =$ [2]

4

3 Solve $\frac{3}{x} = \frac{16}{2x-1}$.

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

4 Given that x and y are integers such that $-8 \leq x \leq 4$ and $-2 \leq y \leq 3$, state

(a) the greatest value of $x - y$,

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

(b) the least value of $\frac{x}{y}$.

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

5

5 Find the obtuse angles A and B such that

(a) $\sin A^\circ = 0.742$,

Answer $A^\circ = \dots\dots\dots$ [1]

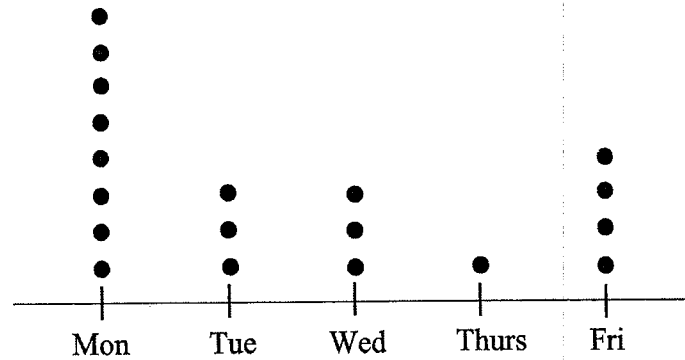
(b) $\cos B^\circ = -0.123$.

Answer $B^\circ = \dots\dots\dots$ [1]

- 6 Mrs Toh deposits her year-end bonus of \$12 400 in a savings plan that pays simple interest at a rate of 2% per annum.
Find the time taken for her initial deposit to grow to \$13 888.

Answeryears [2]

- 7 The following dot diagram shows the number of latecomers each day in a particular week.



- (a) How many latecomers were there in that week?

Answer [1]

- (b) The discipline committee wants to keep track of the latecomers for each month of the year.

State a type of statistical diagram that would be suitable to record that data and explain why you have chosen that diagram.

Answer [1]

.....

.....

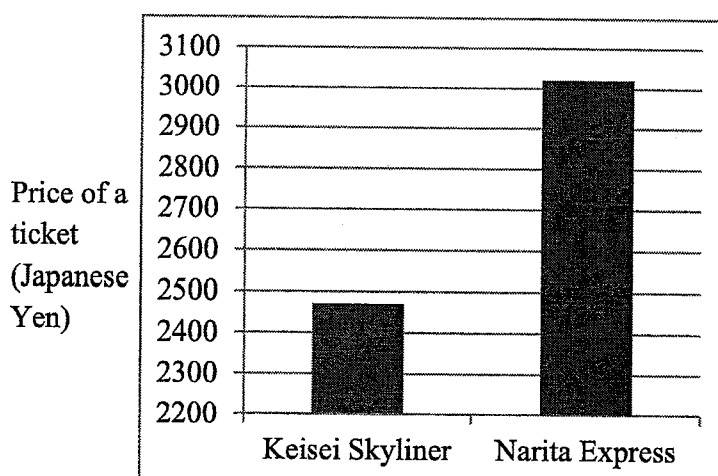
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- 8 There are two train services, Keisei Skyliner and Narita Express, from downtown Tokyo to Narita Airport.

The following bar chart compares the price of a single ticket for the two train services.

A website claims that “The price of a Narita Express ticket is about three times the price of a Keisei Skyliner ticket.”

Do you agree with the claim? Explain your answer.



Answer

.....

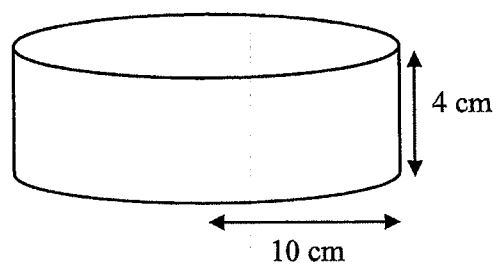
.....

..... [1]

- 9 Find the equation of a straight line passing through the points $(1, -12)$ and $(-1, -4)$.

Answer [3]

- 10 An open cylindrical tin has an exterior radius of 10 cm and a height of 4 cm. Find the total exterior surface area of the tin.



Answercm² [3]

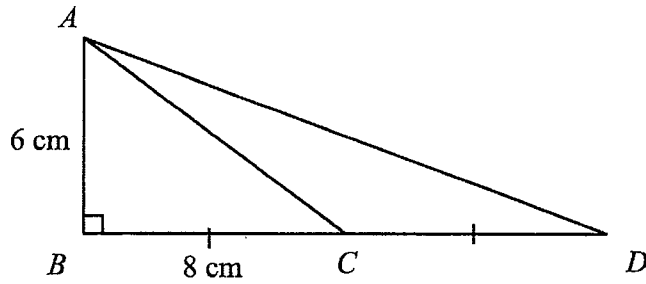
- 11 (a) Simplify $\frac{a^3 \times a^7}{\sqrt{a^5}}$ and give your answer in the form a^n .

Answer [1]

- (b) Solve $4^{x+1} = 2^{6x} \div 2^{3x-3}$.

Answer $x =$ [2]

- 12 In the diagram, ABD is a right-angled triangle where point C is the mid-point of BD .



- (a) Given that $AB = 6$ cm, $BC = 8$ cm, find
- (i) $\tan \angle CAB$,

Answer [1]

- (ii) $\sin \angle ACD$.

Answer [1]

- (b) Explain why triangle ABC and triangle ACD have the same area.

Answer

.....

.....

..... [1]

10

- 13 Solve the simultaneous equations.

$$x + 4y = 1$$

$$3x + 2y = 13$$

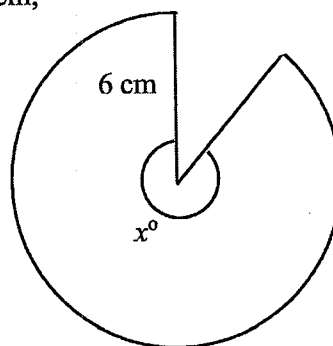
Answer $x = \dots\dots\dots$

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

- 14 The diagram shows a sector of a circle of radius 6 cm.
The angle subtended by the sector is x° .

Given that the perimeter of the sector is $\left(12 + \frac{32}{3}\pi\right)$ cm,

find the value of x .



Answer $x = \dots\dots\dots^\circ$ [3]

- 15 (a) p varies inversely as $\sqrt{q}$.

Given that $p = 9$ when $q = 16$, find the value of p when $q = 25$.

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

- (b) y is directly proportional to x^3 .

When x has a certain value, $y = 5$.

Find the value of y when x is doubled.

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

16 $x^2 + 8x + 11$ can be expressed in the form $(x + p)^2 + q$.

(a) Find p and q .

Answer $p = \dots\dots\dots$

$q = \dots\dots\dots$ [2]

(b) Hence, solve $x^2 + 8x + 11 = 0$.

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

- 17 (a) Simplify $3(2y-5)-2(7-2y)$.

Answer [2]

- (b) Factorise $ac+3bc-2ad-6bd$.

Answer [2]

-
- 18 In a warehouse, boxes have heights of 60 cm or 1 m.
Boxes with heights of 60 cm are stacked next to those with heights 1 m.

- (a) Calculate the minimum height, in cm, at which both stacks have the same height.

Answercm [2]

- (b) Find the total number of boxes in these two stacks.

Answer [2]

19

Brownie Recipe

114 g butter
 200 g sugar
 30 g flour
 59 g cocoa powder
 1 tsp of vanilla extract
 $\frac{1}{2}$ tsp of salt

Makes 12 brownies

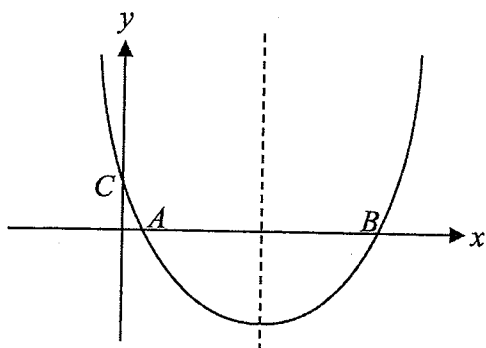
- (a) Teresa wants to make 27 brownies.
 How much flour will she use?

Answerg [2]

- (b) Teresa decides to reduce the amount of sugar to 160 g.
 Find the percentage decrease in the amount of sugar used.

Answer% [2]

- 20 The diagram shows part of the graph of $y = x^2 - 6x + 5$. The graph cuts the x -axis at A and B , and the y -axis at C .



- (a) Write down the coordinates of A , B and C .

Answer $A = (\dots\dots\dots, \dots\dots\dots)$

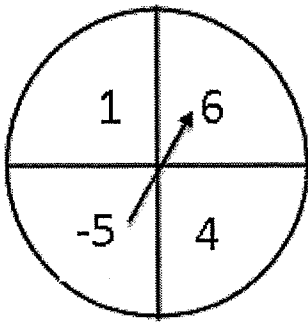
$B = (\dots\dots\dots, \dots\dots\dots)$

$C = (\dots\dots\dots, \dots\dots\dots)$ [3]

- (b) Find the equation of the line of symmetry.

Answer [1]

21 The spinner shown is spun twice and the sum of the two numbers is recorded.



(a) Complete the possibility diagram.

+	1	6	4	-5
1	2		5	
6	7			1
4		10		
-5		1	-1	-10

[2]

(b) Find the probability that the sum is less than 7.

Answer [1]

(c) Find the probability that at least one of the number on the spinner is odd.

Answer [1]

22 Given that $P = \frac{RT}{v-b}$,

(a) find P when $R = 9.412$, $T = 300$, $v = 0.019$ and $b = 0.004$,

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

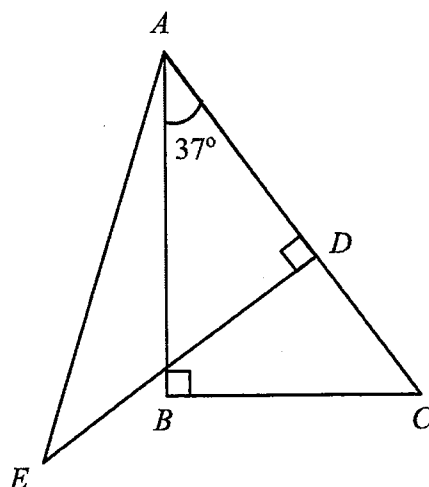
(b) express b in terms of P , R , T and v .

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

- 23 (a) Four of the angles in a hexagon are x° each.
 The fifth angle is 40° smaller than x° .
 The sixth angle is two times the size of the fifth angle.
 Form an equation and find the size of the smallest angle in the hexagon.

Answer $^\circ$ [2]

(b)

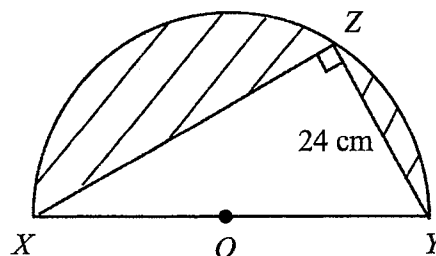


In the diagram, $\triangle ABC$ is congruent to $\triangle EDA$, $\angle BAC = 37^\circ$.
 Find $\angle BAE$, stating your reasons clearly.

Answer $\angle BAE =$ $^\circ$ [2]

- 24 The figure below consists of a semicircle with a right-angled triangle inscribed in it. The length of YZ is 24 cm and $YZ : ZX : XY = 3 : 4 : 5$.

(a) Show that the length of $OX = 20$ cm.



Answer $OX = 20$ cm (shown) [1]

(b) Find the area of the shaded region.

Answer cm^2 [3]

(c) Find the perimeter of the shaded region.

Answer cm [2]

- 24 The following table are the distances in km, to the nearest km, that each student in a class travels from home to school. There are 30 students in this class.

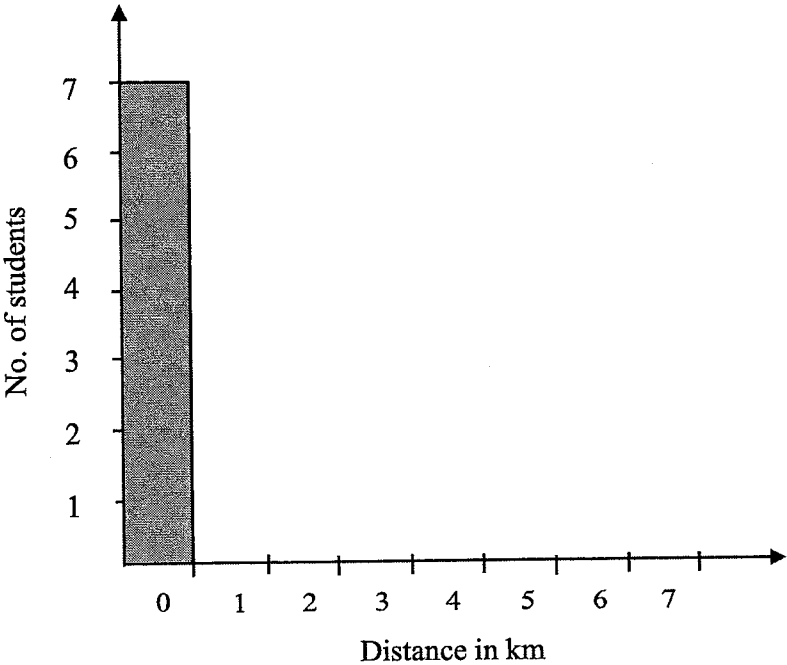
1	0	6	2	3	4	4	1	7	0	5	2	0	4	1
5	2	0	6	2	0	4	1	1	0	0	2	5	1	3

- (a) Complete the following table.

Distance	Tally	Frequency
0		7
1		
2		
3		
4		
5		
6		
7		

[1]

- (b) Complete the histogram to illustrate this information.



[1]

- (c) Write down the modal distance.

Answerkm [1]

- (d) Write down the median distance.

Answerkm [1]

- (e) Calculate the mean distance.

Answerkm [1]

- End of paper -



YUHUA SECONDARY SCHOOL

PRELIMINARY EXAMINATION 2018

4N	CANDIDATE NAME		
	CLASS		INDEX NUMBER

MATHEMATICS SYLLABUS A

4045/02

Paper 2

3 Aug 2018
2 hours

Additional Materials: Answer Paper
Graph Paper
Answer Cover Page

Setter: Mdm Chan May Foon

READ THESE INSTRUCTIONS FIRST

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

Write in dark blue or black pen.

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

Do not use staples, paper clips, glue or correction fluid.

Section A

Answer **all** 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 with the answer.

Omission of essential working will result in loss of marks.

The total number of marks for this paper is 60.

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.

At the end of the examination, fasten all your work securely together.

TOTAL MARKS	60
--------------------	-----------

This document consists of **10** printed pages, inclusive of this page.

[Turn over

MATHEMATICAL FORMULAE*Compound interest*

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

Mensuration

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

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

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

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

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

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

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

Trigonometry

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

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

Statistics

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

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

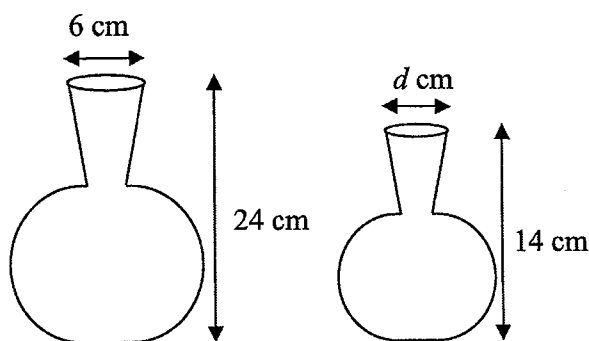
Section A (52 marks)

Answer **all** the questions in this section.

- 1 (a) The scale of map A is 4 cm : 1 km.
The area of a park is represented by an area of 200 cm^2 on map A .
Find the actual area of the park in square kilometres. [2]
- (b) The same park is represented by an area of 0.78125 cm^2 on map B .
Find the actual length of a path in the park, in kilometres, which is represented by a length of 8.2 cm on map B . [2]
-

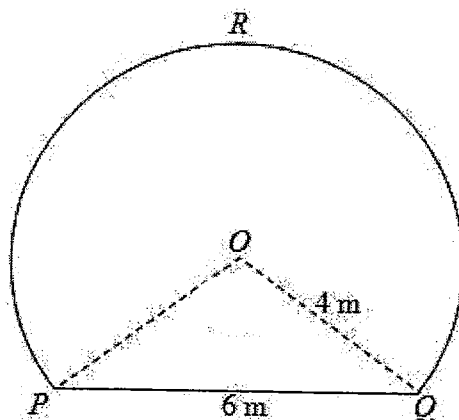
- 2 A bag contains 4 red, 5 black and 1 green marbles.
- (a) Two marbles are drawn without replacement.
Find the probability of getting at least 1 black marble. [2]
- (b) How many green marbles must be added so that the probability of getting a green marble in one draw is 0.4? [2]
-

- 3 The two water containers shown in the diagram below are similar.
The heights of the larger and smaller container are 24 cm and 14 cm respectively.



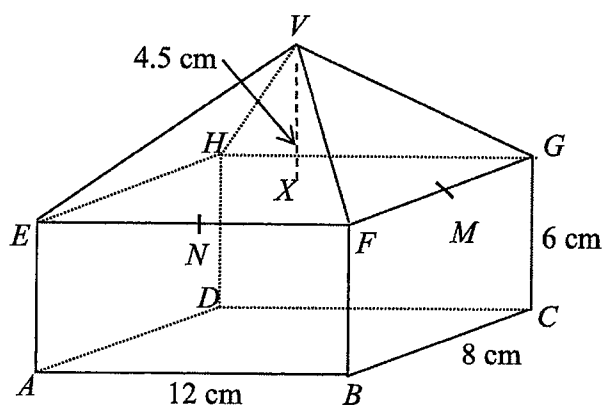
- (a) The diameter of the circular top of the larger container is 6 cm.
Find the diameter, d cm, of the circular top of the smaller container. [2]
- (b) Given that the smaller container can hold 196 cm^3 of water, calculate the volume of water the larger container can hold. [2]
-

- 4 The diagram below shows a major segment PQR of a circle, centre O .



- (a) Given that the area of the major sector $OPRQ = 36.3 \text{ m}^2$, show that the reflex angle $POQ = 4.5375$ radians. [2]
- (b) Find the area of the triangle POQ . [2]

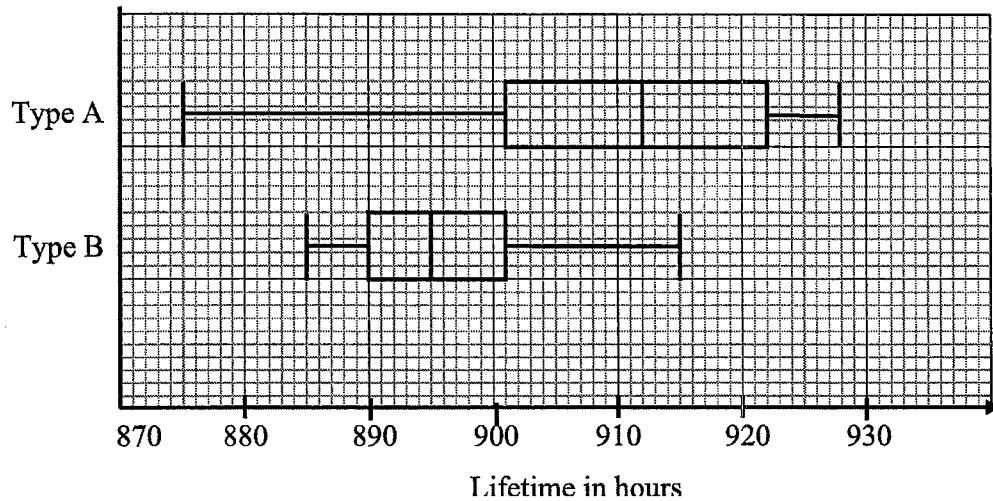
- 5 The diagram below shows a solid piece of metal. It consists of a regular pyramid, $VEFGH$, attached to a cuboid $ABCDEFGH$. VX is the vertical height of the pyramid. M is the mid-point of FG and N is the mid-point of EF . It is given that $AB = 12 \text{ cm}$, $BC = 8 \text{ cm}$, $CG = 6 \text{ cm}$ and $VX = 4.5 \text{ cm}$.



Find

- (a) the volume of the solid, [2]
- (b) the length of VN , [1]
- (c) $\angle VNX$. [2]

- 6 Data was collected on the lifetime in hours of two types of light bulb, A and B. The results are summarised in the box-and-whisker plots below.



- (a) Write down the median lifetime for Type A light bulb. [1]
- (b) If all light bulbs have the same cost, which type of light bulb gives better value for money?
Give a reason for your answer. [1]
- (c) Find the range of lifetime for Type B light bulb. [1]
- (d) Which type of light bulb is more consistent in their lifetime?
Give a reason for your answer. [2]
-
- 7 A piece of wire 20 cm long is bent into a right-angled triangle.
Given that the longest length of the triangle is 9 cm and the other length is x cm,
- (a) express the length of the third side in terms of x , [1]
- (b) form an equation to show it reduces to $x^2 - 11x + 20 = 0$, [2]
- (c) solve the equation $x^2 - 11x + 20 = 0$ and give your answers correct to 2 decimal places. [3]
-

6

- 8 (a) Expand and simplify $(3x-2)^2$. [2]
- (b) Write $\frac{7}{3x+2} - \frac{2}{x-5}$ as a single fraction, simplifying the numerator. [2]
- (c) Solve the inequality $\frac{5x-1}{2} < \frac{4x+8}{3}$. [2]

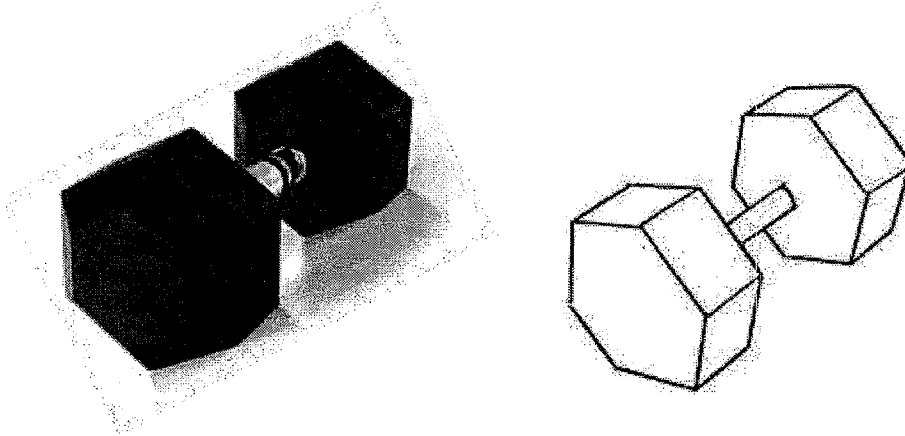
9 Answer the whole of this part on a single sheet of graph paper.

The table below is for $y = 2 \times 3^x$.

x	0	0.5	1	1.5	2	2.5	3
y	2	3.5	6	10.4	18	p	54

- (a) Find the value of p . [1]
- (b) Draw the graph of $y = 2 \times 3^x$ for $0 \leq x \leq 3$, using a scale of 4 cm to 1 unit on the x -axis and 2 cm to 10 units on the y -axis. [2]
- (c) Use your graph to find the value of x when $y = 15$. [1]
- (d) By drawing a tangent, find the gradient of the curve $y = 2 \times 3^x$ when $x = 2$. [2]

- 10 A dumbbell can be modelled using a cylinder and two regular hexagonal prisms. The volume of one prism is 831.4 cm^3 . The dumbbell shown in the diagram below is made entirely of cast iron. The density of cast iron is 7000 kg/m^3 . 1 kg is 2.204 pounds.



- (a) Given that the cylindrical rod has a radius of 1.5 cm and a length of 15 cm, calculate the total volume of the dumbbell. [3]
- (b) Vincent wants to do weight-lifting and his physical trainer advises him not to carry more than 25 pounds.

Determine if Vincent should use this dumbbell if he wants to follow his physical trainer's advice.

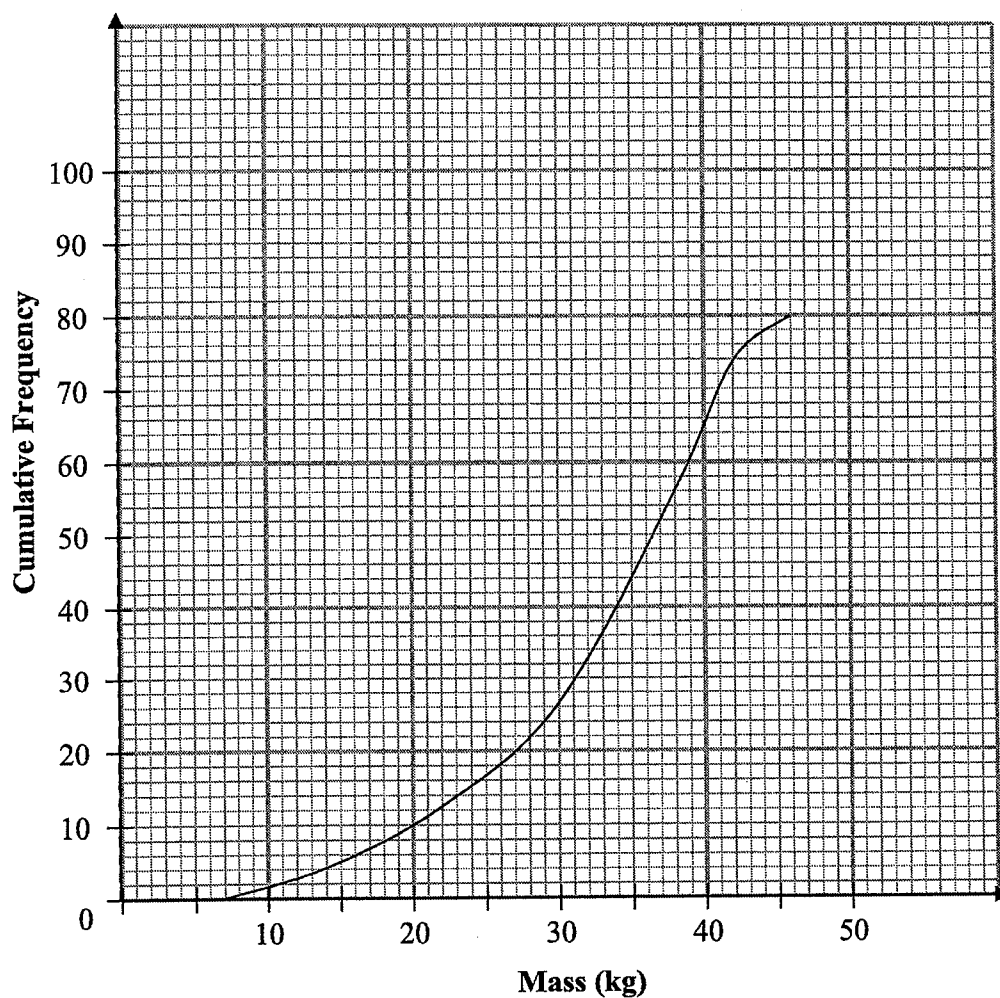
Justify your decision with calculations.

[5]

Section B (8 marks)

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

- 11** In farm A, the total mass of durians produced by each of the 80 durian trees were measured. The cumulative frequency curve below shows the distribution of the masses.



- (a) Use the curve to estimate
- (i) the median mass, [1]
 - (ii) the interquartile range of the mass. [2]
 - (iii) the number of durians with mass greater than 34 kg. [1]

Q11(b) continued on next page

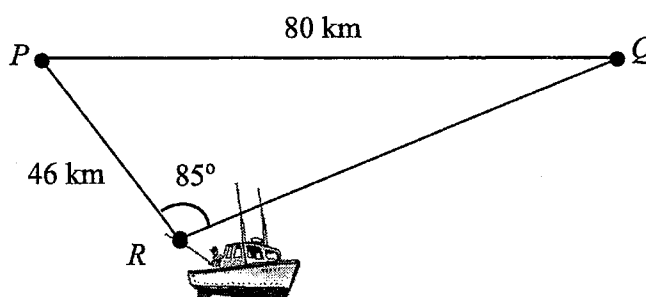
- (b) The grouped frequency table of the mass of durians on each plant is given below.

Mass (x kg)	$6 \leq x < 14$	$14 \leq x < 22$	$22 \leq x < 30$	$30 \leq x < 38$	$38 \leq x < 46$
Frequency	4	8	14	30	24

Using your grouped frequency table, calculate an estimate of

- (i) the mean mass of durians produced by each plant, [1]
- (ii) the standard deviation. [2]
- (c) The mass of the durians from another 80 durian trees from farm B had the same interquartile range as farm A's but a lower median. Describe how the cumulative frequency curve for farm B may differ from the curve for farm A. [1]

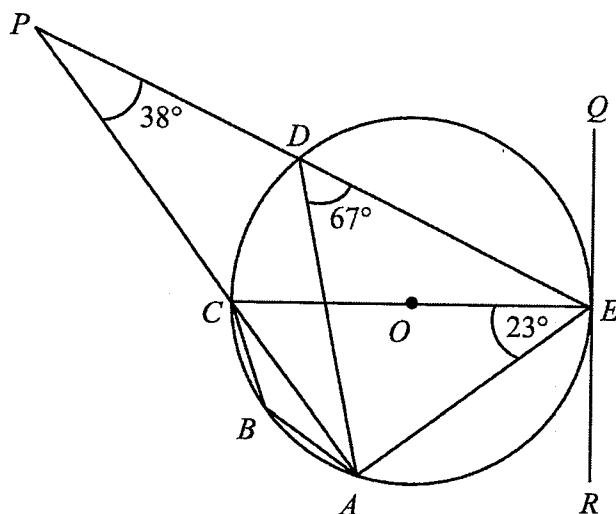
- 12 (a) Two coast guard bases P and Q are located 80 km apart along a coastline with Q due east of P . The coast guards at P and Q both receive an SOS signal from a fishing boat, R , which is 46 km away from P . The bearing of R from P is 150° and angle PRQ is 85° .



- (i) Find the distance of the boat from Q . [2]
- (ii) If there is a vertical tower, QT at the point Q where $QT = 35$ m, calculate the angle of elevation of T from R . Give your answer correct to 2 decimal places. [2]

Q12(b) continued on next page

- (b) The diagram shows a circle, $ABCDE$, centre O .
 When produced, the lines AC and ED meet at P .
 COE is the diameter and QER is the tangent to the circle.
 Angle $AEC = 23^\circ$, angle $APE = 38^\circ$ and angle $ADE = 67^\circ$.



Find, giving reasons for each answer,

- | | |
|---------------------|-----|
| (i) angle ABC , | [1] |
| (ii) angle AER , | [1] |
| (iii) angle DAE . | [2] |

- End of paper -

YUHUA SECONDARY SCHOOL
4N MATHEMATICS PRELIMINARY EXAMINATION PAPER 1
MARKING SCHEME

Qn	Solution	Marks	Test Objective
1	$\sqrt{\frac{45.31 \times 0.528}{99.821}}$ $\approx \sqrt{\frac{50 \times 0.5}{100}}$ $= \frac{1}{2} / 0.5$	M1 A1	Able to approximate each value to 1 s.f.
2	$p = 0.6$ $q = \frac{5}{8}$ $r = \frac{\pi}{2}$ $s = \frac{8}{5}$	B2: All correct B1: Any 2 correct	
3	$\frac{3}{x} = \frac{16}{2x-1}$ $3(2x-1) = 16x$ $6x-3 = 16x$ $-10x = 3$ $x = -\frac{3}{10} / -0.3$	M1 A1	Able to multiply both sides by the LCM.
4a	$4 - (-2) = 6$	B1	
4b	$\frac{-8}{1} = -8$	B1	
5a	$\sin A = 0.742$ $A = \sin^{-1}(0.742)$ $= 47.90206471^\circ$ Obtuse $A = 180 - 47.90206471$ $= 132.0979353$ $= 132.1^\circ$	B1	
5b	$\cos B = -0.123$ $B = \cos^{-1}(-0.123)$ $= 97.06527293$ $= 97.1^\circ$	B1	

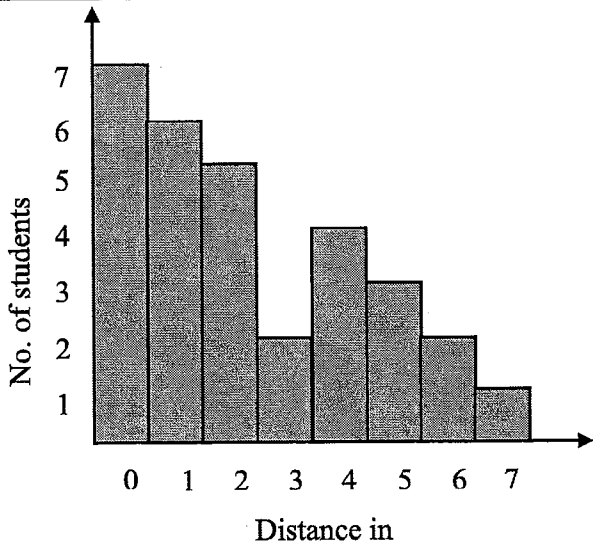
6	$\begin{aligned} \text{Interest} &= 13\,888 - 12\,400 \\ &= 1488 \\ 1488 &= \frac{(12400)(2)T}{100} \\ 1488 &= 248T \\ T &= \frac{1488}{248} \\ &= 6 \text{ years} \end{aligned}$	M1 A1	Able to substitute values into the formula correctly.
7a	19	B1	
7b	Bar chart / Line graph. It is easier to track the number of latecomers from the height of the bars. Pie chart. The different sectors will represent each month of the year. <u>Not acceptable:</u> Pictogram (too many pictures) Histogram / Stem-&-Leaf (cannot represent months as a range of values)	B1	No explanation given: no marks awarded
8	I do not agree as the vertical axis of the bar chart does not start at 0 yen. I do not agree because the price of the Keisei Skyliner is about 2450 yen and if the price of the Narita Express is about three times, then it should be 7350 yen, which is not shown in the bar chart.	B1	
9a	$\begin{aligned} \text{Gradient} &= \frac{-4 - (-12)}{-1 - 1} \\ &= -4 \\ -12 &= (-4)(1) + c \\ c &= -8 \\ \text{Equation of line is } y &= -4x - 8 \end{aligned}$	M1 M1 A1	Able to substitute values into the formula correctly. Able to substitute values correctly to find c.
10	$\begin{aligned} \pi(10)^2 + 2(\pi)(10)(4) \\ &= 565.4866776 \\ &= 565 \text{ cm}^2 \text{ (3 sf)} \end{aligned}$	M2 A1	M1: Correct substitution of values into formula for area of circle. M1: Correct substitution of values into formula for curved surface area of cylinder.

	Sub $y = -1$ into (1): $x + 4(-1) = 1$ $x - 4 = 1$ $x = 5$	A1	
14	$6 + 6 + \left(\frac{x}{360} \times 2\pi \times 6 \right) = 12 + \frac{32}{3} \pi$ $12 + \frac{12\pi}{360} x = 12 + \frac{32}{3} \pi$ $\frac{12\pi}{360} x = \frac{32}{3} \pi$ $x = \frac{32\pi}{3} \div \frac{12\pi}{360}$ $= 320^\circ$	M1 M1 A1	Able to substitute values into formula for arc length correctly. Able to simplify.
15a	$p = \frac{k}{\sqrt{q}}$ $9 = \frac{k}{\sqrt{16}}$ $k = 36$ $p = \frac{36}{\sqrt{q}}$ When $q = 25$, $p = \frac{36}{\sqrt{25}}$ $= 7\frac{1}{5} / 7.2$	M1 A1	Able to find the correct value of k .
15b	$y = kx^3$ $k = \frac{5}{x^3}$ When x is doubled, $y_{new} = \left(\frac{5}{x^3} \right) (2x)^3$ $= \left(\frac{5}{x^3} \right) (8x^3)$ $= 40$	M1 A1	Able to express the new value of x as $(2x)^3$
16a	$p = 4$ $q = -5$	B1 B1	

16b	$(x+4)^2 - 5 = 0$ $(x+4)^2 = 5$ $x+4 = \pm\sqrt{5}$ $x = \sqrt{5} - 4$ or $x = -\sqrt{5} - 4$ $= -1.76$ (3 sf) $= -6.24$ (3 sf)	M1 A1	Able to include $\pm$ after taking the square root. For both correct answers of x .
17a	$3(2y-5) - 2(7-2y)$ $= 6y - 15 - 14 + 4y$ $= 10y - 29$	M1 A1	Able to expand correctly.
17b	$ac + 3bc - 2ad - 6bd$ $= c(a+3b) - 2d(a+3b)$ $= (a+3b)(c-2d)$	M1 A1	Able to factorise correctly.
18a	$60 = 2^2 \times 3 \times 5$ $100 = 2^2 \times 5^2$ LCM of 60 and 100 = $2^2 \times 3 \times 5^2$ $= 300$	} M1 A1	Able to find the LCM of 60 and 100 correctly.
18b	$\frac{300}{60} + \frac{300}{100}$ $= 8$	M1 A1	Able to use LCM divided by the respective heights.
19a	$\frac{30}{12} \times 27$ $= 67.5g$	M1 A1	Able to apply proportion correctly.
19b	$\frac{200-160}{200} \times 100\%$ $= 20\%$	M1 A1	Able to substitute values into the formula correctly.
20a	$A = (1, 0)$ $B = (5, 0)$ $C = (0, 5)$	B1 B1 B1	
20b	$x = 3$	B1	

21a	+	1	6	4	- 5		B2: All correct B1: Any 4 correct	
	1	2	7	5	- 4			
	6	7	12	10	1			
	4	5	10	8	- 1			
	- 5	- 4	1	-1	-10			
21b	$\frac{5}{8}$						B1	
21c	$\frac{3}{4}$						B1	
22a	$P = \frac{9.412 \times 300}{0.019 - 0.004}$ $= 188240$						M1 A1	Able to substitute values correctly.
22b	$P = \frac{RT}{v - b}$ $P(v - b) = RT$ $Pv - Pb = RT$ $Pb = Pv - RT$ $b = \frac{Pv - RT}{P} / v - \frac{RT}{P}$						M1 A1	Able to expand correctly.
23a	$4x + x - 40 + 2(x - 40) = 720$ $4x + x - 40 + 2x - 80 = 720$ $7x - 120 = 720$ $7x = 840$ $x = 120$ $\text{Smallest angle} = 120 - 40$ $= 80$						M1 A1	Able to formulate the equation correctly.
23b	$\angle DEA = 37^\circ \text{ (}\triangle ABC \text{ is congruent to } \triangle EDA \text{)}$ $\angle BAE = 180 - 90 - 37 - 37$ $= 16^\circ \text{ (sum of angles in a triangle)}$						M1 A1	Able to find $\angle DEA$.

25a	Distance	Tally	Frequency	B1	
	0		7		
	1		6		
	2		5		
	3		2		
	4		4		
	5		3		
	6		2		
	7		1		

25b	 No. of students Distance in	B1	
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25c	0 km	B1	
25d	2 km	B1	
25e	$\frac{0+6+10+6+16+15+12+7}{30}$ $= \frac{72}{30}$ $= 2.4$	B1	

YUHUA SECONDARY SCHOOL
4N MATHEMATICS PRELIMINARY EXAMINATION PAPER 2
MARKING SCHEME

Qn	Solution	Marks	Test Objectives
1a	$1 \text{ cm} : 0.25 \text{ km}$ $1 \text{ cm}^2 : 0.0625 \text{ km}^2$ $\text{Area} = 0.0625 \times 200$ $= 12.5 \text{ km}^2$	M1 A1	Able to find area scale correctly.
1b	$0.78125 \text{ cm}^2 : 12.5 \text{ km}^2$ $1 \text{ cm}^2 : 16 \text{ km}^2$ $1 \text{ cm} : 4 \text{ km}$ $\text{Actual length} = 8.2 \times 4$ $= 32.8 \text{ km}$	M1 A1	Able to find linear scale correctly.
2a	$2 \times \left(\frac{5}{10}\right)\left(\frac{4}{9}\right) + \left(\frac{1}{10}\right)\left(\frac{5}{9}\right) + \left(\frac{5}{10}\right)\left(\frac{1}{9}\right) + \left(\frac{4}{10}\right)\left(\frac{5}{9}\right)$ $= \frac{7}{9}$	M1 A1	Able to substitute the values correctly to find probability.
2b	Let x be the number of green marbles added. $\frac{1+x}{10+x} = 0.4$ $1+x = 4+0.4x$ $0.6x = 3$ $x = 5$	M1 A1	Able to formulate the probability equation correctly.
3a	$\frac{d}{6} = \frac{14}{24}$ $d = \frac{14 \times 6}{24}$ $= 3\frac{1}{2} / 3.5 \text{ cm}$	M1 A1	Able to express the ratio for similar figures.
3b	$\frac{V_L}{196} = \left(\frac{24}{14}\right)^3$ $V_L = \frac{196 \times 13824}{2744}$ $= 987.4285714$ $= 987 \text{ cm}^3 \text{ (3 sf)}$	M1 A1	Able to find volume of similar figures.

4a	$36.3 = \frac{1}{2}(4)^2(\theta)$ $\theta = \frac{36.3}{8}$ $= 4.5375 \text{ radians (shown)}$	M1 A1	Able to apply area of segment correctly.
4b	$\frac{1}{2}(4)(4)\sin(2\pi - 4.5375)$ $= 7.877966898$ $= 7.88 \text{ cm}^2 \text{ (3 sf)}$ OR $6^2 = 4^2 + 4^2 - 2(4)(4)\cos \angle POQ$ $\angle POQ = \cos^{-1}\left(-\frac{4}{32}\right)$ $= 97.18075578^\circ$ $\text{Area} = \frac{1}{2}(4)(4)\sin 97.18075578$ $= 7.937253933$ $= 7.94 \text{ cm}^2 \text{ (3 sf)}$ OR $\text{Area} = \frac{1}{2}(3)(\sqrt{4^3 - 3^2}) \times 2$ $= 7.937253933$ $= 7.94 \text{ cm}^2 \text{ (3 sf)}$	M1 A1 M1 A1 M1 A1	Able to apply area of triangle correctly. Able to apply area of triangle correctly. Able to apply area of triangle correctly.
5a	$(12)(8)(6) + \frac{1}{3}(12)(8)(4.5)$ $= 576 + 144$ $= 720 \text{ cm}^3$	M1 A1	Able to substitute into correct volume formula.
5b	$\sqrt{4.5^2 + 4^2}$ $= 6.020797289$ $= 6.02 \text{ cm (3 sf)}$	B1	

5c	$\tan \angle VNX = \frac{4.5}{4}$ $\angle VNX = \tan^{-1}\left(\frac{4.5}{4}\right)$ $= 48.36646066$ $= 48.4^\circ (1 \text{ dp})$	M1 A1	Able to apply correct trigonometric ratio.
6a	912	B1	
6b	Type A. Because it has a <u>higher median lifetime</u> as compared to Type B.	B1	
6c	$915 - 885 = 30$	B1	
6d	<u>Type B. Because it has a smaller interquartile range.</u> Alternative solution: Shows IQR workings IQR for Type A = $928 - 876$ $= 52$ hours IQR for Type B = $901 - 890$ $= 11$ hours	B2	B1: Type B B1: Correct reason given.
7a	$(11 - x)$ cm	B1	
7b	$x^2 + (11 - x)^2 = 9^2$ $x^2 + 121 - 22x + x^2 = 81$ $2x^2 - 22x + 40 = 0$ $x^2 - 11x + 20 = 0$ (shown)	M1 A1	Able to formulate the equation correctly.
7c	$x^2 - 11x + 20 = 0$ $x = \frac{11 \pm \sqrt{(-11)^2 - 4(1)(20)}}{2(1)}$ $= \frac{11 \pm \sqrt{41}}{2}$ $x = \frac{11 + \sqrt{41}}{2} \quad \text{or} \quad x = \frac{11 - \sqrt{41}}{2}$ $= 8.701562119 \quad \quad \quad = 2.298437881$ $= 8.70 (2 \text{ dp}) \quad \quad \quad = 2.30 (2 \text{ dp})$	M1 A2	Able to substitute the values into formula correctly.
8a	$9x^2 - 12x + 4$ OR	B2	

	$9x^2 - 6x - 6x + 4$ $= 9x^2 - 12x + 4$	M1 A1	Able to expand correctly.
8b	$\frac{7(x-5) - 2(3x+2)}{(3x+2)(x-5)}$ $= \frac{7x-35-6x-4}{(3x+2)(x-5)}$ $= \frac{x-39}{(3x+2)(x-5)}$	M1 A1	Able to express into a single fraction with common denominator. Accept $\frac{x-39}{3x^2-13x-10}$
8c	$3(5x-1) < 2(4x+8)$ $15x-3 < 8x+16$ $7x < 19$ $x < \frac{19}{7} / 2 \frac{5}{7} / 2.71$	M1 A1	Able to multiply both sides with LCM.
9a	31.2 (1 dp)	B1	
9b	See last page for the drawing of graph	C2	C1: All points plotted correctly C1: Smooth curve
9c	$x = 1.85(\pm 0.5)$	B1	
9d	$17.5(\pm 0.5)$	B1: drawing of tangent B1: value of gradient	
10a	$(2)(831.4) + \pi(1.5)^2(15)$ $= 1662.8 + 106.0287521$ $= 1768.828752$ $= 1770 \text{ cm}^3 \text{ (3 sf)}$	M2 A1	M1: Volume of prisms M1: Volume of cylinder
10b	Mass of dumbbell $= \frac{1768.828752}{100^3} \times 7000$ $= 12.38180126 \text{ kg}$	M2	M1: Conversion from cm^3 to m^3 . M1: Correct formula to find mass.

	$\frac{25}{2.204} = 11.3430127 \text{ kg}$ OR $12.38180126 \times 2.204 = 27.28948998 \text{ pounds}$ Since $12.38180126 \text{ kg} > 11.3430127 \text{ kg} / 27.28948998 \text{ pounds} > 25 \text{ pounds}$, Vincent <u>should not</u> use this dumbbell.	M1 M1 M1 A1	Conversion from pounds to kg. Conversion from kg to pounds. Correct comparison in mass.
11ai	34 kg	B1	
11aii	$\text{IQR} = 39 - 27$ $= 12 \text{ kg}$	M1 A1	Able to read the values of LQ and UQ correctly.
11aiii	$80 - 40 = 40$	B1	
11bi	$\frac{(4)(10) + (8)(18) + (14)(26) + (30)(34) + (24)(42)}{80}$ $= \frac{2576}{80}$ $= 32.2 \text{ kg}$	B1	
11bii	S.D. = 9.03 kg	B2	
11c	The curve for farm B will be <u>on the left side</u> of the curve for farm A. OR The graph looks steeper.	B1 B1	
12ai	$\frac{QR}{\sin 60} = \frac{80}{\sin 85}$ $QR = \frac{80 \sin 60}{\sin 85}$ $= 69.54667841$ $= 69.5 \text{ km (3 sf)}$ Alternative solution: $(QR)^2 = 80^2 + 46^2 - 2(80)(46) \cos 60$ $QR = \sqrt{4836}$ $= 69.5413546$ $= 69.5 \text{ km (3 sf)}$	M1 A1 M1 A1	Able to apply sine rule correctly. Able to apply cosine rule correctly.

12aii	$\tan \angle R = \frac{0.035}{69.54667841}$ $\angle R = 0.028834621$ $= 0.03^\circ \text{ (2 dp)}$	M1 A1	Able to apply correct trigonometric ratio.
12bi	$180^\circ - 23^\circ = 157^\circ$ (Angles in opposite segment)	B1	No/Incorrect reason given: (-1) mark overall.
12bii	$\angle CER = 90^\circ$ (Radius perpendicular to tangent) $\angle AER = 90^\circ - 23^\circ$ $= 67^\circ$	B1	No/Incorrect reason given: (-1) mark overall.
12biii	$\angle DAP = 67^\circ - 38^\circ$ (Exterior angle of triangle) $= 29^\circ$ $\angle DAE = 90^\circ - 29^\circ$ $= 61^\circ$	M1 A1	Able to find $\angle DAP$ No/Incorrect reason given: (-1) mark overall.

Subject ANA Prelim Exam

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