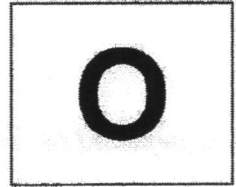




**SWISS COTTAGE SECONDARY SCHOOL
SECONDARY FOUR
PRELIMINARY EXAMINATION**



Name: _____ () Class: _____

MATHEMATICS

4048/01

Paper 1

Thursday 27 August 2020

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.

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 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, unless the question requires the answer in terms of π .

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

The total number of marks for this paper is 80.

For Examiner's use

80

This document consists of 18 printed pages.

Setter: Ms Yeo Koon Koon
Vetter: Mdm Zoe Pow

[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 (42 marks)
Answer all the questions.

- 1 Write the following numbers in order of size, starting with the **smallest**.

$$\frac{2}{3}, \quad \left(\frac{3}{5}\right)^2, \quad \frac{3}{5}, \quad 0.66\bar{7}$$

Answer

[1]

2 (a) Calculate $\frac{12^3 - \sqrt{22.572 - 5.3 \times (-2)}}{3.109}$.

Write down the first five digits on your calculator display.

Answer

[1]

- (b) Write down your answer to part (a) correct to 4 significant figures.

Answer

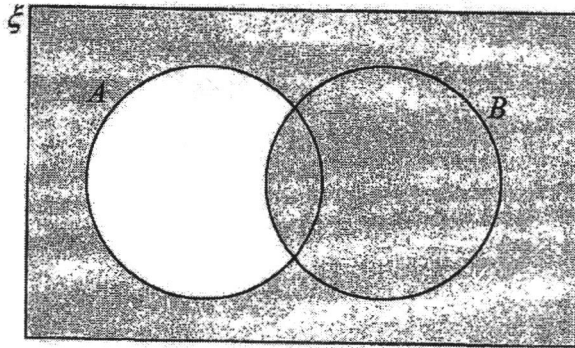
[1]

- 3 Find the greatest perfect square number that satisfies the inequality $4x + 7 < 180$.

Answer

[2]

- 4 (a) Write down the set represented by the shaded region.

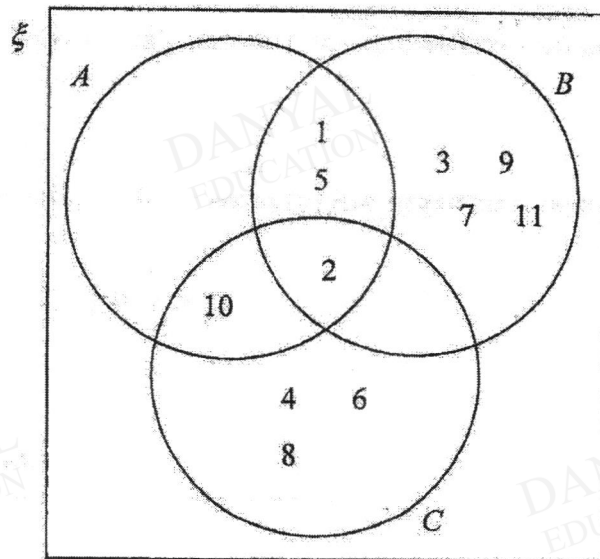


Answer

[1]

- (b) $\xi = \{\text{integers } x : 1 \leq x \leq 11\}$

The Venn diagram shows the elements of ξ and three sets A , B and C .



Underline the **incorrect** statements from the list below.

$A \subset B$ $B \cap C = \{ \}$ $B \cap A = \{1, 5\}$ $2 \in (A \cap B \cap C)$ $\emptyset \subset C$

[2]

- 5 Show that $2^{x+2} + \left(\frac{1}{2}\right)^{-x-1} - \sqrt{4^x}$ is divisible by 5 for all real positive integer values of x .

Answer

[3]

- 6 One solution of the equation $(h-1)x^2 = -hx - 10$ is $x = -2$.

Find

- (a) the value of h ,

Answer $h =$.

[1]

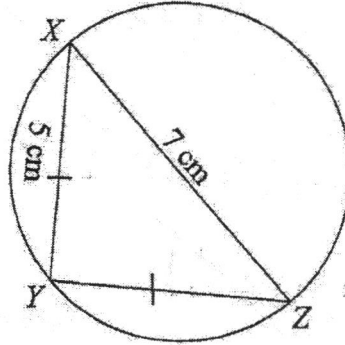
- (b) the second possible value of x .

Answer $x =$.

[1]

- 7 The diagram shows an isosceles triangle inscribed in a circle.
 $XZ = 7$ cm and $XY = YZ = 5$ cm.

Explain why XZ is not a diameter of the circle.



[2]

- 8 The hire-purchase price of an Orange Macnote is \$1899.
 The hire-purchase price is a deposit plus 12 equal monthly payments of \$132.93.

Express the deposit as a percentage of the hire-purchase price.

Answer

...% [3]

- 9 The table shows the market values of 160 homes at Swiss Cottage estate.

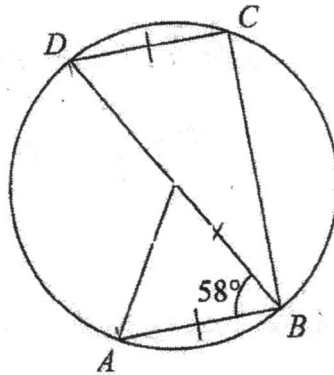
Market values (\$ x)	Number of homes
$200\,000 < x \leq 300\,000$	20
$300\,000 < x \leq 400\,000$	14
$400\,000 < x \leq 500\,000$	75
$500\,000 < x \leq 600\,000$	26
$600\,000 < x \leq 3\,000\,000$	25

The mean market value of the homes at Swiss Cottage estate is \$643 437.50.

Explain if the mean is a fair representation of the market values of homes at Swiss Cottage estate.

[1]

10



In the diagram, A , B , C and D are points on a circle, centre O .
Angle $OBA = 58^\circ$, $CD = AB$ and DOB is a straight line.

- (a) Find angle ODA .

Answer

[2]

- (b) State the name of the quadrilateral $ABCD$.

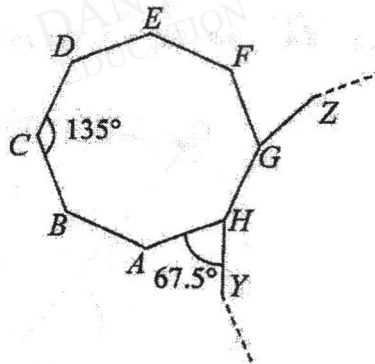
- 11 Leslie runs an online tour agency which only sells air tickets.
 In 2018 he sold 17 560 one-way air tickets and 8 000 return air tickets.
 His aim is that at least 65% of the air tickets sold in 2019 should be return air tickets.

Assuming that he sold the same number of one-way air tickets in 2019, work out the smallest number of additional return air tickets that he would need to sell in order to achieve his aim.

Answer

[3]

- 12 The diagram shows a regular octagon, $ABCDEFGH$ and $ZGHY$, part of a second regular polygon.
 Angle $BCD = 135^\circ$ and angle $AHY = 67.5^\circ$.



Find the number of sides in the second regular polygon.

Answer

[3]

- 13 An Olympic size swimming pool can hold 660 253 gallons of water.
A model of this swimming pool is built to a scale of 1 : 11.

Find the volume of water the model can hold and round off your answer to the nearest m^3 .
[1 gallon of water : 3.7854 litres of water]

Answer . m^3 [4]

- 14 (a) Factorise completely $2x^2 + x - 6$.

Answer [2]

- (b) Hence factorise completely $2(z-3)^2 + (z+4) - 13$.
Write your answer as simply as possible.

Answer [2]

- 15 (a) In Swiss Canteen, the fruits stall sells only Fuji apples and Brown pears. The mean mass of all fruits is 160 grams. In the stall, there are 25 more apples than pears.

The mean mass of the apples is 152 grams.

The mean mass of the pears is 170 grams.

Calculate the total number of fruits in the fruits stall.

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- (b) Ali intends to buy 2 fruits from the fruits stall.

Find the probability of him buying 1 apple and 1 pear.

Answer

[4]

Answer

[2]

Name : _____ ()

Class :

Section B (38 marks)
Answer **all** the questions.

- 16 (a) Petrol costs $35s$ cents per litre.
Phoebe buys some petrol and it costs her $\$24t$.

Find an expression, in terms of s and t , for the number of litres that Phoebe buys.

Answer

1 [2]

- (b) 97 litres of water was collected in the cylindrical container after 2 hours.

Find the time taken to fill a volume of 200 litres.
Give your answer in hours and minutes, correct to the nearest minute.

Answer h min [2]

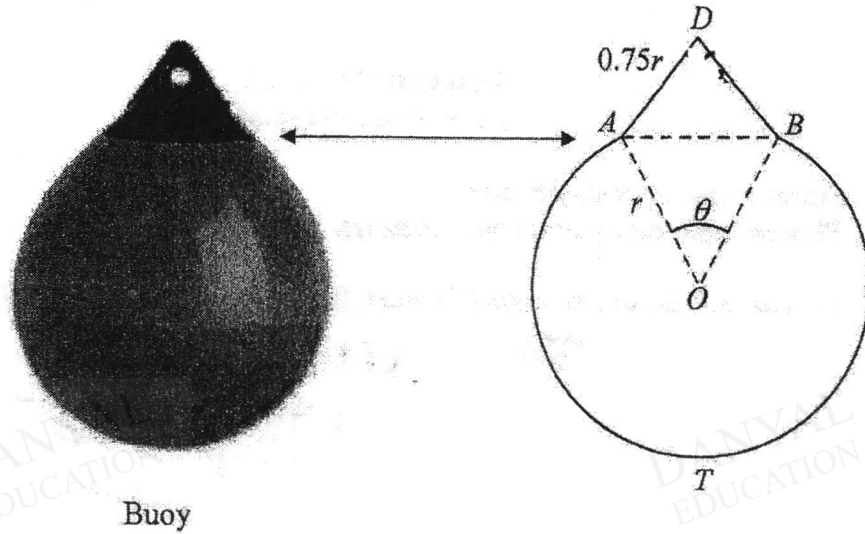
- (c) p is inversely proportional to q^3 .

If q is decreased by 25%, find the percentage increase in p .

Answer

% [2]

- 17 The diagram below shows a buoy.



The cross-section of the buoy can be modelled as a segment ATB and an isosceles triangle ADB with sides $AD = BD = 0.75r$ m. Angle AOB is θ radians and $OA = r$ m.

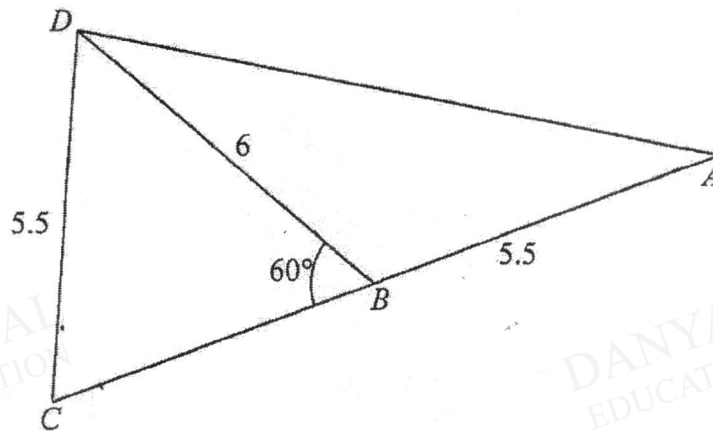
- (a) If the arc length of the segment ATB is 7 times that of the length of AD , find the value of θ .

Answer radians [2]

- (b) If $r = 2$ m and angle $ADB = 1.338$ radians, calculate the area of Diagram I.

Answer m^2 [3]

- 18 In the diagram, ACD is an acute triangle.
 B is the point on AC such that angle $CBD = 60^\circ$.
 $AB = CD = 5.5$ cm and $BD = 6$ cm.



Calculate

- (a) angle BCD ,

- (b) the length of AD .

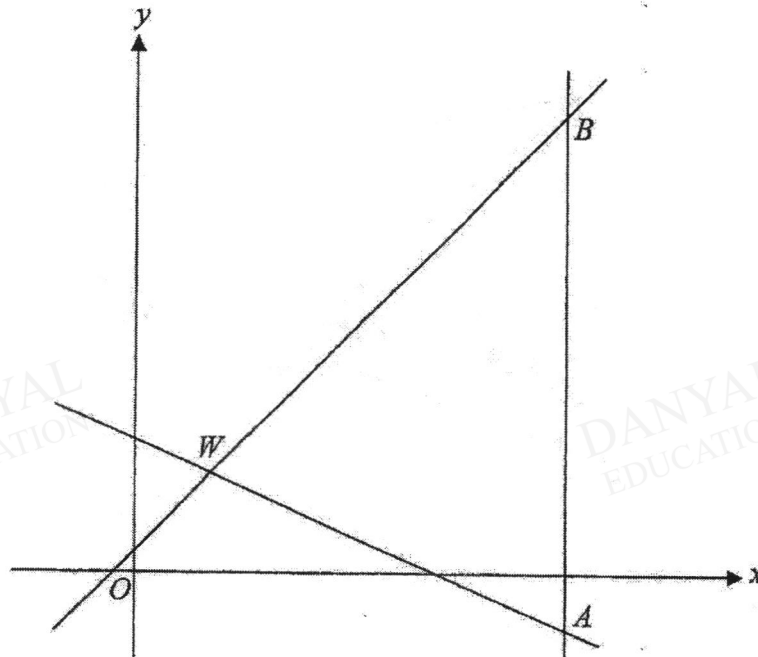
Answer

[2]

Answer

cm [3]

- 19 The diagram, which is not drawn to scale, shows three lines $x=10$, $y=8-x$ and $2y=5x+2$.



- (a) Find the coordinates of W .

Answer $W = (\quad , \quad)$ [2]

- (b) Calculate the area of triangle AWB .

Answer $\quad \text{units}^2$ [2]

- 20 (a) Express 360 as the product of its prime factors.

Answer

[1]

- (b) The number $\frac{360}{h}$ is a perfect square.

Find the smallest positive integer value of h .

Answer $h =$

[1]

- (c) k is a number between 200 and 420.
The highest common factor of 360 and k is 40.

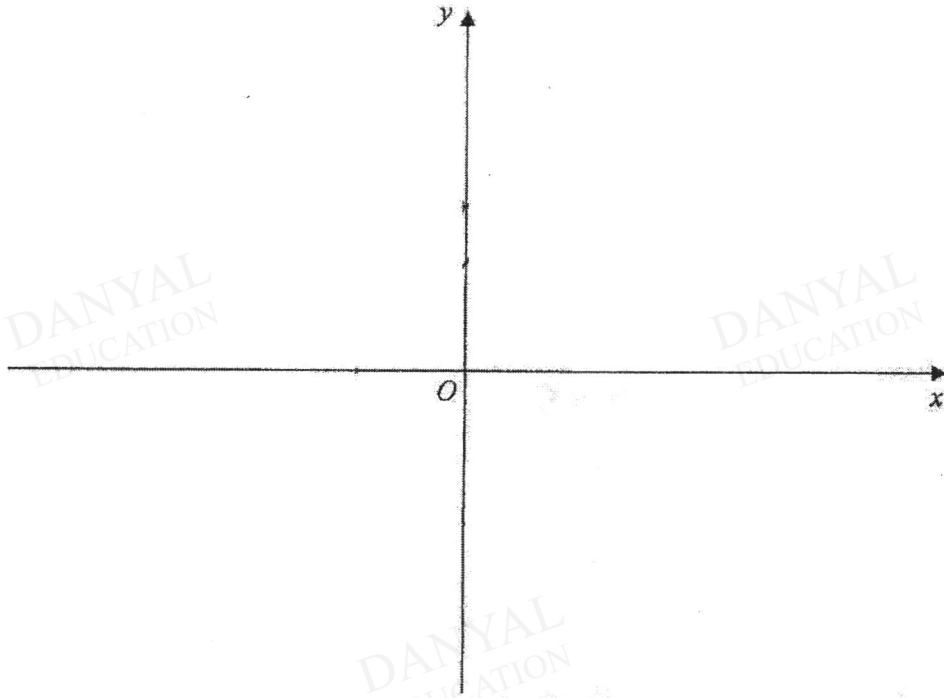
Find the smallest possible value of k .

Answer $k =$

[2]

- 21 (a) Sketch the graph of $y = -(x-8)(x+3)$ on the axes below.

Indicate clearly the coordinates of the points where the graph crosses the x and y -axes and the maximum point on the curve.



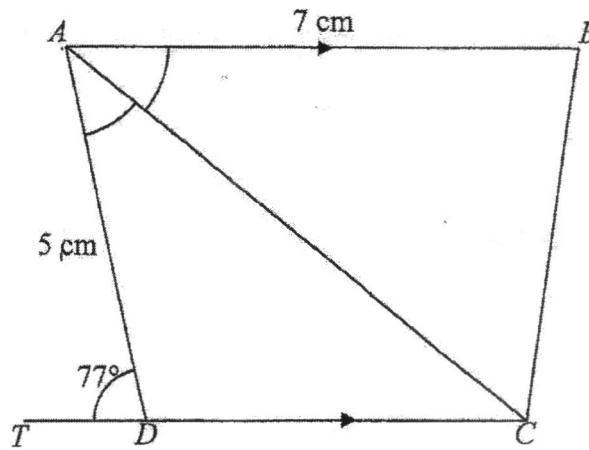
[3]

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

Answer

[1]

22



$ABCD$ is a trapezium.

AC bisects angle BAD .

$AD = 5\text{ cm}$, $AB = 7\text{ cm}$ and angle $ADT = 77^\circ$.

Calculate the area of trapezium $ABCD$.

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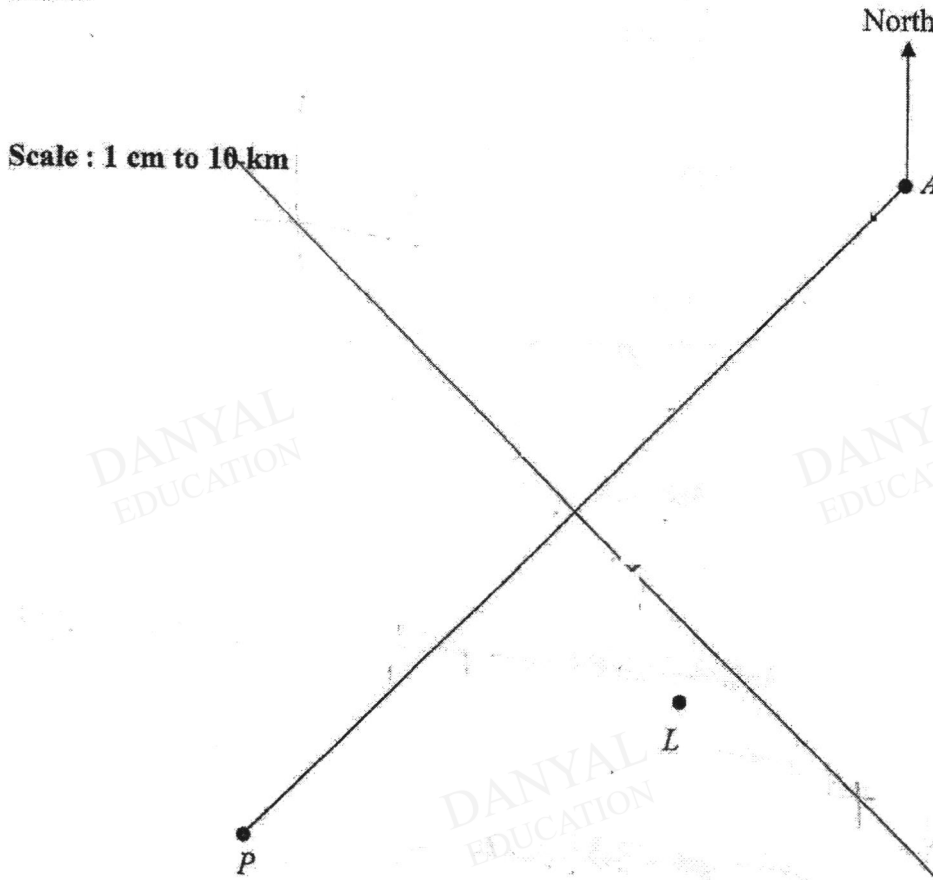
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Answer

cm^2 [4]

- 23 In the scale drawing, L is a lighthouse, A is a ship and P is a port. The line AP shows the ship's course.



- (a) Measure the bearing of P from A .

Answer

[1]

- (b) The light from the lighthouse is visible to all ships within a radius of 40 km.

Using your diagram, estimate the duration with which the light can be seen from the ship while it sails at an average speed of 35 km/h.

Give your answer in hours and minutes, correct to the nearest minute.

Answer

. h .. min

[4]

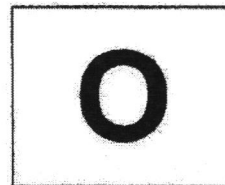
- (c) The location of a buoy, B , equidistant from A and P , is visible from the lighthouse.

Indicate the possible location of the buoy and label it as B .

[1]



SWISS COTTAGE SECONDARY SCHOOL
SECONDARY FOUR
PRELIMINARY EXAMINATION



Name: _____ ()

Class: _____

MATHEMATICS

4048/02

Paper 2

Monday 31 August 2020

2 hours 30 minutes

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.

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 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, unless the question requires the answer in terms of π .

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

The total number of marks for this paper is 100.

This document consists of 26 printed pages and 2 blank pages.

Setter: Ms Leung Yan Ru

Vetter: Mdm Zoe Pow

[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 (40 marks)

1 (a) Simplify $\frac{9b^3c}{d} + \frac{3bc}{d^2}$.

Answer

[1]

(b) Simplify $\frac{12x^2 - 75}{2x^2 - 3x - 20}$.

Answer

[3]

(c) It is given that $s = 2at^2 - gt^2 + ag$.

(i) Evaluate s when $t = 2$, $a = -3$ and $g = -5$.

Answer $s =$

[1]

- (ii) Express t in terms of a , s and g .

Answer $t =$

[2]

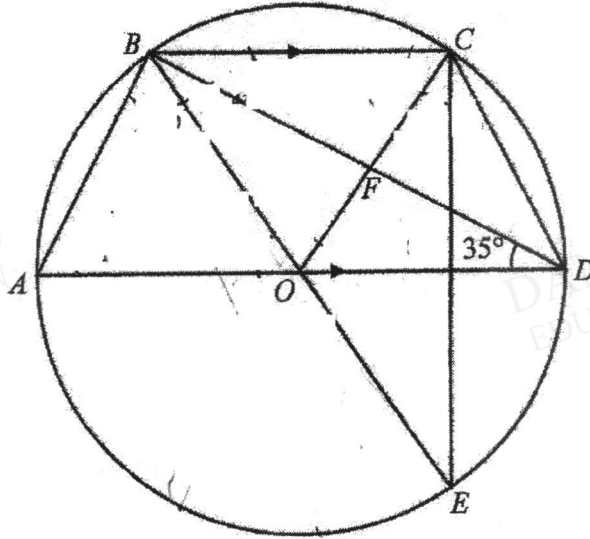
- (d) Solve the equation $\frac{3}{x+2} + \frac{4}{x-3} = 2$.

Answer $x =$

or

[4]

- 2 The diagram shows a circle $ABCDE$, centre O .
 AD and BE are diameters of the circle and BC is parallel to AD .
 F is the intersection of OC and BD .
 Angle $BDA = 35^\circ$.



- (a) Find, giving reasons for each answer,

(i) angle BOC ,

Answer

[2]

(ii) angle BEC ,

Answer

[1]

(iii) angle BDC ,

Answer

[1]

(iv) angle ABC .

Answer

[1]

- (b) Given that angle $BXC = 15^\circ$, determine if X lies inside, on the circumference of or outside the circle $ABCDE$.
Justify your answer with clear reasoning.

Answer

[2]

- (c) Show that triangle BCF is similar to triangle DOF .

Answer

Answer

[2]

- 3 A prata shop operates for 7 days a week.
The matrix, M , shows the number of pratas of different types that are sold each day.

$$M = \begin{matrix} & \begin{matrix} \text{Plain} & \text{Egg} & \text{Milo} & \text{Chocolate} \end{matrix} \\ \begin{pmatrix} 57 & 38 & 23 & 18 \\ 42 & 29 & 13 & 16 \end{pmatrix} & \begin{matrix} \text{Regular} \\ \text{Upsize} \end{matrix} \end{matrix}$$

- (a) Evaluate the matrix $P = 7M$.

Answer

[1]

- (b) Plain pratas cost \$0.50 each to make.
Egg pratas cost \$0.75 each to make.
Milo pratas cost \$1.20 each to make.
Chocolate pratas cost \$1.20 each to make.

Represent these amounts in a 4×1 column matrix N .

Answer

[1]

- (c) Evaluate the matrix $T = PN$.

Answer

[2]

- (d) State what each of the elements of T represents.

Answer

[1]

- (e) The prata shop sells each prata for 50% more than it costs to make.
 One week they sold $\frac{7}{8}$ of each type of the regular pratas and $\frac{17}{20}$ of each type of the
 upside pratas made that week.
 The unsold pratas were thrown away.

- (i) Using matrix multiplication, calculate the total cost of making the pratas in a week.

Answer \$

[1]

- (ii) Find the total profit the prata shop made that week.

Answer \$

[3]

- 4 The variables x and y are connected by the equation $y = \frac{2x^3}{7} - x + 3$.

Some corresponding values of x and y are given in the table below.

x	-4	-3	-2	-1	0	1	2	3
y	-11.29	-1.71	2.71	p	3	2.29	3.29	7.71

- (a) Find the value of p .

Answer $p =$

[1]

- (b) Using a scale of 2 cm to represent 1 unit, draw a horizontal x -axis for $-4 \leq x \leq 3$.
Using a scale of 1 cm to represent 1 unit, draw a vertical y -axis for $-12 \leq y \leq 8$.
On your axes, plot the points given in the table and join them with a smooth curve.

[3]

- (c) Use your graph to write down an inequality in x to describe the range of values where $y > 3$.

Answer

[1]

- (d) By drawing a suitable straight line on the graph, estimate the solutions to

$$\frac{2x^3}{7} - 2x + 1 = 0.$$

Answer $x =$

or $x =$

[4]

- (e) By drawing tangent(s), find the x -coordinate(s) of the point(s) at which the gradient of the curve $y = \frac{2x^3}{7} - x + 3$ is 2.

Answer

[2]

Name:

Class:

Section B (60 marks)

5 Jared went on a journey of 120 km.

- (a) Jared took x minutes to drive the first 45 km at a constant speed.

Write down an expression in terms of x , for his speed in km/h for the first 45 km.

Answer km/h [1]

- (b) It took Jared $(x + 40)$ minutes to drive the rest of the distance at a different constant speed.

Write down an expression in terms of x , for his speed in km/h for this part of the journey.

Answer km/h [1]

- (c) Jared's speed for the first part of the journey was 25 km/h faster than for the second part.

Write down an equation in x to represent this information, and show that it reduces to $x^2 + 112x - 4320 = 0$.

Answer

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- (d) Solve the equation $x^2 + 112x - 4320 = 0$, giving your solutions correct to 2 decimal places.

Answer $x =$ or [4]

- (e) Calculate Jared's speed, in km/h, for the first 45 km.

Answer km/h [2]

- 6 (a) Amy decides to deposit \$8200 in a bank account offering compound interest at 5.2% per annum, compounded once every three months.

Calculate the total amount of interest she has earned after 3 years.
Give your answer correct to the nearest cent.

Answer \$ [3]

- (b) The exchange rate between Singapore dollars (\$) and euros (€) is SGD\$1 = €\$0.63.

Amy goes on a trip to Germany and chances upon a leather jacket that costs €143.20 in shop A.

- (i) Calculate how much the leather jacket costs in Singapore dollars.

Answer \$ [2]

- (ii) Amy leaves shop A without making a purchase.
Amy enters Shop B and sees a similar leather jacket.
Shop B is offering a 25% discount for all its products.
The original price of the leather jacket in Shop B is €189.90.

Which shop's leather jacket is more value for money?
Justify your answer with mathematical calculations.

Answer Shop [2]

- (c) Amy books 3 nights in the hotel in Germany.
The hotel pricing is €156 per night.
She pays using her credit card.
The credit card company converts the prices to Singapore dollars.
Amy is charged a fee of 2.5% for the currency conversion.

Calculate the total amount Amy pays for the hotel stay, including the credit card fee.
Give your answer correct to the nearest dollar.

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Answer \$

[3]

- 7 (a) These are the first four terms in a sequence.

11, 7, 3, -1, ...

- (i) Find an expression, in terms of n , for the n th term of the sequence.

Answer

[2]

- (ii) Explain why it is not possible for a term in the sequence to be a multiple of 4.

Answer

[1]

- (b) The first four terms in another sequence of numbers, $T_1, T_2, T_3, T_4, T_5, \dots$, are given below.

$$T_1 = 4^2 + 4 = 20$$

$$T_2 = 4^3 + 16 = 80$$

$$T_3 = 4^4 + 36 = 292$$

$$T_4 = 4^5 + 64 = 1088$$

- (i) Find T_5 .

Answer

[1]

- (ii) Find an expression, in terms of n , for the n th term, T_n , of this sequence.

Answer

[3]

- (iii) Evaluate T_{20} .

Leave your answer in standard form.

Answer

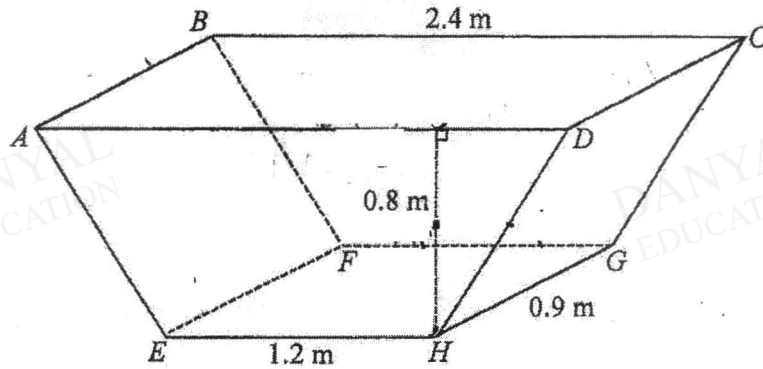
[1]

- (iv) Find and simplify an expression, in terms of n , for $T_{n+1} - T_n$.

Answer

[2]

- 8 The diagram below shows an open water tank.
 Both the base $EFGH$ and the top $ABCD$ are horizontal and rectangular.
 Each of the sides $ADHE$ and $BCGF$ is a trapezium.
 $BC = AD = 2.4$ m, $FG = EH = 1.2$ m, $AB = DC = EF = HG = 0.9$ m, $AE = BF = CG = DH$ and
 the perpendicular height of $ADHE$ is 0.8 m.



- (a) Calculate the total external surface area of the tank.

Answer

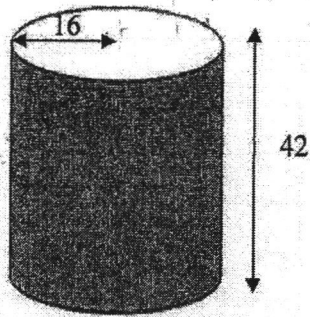
m^2 [3]

- (b) Calculate the volume of the tank.

Answer

m^3 [2]

A cylindrical bucket is used to transfer water to the tank.
The cylindrical bucket has radius 16 cm and a height of 42 cm.



- (c) Calculate the volume of the bucket.

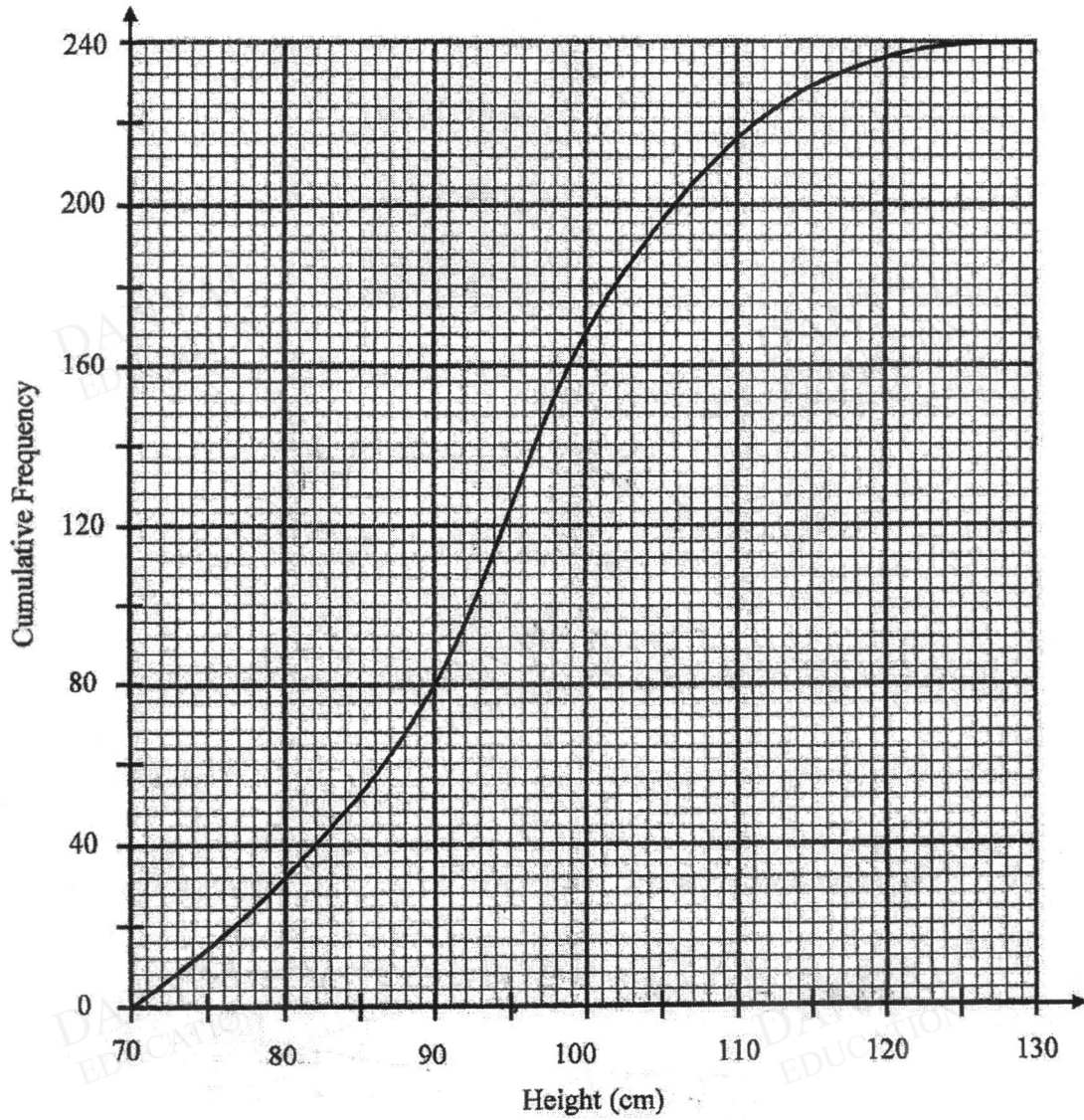
Answer cm^3 [2]

- (d) Find the number of buckets of water required to fill the empty tank to a height of 0.4 m.

Answer

[3]

- 9 (a) The cumulative frequency curve below shows the heights of 240 children in a church in March.



- (i) Use the curve to estimate the median heights.

Answer cm [1]

- (ii) Use the curve to estimate the interquartile range of their heights.

Answer cm [1]

- (iii) 65% of the children have a height of at least x cm.

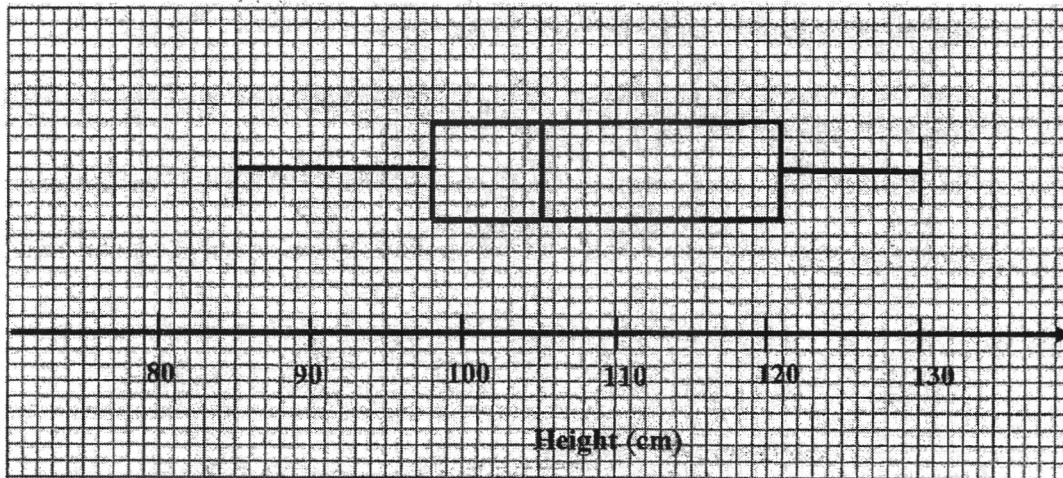
Find x .

Answer

cm

[2]

- (iv) The heights of the same 240 children in April were also recorded. The box-and-whisker plot shows the distribution of their heights.



Make two comments comparing the heights of the 240 children in the month of March and April.

[2]

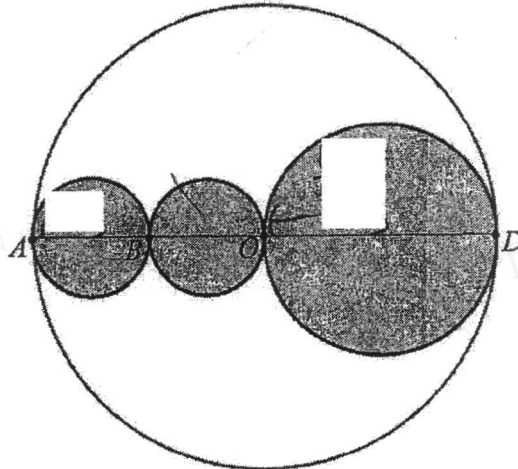
Name: _

Class: .

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Instructions: Answer the 2020 S4E Preliminary Paper 2 Page 24 Section B Question 9b here

(b)



In the diagram, $ABOD$ is a straight line passing through the centre of all 4 circles. The two smallest circles are identical and O is the centre of the largest circle. A point is chosen at random inside the largest circle.

Find, as a fraction in its simplest form, the probability that the point lies in the **unshaded** region.

Answer

[3]

- 10 In 2020, the world experienced a global pandemic, COVID-19. Vee enterprise decided to start manufacturing adult size disposable surgical masks, one of the highest demanded item due to COVID-19. Information that Vee enterprise needs is on page 27.

- (a) Vee Enterprise is new in this line of work. As a start, it would like to import the adult size disposable face mask welding machine and 1 kg of each raw material required.

Assuming that the machine and raw materials are from the same factory, calculate the cost required to import them. [3]

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- (b) As part of the government policy, Vee Enterprise can only operate for 2.5 hours per day.

Determine the maximum number of adult size disposable surgical mask Vee Enterprise can produce in a working day using the materials imported in part (a).

Justify your answer with proper working and conclusion.

[7]

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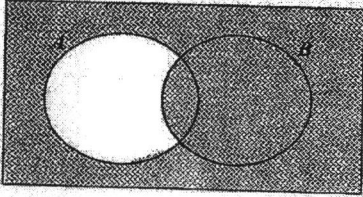
Types of shipping	Cost
By air freight	\$4.80 for the first 0.50 kg \$3 for the subsequent 0.5 kg
By sea freight	\$3.52 for the first 0.80 kg \$1.90 for the subsequent 0.5 kg

Parts of an adult size surgical face mask		Quantity	Measurements
1	Blue Nonwoven Fabric	1	17 by 9.5 cm
2	Filtering Material	1	17 by 9.5 cm
3	White Nonwoven Fabric	1	19 by 9.5 cm
4	Plastic Nose Wire	1	15 cm
5	Round Elastic Band	2	15 cm

Item	Description of Item	Cost of item
Adult Size Disposable Face Mask Welding Machine	Weight: 180 kg Speed of production: 15 face masks per min Shipping: By sea freight	\$6 850 per machine
Blue Nonwoven Fabric	Width: 7 m per kg Length: 7 m per kg Shipping: By sea freight	\$3.48 per kg
Filtering Material	Width: 7 m per kg Length: 7 m per kg Shipping: By sea freight	\$4.60 per kg
White Nonwoven Fabric	Width: 7 m per kg Length: 7 m per kg Shipping: By sea freight	\$3.48 per kg
Plastic Nose Wire	580 m per kg Shipping: By sea freight	\$4.17 per kg
Elastic Ear Loop Band	780 m per kg Shipping: By sea freight	\$7.41 per kg

End-of-paper

Error Analysis to 2020 PRELIM Elementary Math Paper 1

Qn	Solution	Error Analysis
1	$\left(\frac{3}{5}\right)^2, \frac{3}{5}, \frac{2}{3}, 0.66\bar{7}$	No major concern
2a	$\frac{12^2 - \sqrt{22.572 - 5.3 \times (-2)}}{3.109} \approx 533.95$	No major concern
2b	554.0	No major concern
3	$4x + 7 < 180$ $4x < 173$ $x < 43\frac{1}{4}$ Greatest perfect square is 36.	Application: There were students using trial and error to achieve answer though they just have to solve inequality. Conceptual: Most students understand perfect square does not include rational number as there will be infinitely many sol to this question.
4a	E  $B \cup A'$ or $(A \cap B)' \cup B$ or $(A \cap B) \cup A'$ or $(A \cap B)'$	No major concern
4b	$A \subset B$ $B \cap C = \{ \}$ $B \cap A = \{1, 5\}$	Careless: Some students underline the correct relations.
5	$2^{x+2} + \left(\frac{1}{2}\right)^{-x-1} - \sqrt{4^x}$ $= 2^{x+2} + 2^{x+1} - \sqrt{2^{2x}}$ $= 2^{x+2} + 2^{x+1} - 2^x$ $= 2^x(2^2) + 2^x(2) - 2^x$ $= 2^x(2^2 + 2 - 1)$ $= 2^x(5)$ Since $2^{x+2} + \left(\frac{1}{2}\right)^{-x-1} - \sqrt{4^x} = 2^x(5)$ which has a factor of 5, hence its divisible by 5.	Application: 1) Many students stopped at $2^{x+2} + 2^{x+1} - 2^x$ stage and could not proceed to factorise the common factor 2^x as most students could not associate 2^x like a normal algebra term x. 2) Most students missed the conclusion part. They are required to comment on the divisibility of 5, such as ... can be expressed as the multiples of 5, factors of 5 or coefficient of 2^x is 5 etc.

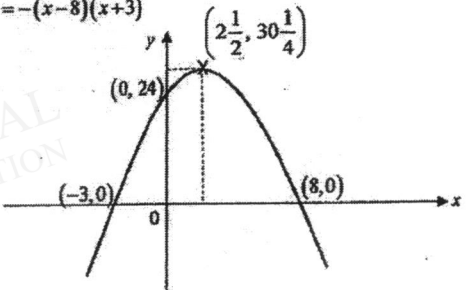
Qn	Solution	Error Analysis
6a	$(h-1)x^2 = -hx - 10$ is $x = -2$ $(h-1)(4) = 2h - 10$ $4h - 4 = 2h - 10$ $2h = -6$ $h = -3$	No major concern
6b	$4x^2 + 3x - 10 = 0$ $(4x - 5)(x + 2) = 0$ $x = \frac{5}{4}$	Application: 1) Still a major concern as most students could not perform cross-method. 2) Some students used quadratic formula to achieve the answer. 3) There are a couple of careless mistakes here and there esp dealing with change of sign.
7	$(XY)^2 + (YZ)^2 = 5^2 + 5^2 = 50$ $(XZ)^2 = 7^2 = 49 \neq 50$ By the <u>converse of Pythagoras' thm</u> , $\angle XYZ \neq 90^\circ$. Hence by the <u>converse of right-angle of a semicircle</u> , XZ is not the diameter of the circle.	Application: 1) Students were confused of the main concept that link 90° to the diameter of the circle. 2) Most students did not state Pythagoras' Thm, Cosine rule, etc. Note that all Explain, show question requires you to state what you are using to prove the case.
8	Sum of 12 installments = $132.93 \times 12 = \$1595.16$ Deposit = $1899 - 1595.16 = \$303.84$ % of deposit = $\frac{303.84}{1899} \times 100 = 16\%$	No major concern
9	Given the mean of Swiss Cottage estate is \$643 437.50 from the distribution, <u>only 25 out of 160 homes which is 15.625% \leq 50% of the distribution of homes was represented.</u> Thus the mean is not a fair representation for the values of homes at Swiss Cottage Estate.	Application: 1) This question is a statistic question, but surprisingly, most students did not use tools like % to explain. 2) Most stated how to derive the mean and not explain why the mean here (which is calculated based on the data) was not relevant. 3) Many students were confused with the <u>definition of Outliner</u> .
10a	$\angle BAD = 90^\circ$ (right angle in a semicircle) $\angle ODA = 180 - 90^\circ - 58^\circ = 32^\circ$	No major concern
10b	ABCD is a rectangle.	No major concern
11	Let the extra number of return tickets by x. $\frac{8000 + x}{17560 + 8000 + x} \geq 0.65$ $8000 + x \geq 0.65(25560 + x)$ $8000 + x \geq 16614 + 0.65x$ $0.35x \geq 8614$ $x \geq 24611.42857$	No major concern though some confused by themselves of their representation of x. Also some students round off the intermediate answer too early thus results in accuracy issue.

Qn	Solution	Error Analysis
	The smallest additional number of return air ticket is 24612.	
12	$\text{Interior angle of } 2^{\text{nd}} \text{ polygon} = 360^\circ - 135^\circ - 67.5^\circ = 157.5^\circ$ $\text{Number of sides} = \frac{360}{180 - 157.5}$ $= 16 \text{ sides}$	No major concern
13	<p>660253 gallon of water : 2499321.706 litres $= 2\,499\,321\,706 \text{ cm}^3$</p> <p>11 cm : 1 cm $1331 \text{ cm}^3 : 1 \text{ cm}^3$ $2\,499\,321\,706 \text{ cm}^3 : 1877777.39 \text{ cm}^3$ $= \frac{1877777.39}{1000000} \text{ cm}^3 \approx 2 \text{ m}^3$</p>	<p>Application: A lot of students do not know how to do conversion question. Such as 1 ml = 1 cm³, 1000 ml = 1000 cm³ = 1 litre. Many students took 1 m³ = 1 litre.</p>
14	$2x^2 + x - 6$ $= (2x - 3)(x + 2)$	No major concern
	$2(-3)^2 + (-3 + 4) - 13$ $= 2(-3)^2 + (-3) - 9$ $= 2(-3)^2 + (-3) - 6$ $= [2(-3) - 3][(-3) + 2]$ $= [2(-9)][(-1)]$	<p>Application: Again a lot of students do not know how to link this question to the previous part's answer. In fact, it's vital to show</p> $2(-3)^2 + (-3) - 6 :$ <p>$2x^2 + x - 6$ so that you can use the factorise format in this part of the question.</p>
15a	<p>Let the number of pears be x.</p> <p>Total mass of apples = $152(x + 25)$</p> <p>Total mass of pears = $170x$</p> <p>Mean mass = 160</p> $\frac{170x + 152x + 3800}{x + x + 25} = 160$ $322x + 3800 = 320x + 4000$ $2x = 200$ $x = 100$ <p>Total fruits = 225</p>	No major concern
15b	<p>P(2 different fruits)</p> $= 2 \times \left[\frac{\binom{125}{225} \times \frac{100}{224}}{252} \right]$ $= \frac{125}{252} / 0.496$	No major concern though some students only have 1 choice and not 2 choices of choosing 2 different fruits.

Section B

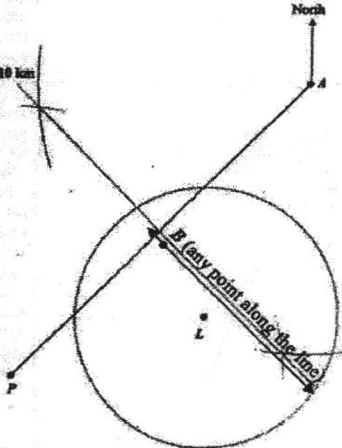
Qn	Solution	Error Analysis
16a	<p>35s cents : 1 litre</p> <p>1 cent : $\frac{1}{35s}$ litres</p> <p>$24t \times 100 : \frac{2400t}{35s}$ litres $\approx \frac{480t}{75s}$ or $68.6 \frac{t}{s}$ litres</p>	<p>1) A lot of students simplify to $0.35s$ as the denominator instead or did not answer in simplest form - P Error.</p> <p>2) Wrong Units used \Rightarrow M0A0</p>
16b	<p>97 litres : 2 hours</p> <p>1 litres : $\frac{2}{97}$ hours</p> <p>200 litres : $\frac{2}{97} \times 200$ hours</p> <p>$= 4 \frac{12}{97}$</p> <p>$= 4$ hours 7 minutes</p>	<p>Some students $\times \frac{97}{2}$ instead of $\times \frac{2}{97}$</p>
16c	<p>$p = \frac{k}{q^3}$</p> <p>$k = pq^3$</p> <p>$P = \frac{pq^3}{\left(\frac{3}{4}q\right)^3}$</p> <p>$P = \frac{64}{27}p$</p> <p>Increment = $1 \frac{10}{27}$</p> <p>% increase = 137% or $137 \frac{1}{27}$%</p>	<p>1) A handful of students assumed a specified value for k instead of applying for general value of k. \Rightarrow M0A0</p> <p>2) A handful of students apply the cube power to q only and not to the entire denominator</p> <p>3) Instead of % increase, several students wrote their answer as the new value of P in % (237%) instead</p>
17a	<p>$r(2\pi - c) = 7(0.75r)$</p> <p>$(2\pi - \theta) = 5.25$</p> <p>$\theta = 2\pi - 5.25 \approx 1.0331853$</p> <p>$\theta \approx 1.03$ radians</p>	<p>1) Significant no. of students change to degree and back to radian unnecessarily</p> <p>2) Some students apply the arc length formula directly and fail to notice that the θ in the formula and question is different</p>

17b	<p>Area of sector $= \frac{1}{2}(2)^2(2\pi - 1.0331853) \approx 10.5000\text{m}^2$</p> <p>Area of triangle $A DB$</p> $= \left[\frac{1}{2} \times (0.75 \times 2)^2 \times \sin 1.338 \right] \approx 1.09465\text{m}^2$ <p>Area of triangle $A O B$</p> $= \left[\frac{1}{2} \times (2)^2 \times \sin 1.0331853 \right] \approx 1.71786898$ <p>Area of Diagram I $\approx 13.3\text{ m}^2$</p>	<p>1) Using cosine rule to obtain AB lead to a slight variance in θ. $\theta = 0.96761$</p> <p>2) Formula is for finding sector, not segment. A lot of students misquote.</p> <p>No major concern in solving.</p> <p>3) ECF is awarded for Area of triangle/sector</p>
18a	<p>Using Sine rule</p> $\frac{\sin \angle BCD}{6} = \frac{\sin 60^\circ}{5.5}$ $\sin \angle BCD = \frac{6 \sin 60^\circ}{5.5}$ <p>$\angle BCD = 70.9^\circ$</p>	<p>No major concern.</p> <p>Students need to show values in order to be awarded M1.</p>
18b	<p>Using Cosine rule,</p> $AD^2 = 6^2 + 5.5^2 - 2 \times 6 \times 5.5 \cos 120^\circ$ <p>$AD \approx 9.96\text{ cm}$</p>	<p>No major concern.</p>
19a	<p>$2y = 5x + 2$ -----(1)</p> <p>$y = 8 - x$ -----(2)</p> <p>Sub (2) into (1)</p> $2(8 - x) = 5x + 2$ $16 - 2x = 5x + 2$ $7x = 14$ $x = 2$ <p>Sub $x = 2$ into (2), $y = 6$</p> <p>Therefore $W(2, 6)$</p>	<p>Quite a number of students left this Qn blank.</p> <p>No major concern otherwise.</p>
19b	<p>$A(10, 26), B(10, -2)$</p> <p>Area of triangle $A WB$</p> $= \frac{1}{2} \times 28 \times 8$ $= 112\text{ units}^2$	<p>It is recommended for students using the shoelace method to write the values down in anticlockwise direction</p>
20a	$360 = 2^2 \times 3^2 \times 5$	<p>No major concern</p>
20b	$\frac{360}{h} = \frac{2^2 \times 3^2 \times 5}{2 \times 5} \text{ perfect square}$ <p>$h = 10$</p>	<p>No major concern</p>

20c	$360 = 2^3 \times 3^2 \times 5$ $\text{HCF } 40 = 2^3 \times 5$ $k = 40 \times 6 \times 7$ $k = 280$	A large no. of students included the end value 200 and 420 in considerations, which is incorrect as it's not between inclusive. Hence, 200 cannot be the solution
21a	$y = -(x-8)(x+3)$ 	1) Diagram is poorly drawn for many students. Sketch has to be fairly symmetrical. Marker has been lenient on the shape of sketch - No curving inwards - Turning point should not be too rounded or pointy - Coordinates should be written besides the points 2) Question requires coordinates to be written clearly. Overall loss of M1 if coordinates were not written 3) For turning point, it should be highlighted by dotted lines and indicated with a cross (x)
21b	$x = 2.5$	No major concern
22	Let h be the height of the trapezium. $h = 5 \sin 77^\circ \approx 4.87185 \text{ cm}$ $\angle BAC = \angle ACD$ (alt angles, $AB \parallel DC$) $\angle DAC = \angle ACD$ (base angle of isos Δ) Area of trapezium $= \frac{1}{2} (5+7) \times 5 \sin 77^\circ$ $\approx 29.2 \text{ cm}^2$	1) A significant number of students fail to show how they arrive at $\angle DAC = \angle ACD$ or $DC = 5 \text{ cm}$ resulting in loss of M1 2) Students are reminded to use at least 1 higher degree of accuracy for their working Alt Solution MS: M1 - Find Angle ACD M1 - Find AC (7.8761 cm) M1 - Sum of Area of Triangle ADC and ABC A1 - Answer

In the scale drawing, L is a lighthouse, A is a ship and P is a port. The line AP shows the ship's course.

Scale: 1 cm to 10 km



(a) Measure the bearing of P from A .
 Answer $225^\circ \pm 0.5$

(b) The light from the lighthouse is visible to all ships within a parameter of 40 km.
 Using your diagram, estimate the duration with which the light can be seen from the while it sails at an average speed of 35 km/h.
 Give your answer in hours and minutes, correct to the nearest minute.

$$\begin{aligned}
 5.75 \text{ cm} &= 57\frac{1}{2} \text{ km} \\
 \text{length of time} &= \frac{57.5}{35} \\
 &= 1\frac{9}{14} \text{ hr} \\
 &= 1 \text{ hr } 39 \text{ min}
 \end{aligned}$$

(c) The location of a buoy, B , is equidistant from A and P and is visible from the lighthouse.
 Indicate the possible location of the buoy and labelled as B .

- 1) A large no of students are unable to determine the bearing.
- 2) Drawing is badly done with many construction lines missing/incomplete.
- 3) For (b), M1 is awarded for attempt to /35 in order to find time taken
- 4) Students are supposed to be using the diagram for values.
- 5) Due to printing, the measurement of duration in (b) is accepted value is approx. $5.6 \text{ cm} \pm 0.1 \text{ cm}$
- 6) For (c), point B has to indicated clearly with perpendicular bisector drawn for accurate position

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Solution to 2020 PRELIM Elementary Math Paper 2

Qn	Solution	Marker Report
1a	$\frac{9b^3c}{d} + \frac{3bc}{d^2}$ $= \frac{9b^3c}{d} \times \frac{d^2}{3bc}$ $= 3b^2d$	Well done
1b	$\frac{12x^2 - 75}{2x^2 - 3x - 20}$ $= \frac{3(4x^2 - 25)}{2x^2 - 3x - 20}$ $= \frac{3(2x-5)(2x+5)}{(2x+5)(x-4)}$ $= \frac{3(2x-5)}{x-4}$	Well done
1ci	$s = 2at^2 - gt^2 + ag$ $s = 2(-3)(2)^2 - (-5)(2)^2 + (-3)(-5)$ $s = 11$	Well done
1cii	$s = 2at^2 - gt^2 + ag$ $s - ag = t^2(2a - g)$ $\frac{s - ag}{2a - g} = t^2$ $t = \sqrt{\frac{s - ag}{2a - g}}$	Majority forgotten to put +/-, resulting in the loss of A1.

Qn	Solution	Marker Report
1d	$\frac{3}{x+2} + \frac{4}{x-3} = 2$ $\frac{3(x-3)+4(x+2)}{(x+2)(x-3)} = 2$ $\frac{3x-9+4x+8}{(x+2)(x-3)} = 2$ $7x-1 = 2(x+2)(x-3)$ $7x-1 = 2(x^2 - x - 6)$ $7x-1 = 2x^2 - 2x - 12$ $0 = 2x^2 - 9x - 11$ $x = \frac{-(-9) \pm \sqrt{(-9)^2 - 4(2)(-11)}}{2(2)}$ $x = \frac{9 \pm \sqrt{169}}{4}$ $x = -1 \text{ or } x = 5.5$	<p>Majority were able to do this question. Please note that A cannot be given if there is any loss of M. M marks are strictly given for the method seen.</p> <p>Failure to demonstrate means a loss of M marks. Students who copied the wrong question were still able to be awarded M marks, provided they do not simplify the question.</p>
2ai	<p>Angle $CBD = 35^\circ$ (alt. \angle) Angle $OBD = 35^\circ$ (base \angle of isos. triangle) Angle $BCO = \text{Angle } OBC$ $= 35^\circ + 35^\circ$ (base \angle of isos. triangle) $= 70^\circ$ Angle BOC $= 180^\circ - 70^\circ - 70^\circ$ (\angle sum of triangle) $= 40^\circ$</p>	<p>Question is badly done. Students do not demonstrate the necessary working and reasoning. Students would simply say that Angle $BCO = 70^\circ$ without showing the angles for angle CBD or OBD. As long as there are missing steps, marks will not be awarded for the entire question. If students demonstrate the step by step working, but do not write reason, R will be marked and there will be an overall 1 mark deduction to the paper. Marks would also not be awarded if students say angle $CBO = \text{angle } COD$ if they do not prove that the 2 triangles, ABO and DCO are congruent first. Many students started writing COD instead of</p>

Qn	Solution	Marker Report
		<p>$\angle COD$ when right at the start they wrote in the angle sign. Marker will assume they are writing for a triangle, thus their values do not apply and they would not get the marks.</p>
2aii	<p>Angle $BCE = 90^\circ$ (\angle in semicircle) Angle BEC $= 180^\circ - 90^\circ - 70^\circ$ (\angle sum of triangle) $= 20^\circ$ Or Angle $BEC = 20^\circ$ (\angle at centre = 2 \angle at circumference)</p>	<p>B ecf is awarded.</p> <p>Question is badly done. Students do not demonstrate the necessary working and reasoning. Students would simply say that Angle $BEC = 180^\circ - 90^\circ - 70^\circ$ but do not show that Angle $BCE = 90^\circ$ in the first place. Marker will not assume that their 90° refers to BCE, thus marks will not be awarded. If students demonstrate the step by step working, but do not write reason, R will be marked and there will be an overall 1 mark deduction to the paper.</p> <p>Many students started writing COD instead of $\angle COD$ when right at the start they wrote in the angle sign. Marker will assume they are writing for a triangle, thus their values do not apply and they would not get the marks.</p>
2aiii	Angle $BDC = 20^\circ$ (\angle in same segment)	<p>B ecf is awarded.</p> <p>Generally well done.</p>

Qn	Solution	Marker Report
		<p>If students demonstrate the step by step working, but do not write reason, R will be marked and there will be an overall 1 mark deduction to the paper.</p> <p>Many students started writing COD instead of $\angle COD$ when right at the start they wrote in the angle sign. Marker will assume they are writing for a triangle, thus their values do not apply and they would not get the marks.</p>
2aiv	<p>Angle ODC $= 35^\circ + 20^\circ$ $= 55^\circ$ Angle ABC $= 180^\circ - 55^\circ$ (opp. \angle of cyclic quadrilateral) $= 125^\circ$</p>	<p>Generally well done. Marks was not awarded for students who do not give step by step working.</p> <p>B ecf is awarded.</p> <p>Many students started writing COD instead of $\angle COD$ when right at the start they wrote in the angle sign. Marker will assume they are writing for a triangle, thus their values do not apply and they would not get the marks.</p>
2b	<p>For any point Y on the arc, Angle $BYC = 20^\circ$ (angle in same segment) or Angle $BYC = 180^\circ - 20^\circ = 160^\circ$ (opp. \angle of cyclic quadrilateral) Angle $BXC = 15^\circ < 20^\circ < 160^\circ$ X has to be outside the circle.</p>	<p>M can only be awarded if both properties are mentioned. Most students only mention angle in the same segment, thus not being awarded the marks.</p>
2c	<p>Angle $BCF =$ Angle FOD (alternate angle) Angle $CBF =$ Angle FDO (alternate angle)</p> <p>Triangle BCF is similar to triangle DOF.</p>	<p>Question was badly done. Students need to remember to give the reason beside the angle they have proven, for example, most students</p>

Qn	Solution	Marker Report
		<p>would give Angle $BCF =$ Angle FOD only, marks will not be awarded in this case, since they have not stated (alternate angles). If however, students wrote Angle $BCF =$ Angle $FOD = 35^\circ$, marks will be awarded since the angle is already found earlier. Similarly, students who went ahead to prove 3 angles, but ended up with wrong reasoning along the way would also not get the full marks. Please highlight to students to not use the acronym, AA (marks was not deducted for the use of this). Additionally, if students say Angle $BCF =$ Angle COD, marks will not be awarded since they are proving a different triangle.</p>
3a	$P = \begin{pmatrix} 57 & 38 & 23 & 18 \\ 42 & 29 & 13 & 16 \\ 399 & 266 & 161 & 126 \\ 294 & 203 & 91 & 112 \end{pmatrix}$	Well done.
3b	$N = \begin{pmatrix} 0.50 \\ 0.75 \\ 1.20 \\ 1.20 \end{pmatrix}$	<p>Well done.</p> <p>Please highlight to students to still include 2 decimal places for money. Marks was not deducted for not doing so.</p>

Qn	Solution	Marker Report
3c	$= \begin{pmatrix} 399 & 266 & 161 & 126 \\ 294 & 203 & 91 & 112 \end{pmatrix} \begin{pmatrix} 0.50 \\ 0.75 \\ 1.20 \\ 1.20 \end{pmatrix}$ $= \begin{pmatrix} 743.40 \\ 542.85 \end{pmatrix}$	<p>Well done.</p> <p>B ecf was awarded.</p> <p>Please highlight to students to still include 2 decimal places for money. Marks was not deducted for not doing so.</p>
3d	<p>743.40 represents the total cost of making regular pratas in 7 days and 542.85 represents the total cost of making upsized pratas in 7 days.</p>	<p>Question was badly done. Question asked for "each of the elements", which would garner a respective breakdown of the 2 values. Majority of the students gave "the elements of T/ T itself", which does not answer the question.</p>
3ei	$(1 \ 1) \begin{pmatrix} 743.40 \\ 542.85 \end{pmatrix}$ $= (1286.25)$ <p>Total cost = \$1286.25</p>	<p>Question was badly done. Majority of the students mistook 3c as a selling price and majority do not understand the meaning of matrix multiplication. Students who wrote 1286.25 as a result from the matrix multiplication would not be awarded the mark as they do not understand the meaning.</p>
3eii	$1.5 \left(\frac{7}{8} \frac{17}{20} \begin{pmatrix} 743.40 \\ 542.85 \end{pmatrix} \right) - (1286.25)$ $= (381.59625)$ <p>Total profit = \$381.60</p>	<p>B ecf was awarded.</p> <p>Question was badly done. Majority could see that its 1.5, but they do not know how to continue after that. Marks was awarded to students who either rounded up the pratas in a single matrix or rounded down the pratas in a single matrix but not when they rounded up and down in a single matrix. Students who went to round off 1.125 to 1.13 would also not be</p>

Qn	Solution	Marker Report
		<p>awarded the full marks. Students who used matrix multiplication to attempt this question but demonstrated the wrong use of the matrix concept would still be awarded 2 marks if their final answer is correct. Students who wrote the new value without showing how, would be marked P with a circle, as presentation error.</p> <p>Second M1 (but now as M ecf) will only be awarded if students are able to demonstrate that they multiply the new value by the pratas sold.</p>
4a	$p = 3.71$	Well done. Fraction would not be accepted since the question already shows the values to be 2 d.p.

Qn	Solution	Marker Report
4b		<p>Axis mark is indicated by a "A". Axis mark was not awarded if students do not write out the values till -12.</p> <p>Plot mark is indicated by a "P". Plot mark was not awarded if students forgot to draw in the plots or if students drew the wrong plot.</p> <p>Curve mark is indicated by a "C". Curve mark was not awarded if students have sketchy or shaky curve or if the shape is not correct.</p>
4c	$-1.85 < x < 0$ and $x > 1.85$	<p>B ecf was awarded when students have lost the Plot mark in 4b and this would greatly affect the answer in 4c. If the plot mark happens to be the last plot, and does not affect the answer for 4c, marker will expect the original answer.</p> <p>Values are checked against their graph, if the values are different, marks will not be awarded.</p> <p>Question requires students to "use their graph" to</p>

Qn	Solution	Marker Report								
		<p>answer this question, therefore, if students do not show a "y=3" line on the graph, marker will not award them the marks. Those who drew "y=3" but do not proceed to draw the intersection was also not awarded the mark.</p> <p>Please highlight to students that there are 2 inequalities and because of the nature of the question, mark was awarded even if student wrote only one inequality.</p>								
4d	$\frac{2x^2}{7} - 2x + 1 = 0$ $\frac{2x^2}{7} - 2x + x + 1 + 2 = x + 2$ $\frac{2x^2}{7} - x + 3 = x + 2$ $y = x + 2$ <table border="1"> <tr> <td>x</td> <td>-4</td> <td>0</td> <td>3</td> </tr> <tr> <td>y</td> <td>-2</td> <td>2</td> <td>5</td> </tr> </table> <p>Draw graph (see attached graph)</p> <p>$x = -2.85$ or $x = 0.50$ or $x = 2.35$</p>	x	-4	0	3	y	-2	2	5	<p>Mark was awarded even if there was no manipulation, as long as students write the line. First M1 will not be awarded when students merely write</p> $\frac{2x^2}{7} - x + 3 = x + 2$ <p>Second M1 will only be awarded when a table of value is written, with 3 coordinates, not 2.</p> <p>Third M1 will only be awarded when the line is drawn with 3 distinct plots.</p> <p>A1 will only be awarded if students obtain all M before this. A is also checked against their graph, if the values are different, marks will not be awarded.</p> <p>If students do not draw the intersection, the A</p>
x	-4	0	3							
y	-2	2	5							

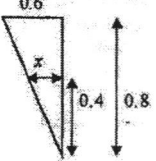
Qn	Solution	Marker Report
		mark will still be awarded, but a P with a circle will be placed there to indicate presentation error.
4e	$x = -2$ or $x = 2$	<p>B ecf was awarded when students have lost the Plot mark in 4b and this would greatly affect the answer in 4e. If the plot mark happens to be the last plot, and does not affect the answer for 4e, marker will expect the original answer.</p> <p>Tangent needs to be parallel to 2 for marks to be awarded and marker will take the tangent value to be the middle of their tangent drawn. If the value does not tally, marker will not award s</p>

Section B

Qn	Solution	Marks
5a	$\text{Speed} = \frac{45}{x \div 60} = \frac{2700}{x}$	Unsimplified form no B1.
5b	Speed	

	$= \frac{120 - 45}{x + 40}$ $= \frac{75 \times 60}{x + 40}$ $= \frac{4500}{x + 40}$	[1]
5c	$\frac{2700}{x} - \frac{4500}{x + 40} = 25$ $\frac{2700(x + 40) - 4500x}{x(x + 40)} = 25$ $2700x + 108000 - 4500x = 25x(x + 40)$ $-1800x + 108000 = 25x^2 + 1000x$ $0 = 25x^2 + 2800x - 108000$ $0 = 25(x^2 + 112x - 4320)$ $x^2 + 112x - 4320 = 0 \text{ (shown)}$	[3]
5d	$x^2 + 112x - 4320 = 0$ $x = \frac{-112 \pm \sqrt{(112)^2 - 4(1)(-4320)}}{2(1)}$ $x = \frac{-112 \pm \sqrt{29824}}{2}$ $x = -142.3481 \text{ or } x = 30.3481$ $x = -142.35 \text{ or } x \approx 30.35$	<p>If students corrected to 3sf, -1. But if students didn't write 5/6 sf answers but only 3sf ans, -2, ie M2 onl</p> <p>[4]</p>
5e	<p>Speed</p> $= \frac{45}{30.3481}$ $= \frac{60}{60}$ $= 88.967$ $\approx 89.0 \text{ km/h}$	[2]

Qn	Solution	Marks
6a	$A = 8200\left(1 + \frac{5.2}{100}\right)^{4 \times 3}$ $A = 9574.744565$ $I = 9574.744565 - 8200$ $I = 1374.744565$ $I \approx \$1374.74$	Quite badly done. Many forgot $i/4$ and $n \times 4$. [3]
6bi	$143.20 + 0.63$ $= 227.3015$ $\approx \$227.30$	[2]
6bii	Price of leather jacket in Shop B $= \frac{100 - 25}{100} \times 189.90$ $= €142.425$ Since €142.425 < €143.20, Shop B's leather jacket is more value for money.	[2]
6c	Cost for 3 nights of hotel stay $= 156 \times 3$ $= €468$ Total cost in Singapore dollars $= 468 + 0.63$ $= \$742.8571$ Total amount $= \frac{100 + 2.5}{100} \times (742.8571)$ $= \$761.4285$ $\approx \$761$	Many left ans as is and did not correct to nearest \$. [3]
		[10]
7ai	$T_n = -4n + 15$	[2]
7aii	$T_n = 15 - 4n$ $T_n = 12 - 4n + 3$ $T_n = 4(3 - n) + 3$ $4(3 - n) + 3$ is not divisible by 4, therefore, a term in the sequence can't be a multiple of 4.	15 is not a multiple of 4 is not sufficient [1]
7bi	$T_5 = 4^6 + 100 = 4196$	[1]
7bii	4, 16, 36, 64 Sequence: $4n^2$ $\therefore T_n = 4^{n+1} + 4n^2$	[3]

7biii	$T_{20} = 4^{20+1} + 4 \times 20^2$ $T_{20} = 4.3980 \times 10^{12}$ $\approx 4.40 \times 10^{12}$	[1]
7biv	$T_{n+1} - T_n$ $= (4^{n+1+1} + 4(n+1)^2) - (4^{n+1} + 4n^2)$ $= 4^{n+2} + 4(n+1)^2 - 4^{n+1} - 4n^2$ $= 4^{n+2} + 4(n^2 + 2n + 1) - 4^{n+1} - 4n^2$ $= 4^{n+2} - 4^{n+1} + 8n + 4$	<p>Many tried to over simplify and made careless mistakes.</p> <p>[2]</p>
		[10]
8a	DH $= \sqrt{0.8^2 + \left(\frac{2.4-1.2}{2}\right)^2}$ $= 1 \text{ m}$ <p>Total Surface Area</p> $= \frac{1}{2} \times (1.2 + 2.4) \times 0.8 \times 2 + 1.2 \times 0.9 + 0.9 \times 1 \times 2$ $= 5.76 \text{ m}^2$	<p>If final ans is wrong, M1 given for either DH or any 2 surface areas correctly evaluated.</p> <p>[3]</p>
8b	<p>Volume:</p> $= \frac{1}{2} \times (1.2 + 2.4) \times 0.8 \times 0.9$ $= 1.296 \text{ m}^3$	<p>Many corrected to 3sf though ans is exact [2]</p>
8c	<p>Volume</p> $= \pi \times 16^2 \times 42$ $= 33778.40$ $\approx 33800 \text{ cm}^3$	[2]
8d	 $\frac{x}{0.6} = \frac{0.4}{0.8}$ $x = 0.3$ <p>Volume of water to be filled</p>	<p>Badly done. Many used similar volumes.</p>

$= \frac{1}{2} \times (1.2 + 0.3 + 0.3 + 1.2) \times 0.4 \times 0.9$ $= 0.54 \text{ m}^3$ $= 540000 \text{ cm}^3$ <p>Number of buckets $= 540000 \div 33778.40$ $= 15.9865$ ≈ 16</p>	[3]
	[10]

Qn	Solution	Marks
9ai	Estimated Median $= 94.5 \text{ cm}$	B1 not given for 94.75 or 95. [1]
9aiii	Interquartile Range $= 102 - 86.5$ $= 15.5 \text{ cm}$	[1]
9aiii	65% of children = 156 children $240 - 156 = 84$ children have a height of less than $x \text{ cm}$. $x = 90.5$	[2]
9aiv	Median for March = 94.5 cm Median for April = 105 cm Since the median of the children's height in March is lower than April, the heights of the children in March is lower than in April. Interquartile Range for March = $102 - 86.5 = 15.5 \text{ cm}$ Interquartile Range for April = $121 - 98 = 23 \text{ cm}$ Since the interquartile range for April is larger than March, therefore the heights of the children in April is more widespread than the heights in March.	Not well done. Many tried to explain without comparing data or had no conclusion [2]
9b	Let the radius of the smallest circle be $r \text{ cm}$. Area of the smallest circle $= \pi r^2$ Area of the medium circle $= \pi(2r)^2$ $= 4\pi r^2$ Area of the largest circle $= \pi(4r)^2$ $= 16\pi r^2$ Probability	Students that let radius of biggest circle be x , got into trouble working with fractions, squaring incorrectly and subtracting wrongly. [3]

	$= \frac{16\pi r^3 - 4\pi r^3 - \pi r^3 - \pi r^3}{16\pi r^2}$ $= \frac{5}{8}$	
		[10]
10a	<p>Cost of disposable face mask welding machine and the raw materials</p> $= 6850 + 4.60 + 3.48 + 3.48 + 4.17 + 7.41$ $= \$6873.14$ <p>Cost to import the materials by sea freight</p> $= \left(\frac{180 + 5 - 0.8}{0.5} \right) \times 1.90 + 3.52$ $= \frac{184.2}{0.5} \times 1.90 + 3.52$ $\approx \frac{184.5}{0.5} \times 1.90 + 3.52$ $= \$704.62$ <p>Total minimum cost</p> $= 6873.14 + 704.62$ $= \$7577.76$	<p>M1 given if total cost of items is represented though ans is wrong. Many did not round up weight ie (185-0.8)=184.5 instead of 184.2 for calculation of weight. [3]</p>
10b	<p>Maximum number of the white nonwoven fabric obtained from width of 1 kg material</p> $= \frac{7 \times 100}{9.5}$ $= 73.684$ ≈ 73 <p>Maximum number of the white nonwoven fabric obtained from length of 1 kg material</p> $= \frac{7 \times 100}{19}$ $= 36.842$ ≈ 36 <p>Maximum white nonwoven fabric that can be obtained from 1 kg material</p> $= 73 \times 36$ $= 2628$ <p>Maximum number of the blue nonwoven fabric/filtering material obtained from width of 1 kg material</p>	<p>Many just took total area of raw material divided by area of mask. If students did not get 6 of the M marks, no final AI. [7]</p>

<p> $\frac{7 \times 100}{9.5}$ $= 73.684$ ≈ 73 Maximum number of the blue nonwoven fabric/filtering material obtained from length of 1 kg material </p> <p> $\frac{7 \times 100}{17}$ $= 41.176$ ≈ 41 Maximum blue nonwoven fabric/filtering material that can be obtained from 1 kg material </p> <p> $= 41 \times 73$ $= 2993$ </p> <p> Maximum plastic nose wire that can be obtained from 1 kg material </p> <p> $= 580 \times 100 \div 15$ $= 3866.66$ ≈ 3866 </p> <p> Number of elastic ear loop that can be obtained from 1 kg material </p> <p> $= 780 \times 100 \div 15$ $= 5200$ </p> <p> Number of masks that can be made from the elastic ear loop of 1 kg </p> <p> $= 5200 \div 2$ $= 2600$ </p> <p> Therefore, since there is 2628 white nonwoven fabric, 2993 blue nonwoven fabric, 2993 filtering material, 2600 pairs of elastic ear loops and 3866 plastic nose wire, the maximum mask that can be made from workable materials is 2600 masks. </p> <p> Maximum mask that can be made from the face mask machine </p> <p> $= 15 \times 60 \times 2.5$ $= 2250$ </p> <p> Therefore, since 2250 masks < 2600 masks, the maximum masks that can be made in a day is 2250 masks. </p>	<p>2 cars</p>
	[10]