Name | Reg. No | Class

MAYFLOWER SECONDARY SCHOOL

4E/5N

MATHEMATICS	4048/01
Paper 1 [80 marks]	PRELIMINARY EXAMINATION
	24 August 2022
	2 hours
Candidates answer on the question paper	

READ THESE INSTRUCTIONS FIRST

Do not open this booklet until you are told to do so.
Write your name, index number and class 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** 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 of the marks for this paper is 80.
Write the brand and model of your calculator in the space provided below.

Brand/Model of Calculator

For Examiner's Use	
Total	**80**

This question paper consists of **17** printed pages and **1** blank page.

Mathematical Formulae

Compound interest

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

Mensuration

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

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

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

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

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

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

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

Trigonometry

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

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

Statistics

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

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

[Turn over

1 Simplify the following expressions, leaving your answers in positive index.

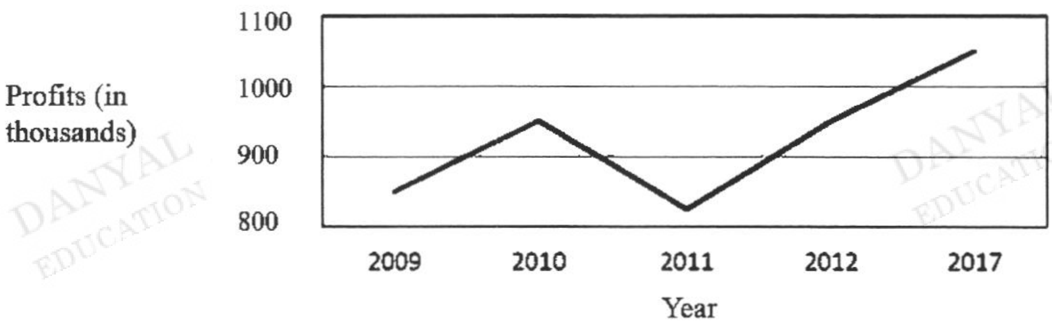
(a) $\left(-a^{2}\right)^{3} \div 4b^{0}$

Answer .... [2]

(b) $\left(a^{-1}b\right)^{2} \times \left(\sqrt{b}\right)^{3}$

Answer .... [2]

2 The line graph shows the profits that a company has made over a few years.



State two ways in which the line graph may be misleading.

Answer ....

....

....

.... [2]

[Turn over

3 The volume of an Olympic size swimming pool is 660 000 gallons.
1 gallon is approximately 3790 cm^3.

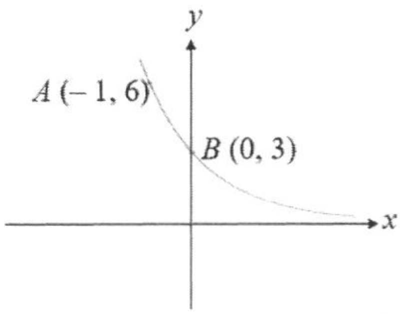
(a) Convert 660 000 gallons to cm^3, leaving your answer in standard form.

Answer .... cm^3 [1]

(b) The average volume of water flowing from tap *A* and tap *B* are 8×10^2 litres per minute and 1.2×10^3 litres per minute respectively. Both taps are used to fill up the Olympic size swimming pool together. Calculate the time needed to fill up the pool completely.

Answer .... minutes [2]

4 The sketch shows the graph of $y = ka^{-x}$. The points *A* (– 1, 6) and *B* (0, 3) lie on the graph.



Find the value of *k* and of *a*.

Answer $k =$ ....

$a =$ .... [2]

[Turn over

5 **(a)** Express 1400 as a product of its prime factors.

Answer .... [1]

(b) Hence, explain why 1400 is not a perfect square.

Answer ....

....

.... [1]

(c) a and b are both prime numbers. Find the value of a and of b such that $1400 \times \frac{a}{b}$ is a perfect cube.

Answer $a =$ ....

$b =$ .... [2]

6 A lake has an actual area of 2.56 km^2. It is represented by an area of 4 cm^2 on a map.

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

Answer 1 : .... [2]

(b) The distance between two towns on the map is 20 cm. Find the actual distance, in kilometres, between the two towns.

Answer .... km [1]

[Turn over

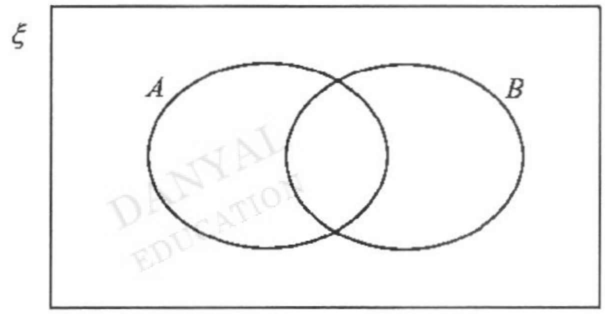
7 $\xi = \{\text{integers } x\text{: } 1 \le x \le 12\}$
$A = \{\text{integers } x\text{: } 1 - 2x > -9\}$
$B = \{\text{prime numbers}\}$

(a) List the elements in $A \cap B'$.

Answer .... [1]

(b) On the Venn diagram, shade the region which represents $A' \cup B$.

Answer



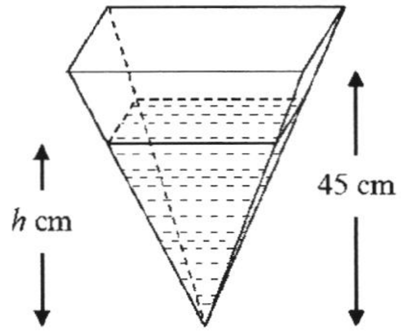
[1]

8 The mass, M grams, of a cylindrical clay is directly proportional to the cube of its radius, r centimetres. The mass of the cylindrical clay is increased by 700%. Calculate the percentage increase in the radius of the cylindrical clay.

Answer .... % [2]

[Turn over

9 The diagram shows a right pyramid of height 45 cm.



The volume of the liquid in the pyramid is half the volume of the pyramid. Calculate the depth, h cm, of the liquid.

Answer ……………………………cm [2]

10 (a) (i) Express $x^2 - 4x + 8$ in the form $(x+p)^2 + q$.

Answer …………………………… [1]

(ii) Hence explain why there is no solution for $x^2 - 4x + 8 = 0$.

Answer ……………………………………………………………

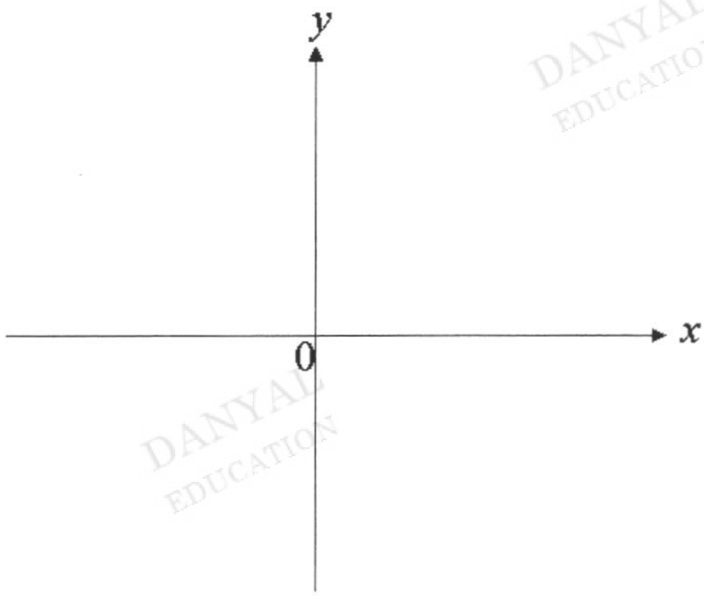
……………………………………………………………

…………………………………………………………… [1]

[Turn over

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

Answer



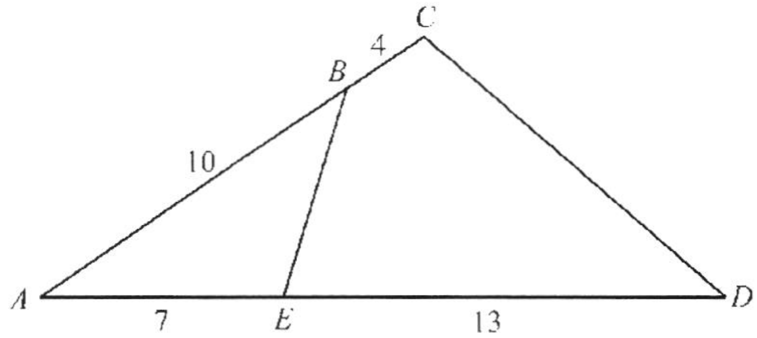
[3]

11 Given $x^2-8xy+16y^2=0$, find the value of $\frac{x}{y}$.

Answer .... [2]

[Turn over

12 In the diagram, ACD is a triangle. B is the point on AC such that $AB = 10$ cm and $BC = 4$ cm. E is the point on AD where $AE = 7$ cm and $ED = 13$ cm.



(a) Show that ACD and AEB are similar.

Answer ....

....

....

....

.... [2]

(b) F is the point on AB such that $\dfrac{\text{Area of } AEF}{\text{Area of } AEB} = \dfrac{1}{4}$. Find the length of AF.

Answer .... cm [1]

[Turn over

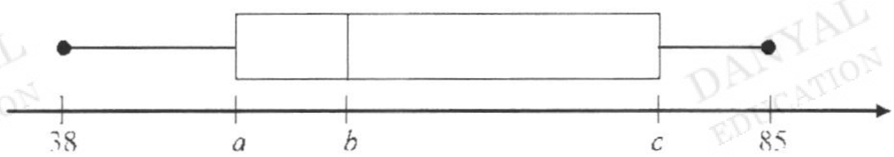
13 The stem-and-leaf diagram shows the test scores of the boys and girls from a particular class.

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

Key (Boys)
8 | 3 means 38

Key (Girls)
4 | 1 means 41

(a) Alvin represented the boys' test scores on a box-and-whisker plot below.



Find the values of a, b and c.

Answer a = ...

b = ...

c = ... [3]

(b) Alvin realised that he forgot to record one boy's test score. After recording this boy's test score, the median of the boys' score remains unchanged. Write down the possible score for this boy.

Answer .... [1]

(c) Alvin wants to measure the consistency of the class's test scores. He claims that the standard deviation is a more accurate measure, compared to the interquartile range. Justify why this claim is valid.

Answer ....

....

.... [1]

[Turn over

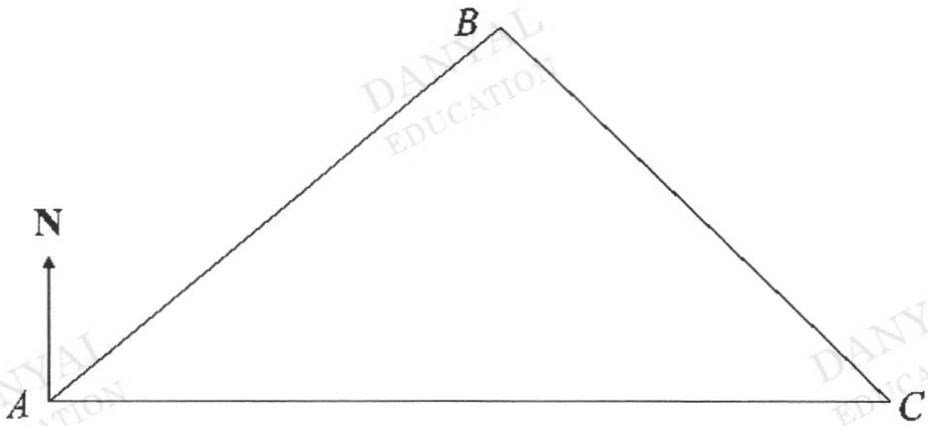
14 **(a)** Factorise $-2x^2+x+3$.

Answer .... [1]

(b) Factorise completely $8x^3-18xy^2$.

Answer .... [2]

15 The diagram shows an accurate drawing of triangle *ABC*.



(a) By constructing appropriate lines on the diagram, mark the point *P* on *AB* such that *P* is equidistant from *AC* and *BC*. [2]

(b) Write down the bearing of *P* from *A*.

Answer .... ° [1]

[Turn over

16 The matrix **A** below shows the prices of football match tickets for seats in Category 1 (Cat 1), Category 2 (Cat 2) and Category 3 (Cat 3). The prices are given in dollars.

$$\mathbf{A} = \begin{array}{c} \\ \\ \end{array}\begin{array}{c} \begin{array}{ccc} \text{Cat 1} & \text{Cat 2} & \text{Cat 3} \end{array} \\ \begin{pmatrix} 80 & 42 & 20 \\ 120 & 62 & 30 \end{pmatrix} \end{array} \begin{array}{l} \\ \text{Semi-final} \\ \text{Final} \end{array}$$

(a) There are 300 Cat 1 seats, 500 Cat 2 seats and 1000 Cat 3 seats. Represent this information in a 3×1 matrix, **B**.

Answer **B** = ... [1]

(b) Evaluate the matrix $\mathbf{X} = \begin{pmatrix} 0.5 & 0.5 \end{pmatrix} \mathbf{AB}$.

Answer **X** = ... [2]

(c) State what the element of **X** represents.

Answer ....

....

.... [1]

[Turn over

17 A regular polygon has n sides. When the number of sides is doubled, each of the interior angles is increased by $30°$. Find the value of n.

Answer $n =$ .... [3]

18 Show that $(2n-1)^2 + 3$ is a multiple of 4 for all integer values of n.

Answer ....

....

....

....

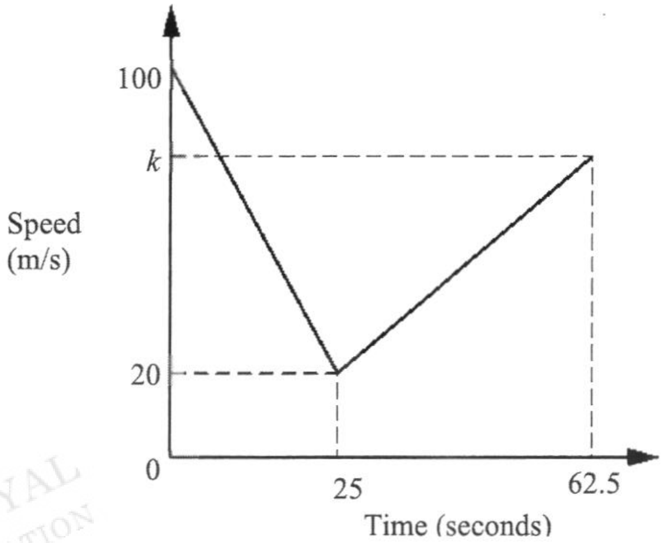
....

....

.... [2]

[Turn over

19 The diagram shows the speed-time graph of a train for the first 62.5 seconds after entering a tunnel.



(a) Find the speed of the train 20 seconds after entering the tunnel. Give your answer in kilometres per hour.

Answer .... km/h [3]

(b) Calculate the distance travelled by the train for the first 25 seconds after entering the tunnel.

Answer .... m [2]

(c) The deceleration of the train for the first 25 seconds after entering the tunnel is twice the acceleration of the train after 25 seconds in the tunnel. Find the value of k.

Answer $k =$ .... [2]

[Turn over

20 P is the point $(3,-1)$ and Q is the point $(-5,\ 5)$.

(a) Find $\left|\overrightarrow{PQ}\right|$.

Answer $\left|\overrightarrow{PQ}\right| =$ ....units [2]

(b) The line PQ intersects the x-axis at R. Find the coordinates of point R.

Answer $R = ($ ...., ... $)$ [2]

(c) The point S is the result of the translation of point P by $\begin{pmatrix} -6 \\ 1 \end{pmatrix}$. Find the coordinates of point S.

Answer $S = ($ ...., ... $)$ [1]

21 The body mass index, BMI, of a person is defined as $\dfrac{\text{mass in kg}}{(\text{height in metres})^2}$. Over two years, Jay's mass decreased by 0.8% and his height increased by 2%. Find the percentage change in Jay's BMI.

Answer .... % [3]

[Turn over

22 A bag contains 150 chips. There are 60 blue chips, x red chips and y green chips in the bag. The probability of drawing a red chip is $\frac{7}{30}$.

(a) Find x and y.

Answer $x =$ ……………………………

$y =$ …………………………… [2]

(b) n yellow chips are added into the bag.

(i) The probability of choosing two yellow chips with replacement is $\frac{1}{256}$. Write down an equation in n to represent this information and show that it simplifies to $17n^2 - 20n - 1500 = 0$.

Answer

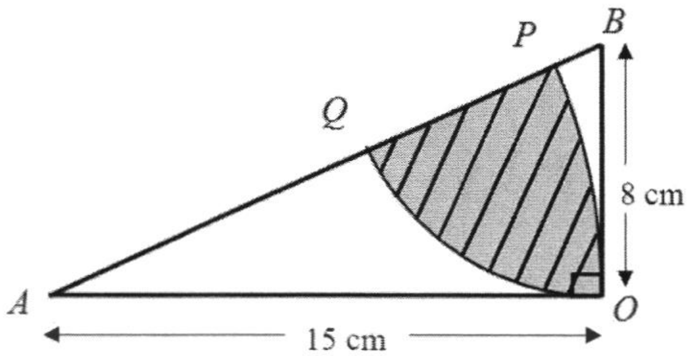
[3]

(ii) Solve the equation $17n^2 - 20n - 1500 = 0$ to find the number of yellow chips added into the bag.

Answer ……………………………… chips [2]

[Turn over

23 The diagram shows a right-angled triangle AOB where $AO = 15$ cm and $BO = 8$ cm. P lies on AB such that OP is an arc of a circle with centre A. Q lies on AB such that OQ is an arc of a circle with centre B.



(a) Show that angle ABO is 1.0808 radians, correct to 4 decimal places.

Answer

[1]

(b) Find the area of the shaded region.

Answer .... cm^2 [3]

END OF PAPER

Name

Reg. No	Class

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4E/5N

MATHEMATICS

4048/02

Paper 2 [100 marks]

PRELIMINARY EXAMINATION

22 August 2022

2 hours 30 minutes

Candidates answer on the Question Paper

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Brand/Model of Calculator

For Examiner's Use	
Total	**100**

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

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

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

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

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

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

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

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

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

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

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

[Turn over

Answer all the questions

1 **(a)** Given $\frac{(3x-y)}{(x+2y)}=\frac{1}{3}$, find the ratio $x:y$.

Answer $x:y=$ …………………………… [2]

(b) Solve the inequality $\frac{2-3x}{3}<\frac{2x-1}{6}$.

Answer …………………………………… [2]

(c) Given that $\frac{1}{x}+\frac{1}{y^2}=\frac{1}{w-3}$, express y in terms of x and w.

Answer $y=$ …………………………… [3]

[Turn over

2 **(a)** The marked price of a mobile phone is $1288. After selling the mobile phone at 15% discount, the shop owner still makes a profit of 25% on its cost price. Find the cost price of the mobile phone.

Answer $ .... [3]

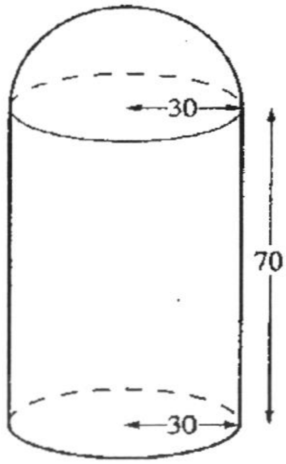
(b) The selling price of a desktop computer is $2388.
The hire purchase price is a deposit of $295 and 18 equal monthly payments of $125 per month. Calculate the simple interest rate per annum.

Answer ....% [3]

(c) The value of a laptop depreciated from $2000 in 2016 to $1200 in 2020.
If the price depreciated by x % every year, find the value of x.

Answer $x =$ .... [3]

3 A hot water tank is made by joining a hemisphere of radius 30 cm to a cylinder of radius 30 cm and height 70 cm.



(a) Calculate the total surface area of the water tank.

Answer ....cm² [3]

(b) The tank is filled with water completely.

(i) Calculate the number of litres of water in the tank.

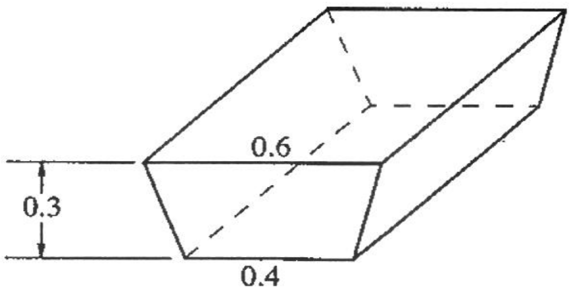
Answer .... litres [3]

[Turn over

3 (b) (ii) The water drains from the tank at a rate of 3 litres per second.
Calculate the time, in minutes and seconds, taken to empty the tank.

Answer .... minutes ....seconds [2]

(iii)

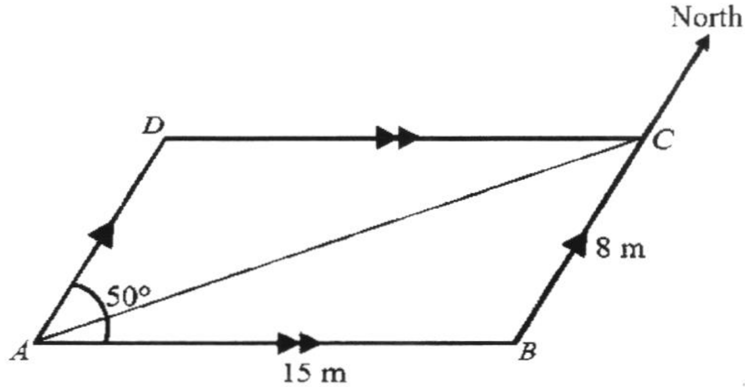


All the water from the tank fills a bath completely.
The bath is a prism whose cross-section is a trapezium.
The lengths of the parallel sides of the trapezium are 0.4 m and 0.6 m.
The depth of the bath is 0.3 m. Calculate, in metres, the length of the bath.

Answer ....m [3]

[Turn over

4 The diagram shows a parallelogram $ABCD$ on horizontal ground where AC is a path. $AB = 15$ m and $BC = 8$ m. The bearing of B from A is 050°.



(a) Find the area of the parallelogram $ABCD$.

Answer ....m² [2]

(b) Find the length of the path AC.

Answer ....m [3]

(c) Find angle DAC.

Answer ....° [2]

[Turn over

4 **(d)** Find the bearing of A from C.

Answer ....° [1]

A vertical pole is erected at B. T is the top of the pole.
The angle of elevation of T from A is 15°.

(e) Find the height of the pole.

Answer ....m [2]

(f) The angle of elevation of T from any point along AC is given by θ.
Find the range of θ.

Answer ....° $\leq \theta \leq$ ....° [4]

[Turn over

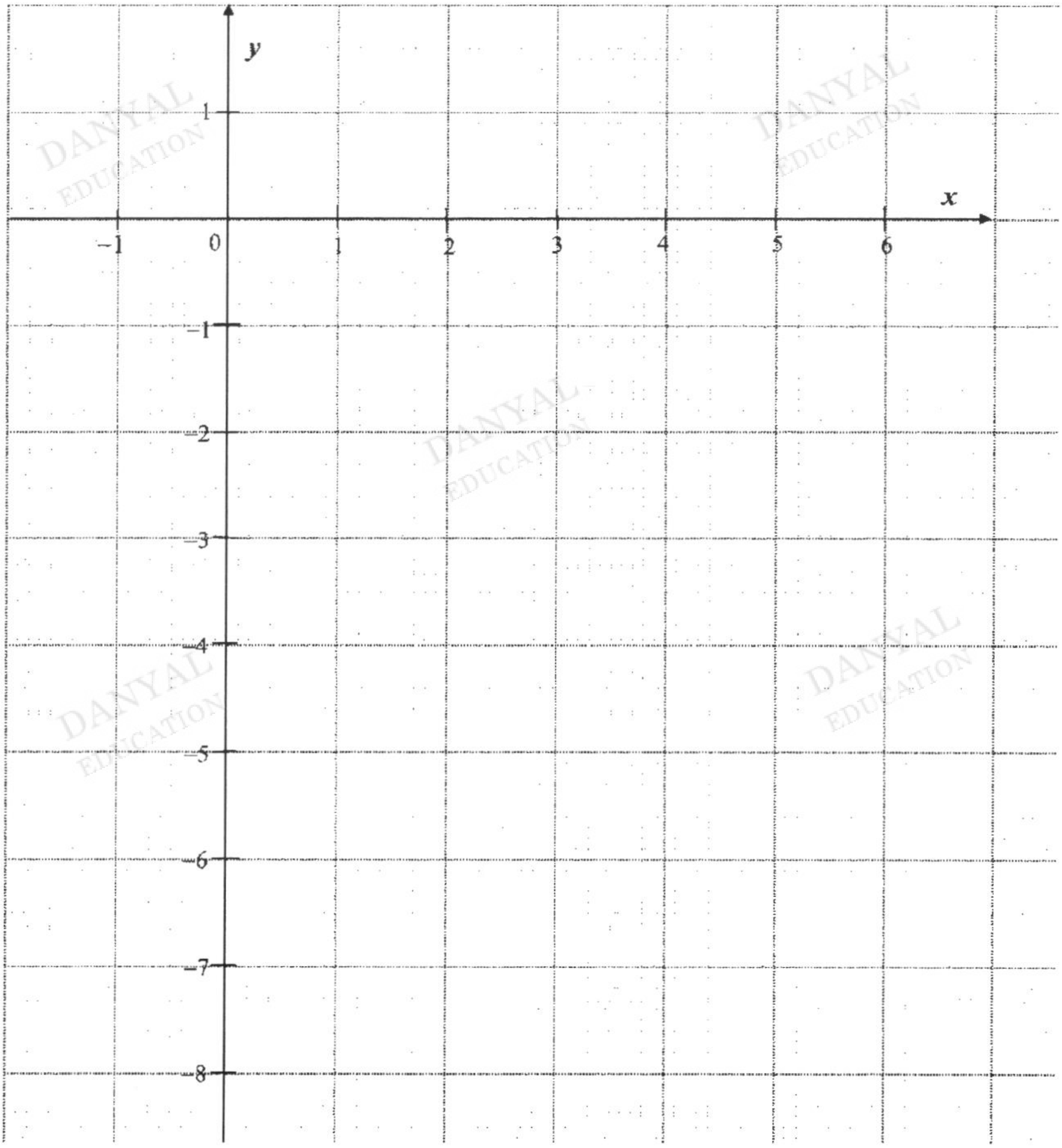
5 The table shows some values for $y = 4 - 2x - \frac{5}{x}$ for $0.5 \le x \le 5.5$.

x	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5
y	−7	−3	−2.3	−2.5	−3	p	−4.4	−5.3	−6.1	−7	−7.9

(a) Find the value of p, correct to one decimal place.

Answer $p =$ .... [1]

(b) On the grid, draw the graph of $y = 4 - 2x - \frac{5}{x}$ for $0.5 \le x \le 5.5$. [3]



[Turn over

5 **(c)** Use your graph to find the solutions of the equation $2x + \frac{5}{x} = 8$.

Answer $x =$ .... or .... [2]

(d) The gradient of the curve at point A is 3.
Use your graph to determine the coordinates of A.

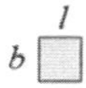
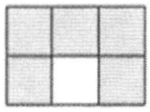
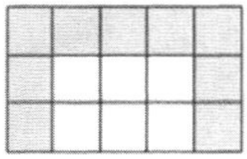
Answer $A =$ (……. , ………) [2]

(e) By adding a suitable straight line to the grid in part **(b)**, find the solutions to the equation $3x^2 - 14x + 10 = 0$.

Answer $x =$ .... or .... [4]

[Turn over

6 The table below shows a flooring consisting of square tiles measuring 1 m^2 each.
Each day similar tiles are added to the previous pattern.

			
Number of days	Day 1	Day 2	Day 3
Area added (m^2)	1	5	9
Length, l (m)	1	3	5
Breadth, b (m)	1	2	3

(a) **(i)** Find an expression, in terms of n, for the area added on Day n.

Answer ....m^2 [1]

(ii) Find the area added on Day 20.

Answer ....m^2 [1]

(iii) Explain why the area added is always odd.

Answer ....

....

.... [1]

(b) **(i)** Find the total area of the flooring on Day 6.

Answer ....m^2 [1]

[Turn over

6 **(b)** **(ii)** Find an expression for the total area of the flooring in the form of $an^2 + bn$, on Day n.

Answer .... [2]

(iii) Determine if an area of 780 m² of flooring can be completed in 3 weeks.

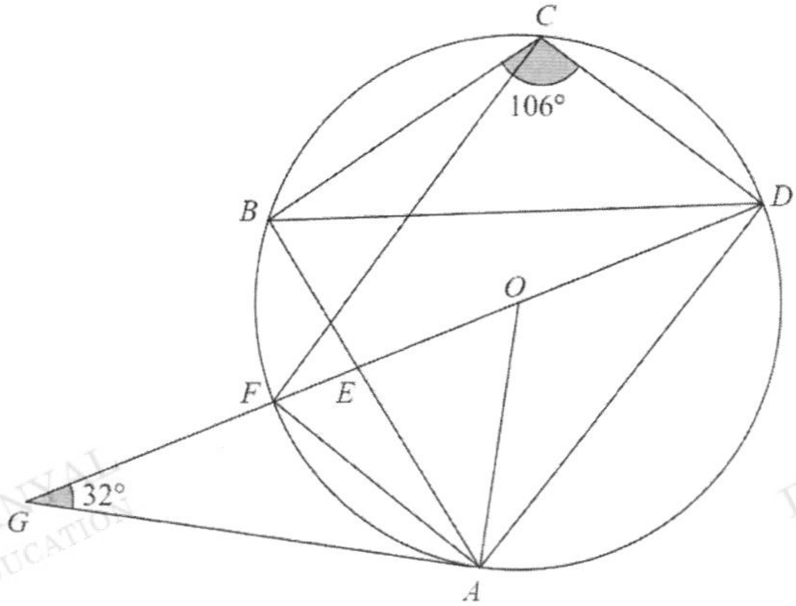
Answer...

....

.... [2]

[Turn over

7 In the diagram, O is the centre of the circle. $DOEFG$ and AEB are straight lines and GA is a tangent to the circle at A. Angle $AGD = 32°$ and angle $BCD = 106°$.



Find, giving reasons for each answer,

(a) angle GOA,

Answer ....° [2]

(b) angle BCF,

Answer ....° [2]

[Turn over

7 **(c)** angle BDA ,

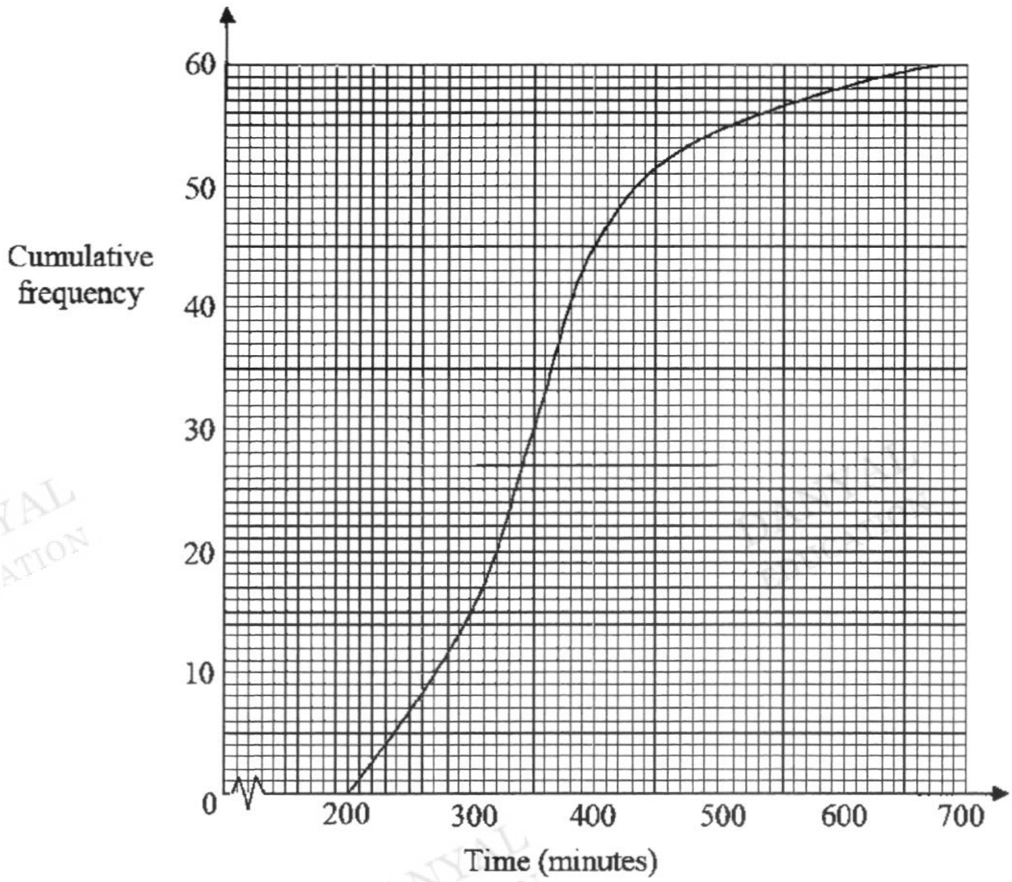
Answer ....° [2]

(d) angle DEA .

Answer ....° [2]

[Turn over

8 (a) The time spent by 60 students on social media in a week is recorded.
The cumulative frequency curve below shows the distribution of the data collected.



(i) Use the curve to estimate
(a) the median,

Answer .... [1]

(b) the interquartile range.

Answer .... [1]

(ii) 20% of the students spent at least x minutes on social media in a week.
Find the value of x.

Answer $x =$ .... [2]

(iii) Another group of 60 students was found to have the same median but a larger interquartile range. Sketch a possible cumulative frequency curve to represent this distribution on the above grid. [1]

[Turn over

8 (b) The table below shows the average amount of time (in minutes) spent daily on social media by a group of 240 students.

Time spent (x minutes)		$20 < x \leq 40$	$40 < x \leq 60$	$60 < x \leq 80$	$80 < x \leq 100$
Frequency	Boys	15	58	22	5
	Girls	8	30	62	40

(i) One of these students is selected at random.
Find, as a fraction in its lowest terms, the probability that the student

(a) is a girl who spent at most 60 minutes on social media in a day.

Answer .... [1]

(b) spent more than 80 minutes on social media in a day.

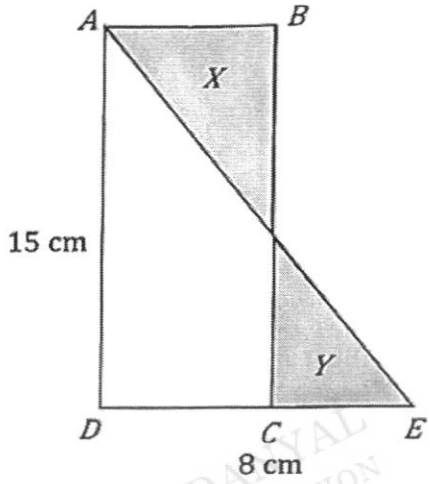
Answer .... [1]

(ii) Two students were selected at random.
Find the probability that at least one of them spent less than or equal to 40 minutes on social media in a day.

Answer .... [2]

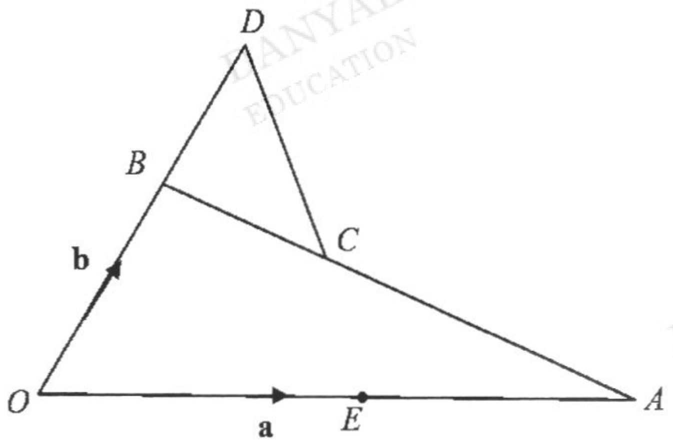
[Turn over

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



Answer .... cm [3]

9 (b) OAB is a triangle and C is a point on AB such that $AC : CB = 2 : 1$.
The side OB is produced to the point D such that $OB : BD = 3 : 2$.
$\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$.



(i) Express $\overrightarrow{OC}$ in terms of $\mathbf{a}$ and $\mathbf{b}$, as simply as possible.

Answer .... [2]

[Turn over

9 (b) (ii) Express $\overrightarrow{CD}$ in terms of **a** and **b**, as simply as possible.

Answer .... [2]

(iii) E is the point on OA such that $\overrightarrow{OE} = \frac{5}{9}\mathbf{a}$.

Show that D, C and E lie on a straight line.

Answer [3]

(iv) Write down the ratio $\frac{\text{area of triangle } OEC}{\text{area of triangle } OCD}$.

Answer .... [1]

(v) Write down the ratio $\frac{\text{Area of triangle } EAC}{\text{Area of triangle } OAB}$.

Answer .... [1]

[Turn over

10 Mr Tan designed two computer models X and Y. Both have the same manufacturing cost. Mr Tan engaged his existing client Mr Chew to find out which model is more likely to sell. Mr Chew sent a survey to 1000 random customers, with the photos, price and specifications for each model.

Question 1	I will buy Model X.	**SD**	**D**	**N**	**A**	**SA**
Question 2	I will buy Model Y.	**SD**	**D**	**N**	**A**	**SA**

SD =Strongly Disagree, **D** =Disagree, **N** =Neutral, **A** =Agree and **SA** =Strongly Agree.

Mr Chew prepared the following report. Unfortunately, coffee spilled on the report before Mr Tan could read it. Mr Tan decided to figure out the missing information.

Points allocated for each type of response	**Model X**	**Model Y**
SD = 1	7	[redacted]
D = 2	16	31
N = 3	628	14
A = 4	347	[redacted]
SA = 5	2	[redacted]
n	1000	1000
Mean of points	[redacted]	1.907
Standard Deviation of points	[redacted]	1.611

(a) Assuming that Mr Tan has done all his calculations correctly, what are the mean and the standard deviation for Model X? Give your answers to 3 decimal places.

Answer mean =.............................. [1]

standard deviation =................ [1]

(b) By comparing the means for both models, which model should Mr Chew recommend Mr Tan to produce? State your reason clearly.

Answer [1]

[Turn over

10 (c) Mr Tan became troubled with the high standard deviation for Model Y, so he decided to find the missing values for **SD**, **A** and **SA** for Model Y.
Help Mr Tan calculate the missing information.

Answer missing values for **SD** =…………., **A** =…………., **SA** =…………. [5]

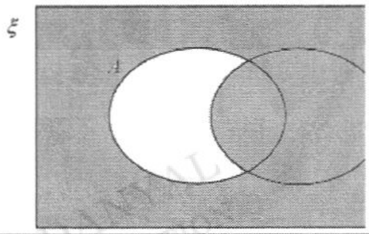
(d) With all the information available now, which model should Mr Tan produce?
State your reason clearly.

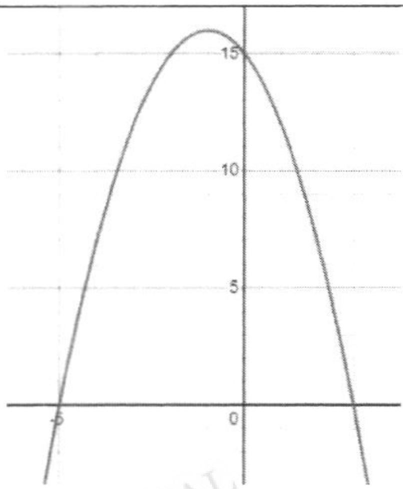
Answer [2]

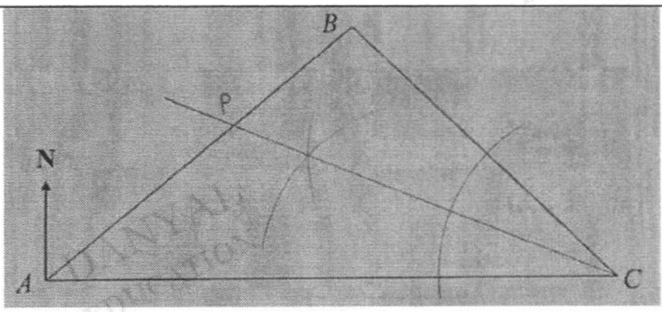
[Turn over

4Exp E Math Prelim 2022 Paper 1 Marking Scheme

Qn	Solution	Mark
1a	$\left(-a^2\right)^3 \div 4b^0 = -a^6 \div 4$ $= -\frac{1}{4}a^6$	B1 for $-a^6$ A1
1b	$\left(a^{-1}b\right)^2 \times \left(\sqrt{b}\right)^3 = a^{-2}b^2 \times b^{\frac{3}{2}}$ $= \frac{b^{\frac{7}{2}}}{a^2}$	B1 for $a^{-2}b^2$ or $b^{\frac{3}{2}}$ A1
2	The vertical axis does not start from zero. The increase in the number of years on the horizontal axis is not a constant.	B1 B1 Ignore any subsequent explanations given by students
3a	2.5014×10^9 cm^3	B1 (exact ans only)
3b	Time needed $= \frac{2.5014 \times 10^9}{(8 \times 10^2 + 1.2 \times 10^3) \times 1000}$ $= 1250.7$ minutes	M1 for $\frac{\text{their (a)}}{(8 \times 10^2 + 1.2 \times 10^3) \times 1000}$ A1 (exact ans only)
4	$y = ka^{-x}$ $3 = ka^{-0}$ $k = 3$ $6 = 3(a^1)$ $a = 2$	B1 B1
5a	$1400 = 2^3 \times 5^2 \times 7$	B1
5b	Not all the index / power of the prime factors of 1400 are even numbers.	B1
5c	$a = 5$ $b = 7$	B1 B1

6a	Area = 4 cm^2 : 2.56 km^2 Length = 2 cm : 1.6 km = 1 cm : 0.8 km = 1 : 80000	M1 for finding length ratio in any units A1
6b	Actual distance = 16 km	B1
7a	$A = \{1, 2, 3, 4\}$ $B = \{2, 3, 5, 7, 11\}$ $A \cap B' = \{1, 4\}$	B1
7b		B1
8	$M = kr^3$ $k = \frac{M}{r^3}$ new $M = k(\text{new } r)^3$ $8M = \frac{M}{r^3}(\text{new } r)^3$ $(\text{new } r)^3 = 8r^3$ new $r = 2r$ % increase in $r = 100\%$ OR $\frac{M_1}{(r_1)^3} = \frac{M_2}{(r_2)^3}$ $\frac{M_1}{(r_1)^3} = \frac{8M_1}{(r_2)^3}$ $r_2 = 2r_1$ % increase in $r = 100\%$	M1 for relationship between new and old sets of values of M and r A1 M1 for relationship between new and old sets of values of M and r A1
9	$\left(\frac{h}{45}\right)^3 = \frac{1}{2}$ $h = 35.716$ $h = 35.7$ cm (3sf)	M1 for relationship between height ratio and volume ratio A1
10ai	$x^2 - 4x + 8 = (x-2)^2 - 2^2 + 8$ $= (x-2)^2 + 4$	B1

10aii	The minimum value of $x^2 - 4x + 8$ is bigger than 0. OR The minimum turning point of $y = x^2 - 4x + 8$ is (2,4) which is above the x-axis. Hence, graph of $y = x^2 - 4x + 8$ does not intersect the x-axis. OR $y = x^2 - 4x + 8$ is a U-shaped graph and its turning point is (2,4) which is above the x-axis. Hence, graph of $y = x^2 - 4x + 8$ does not intersect the x-axis. OR When $(x-2)^2 + 4 = 0$, $(x-2)^2 = -4$. But $(x-2)^2$ cannot be negative and hence, the graph of $y = x^2 - 4x + 8$ does not intersect the x-axis.	B1
10b		B1 for turning point (– 1, 16) B1 for x-intercepts at – 5 and 3; and y-intercept at 15 B1 for correct shape of curve passing through their turning point and intercepts with their axes
11	$x^2 - 8xy + 16y^2 = 0$ $(x-4y)^2 = 0$ $x - 4y = 0$ $x = 4y$ $\frac{x}{y} = 4$	B1 for $(x-4y)^2$ A1

12a	$\frac{AE}{AC}=\frac{7}{14}=\frac{1}{2}$ (given) $\frac{AB}{AD}=\frac{10}{20}=\frac{1}{2}$ (given) $\angle CAD=\angle EAB$ (common) ACD similar to AEB (SAS)	M1 for showing $\frac{AE}{AC}=\frac{AB}{AD}$ (given) - accept if length ratio of $\frac{1}{2}$ not mentioned A1 for complete proof, reasons and conclusion
12b	$AF=\frac{1}{4}\times 10=2.5$ cm	B1
13a	$a=52$ $b=58$ $c=74$	B1 B1 B1
13b	58	B1
13c	Every student's test score is used to calculate the standard deviation while the interquartile range is calculated using the lower and upper quartiles only.	B1
14a	$-2x^2+x+3=(-x-1)(2x-3)$	B1 accept $-(x+1)(2x-3)$
14b	$8x^3-18xy^2=2x(4x^2-9y^2)$ $=2x(2x-3y)(2x+3y)$	M1 for factorising $2x$ A1
15a		M1 for showing all 3 construction lines to draw angle bisector A1 for marking the point P
15b	050°	B1 (accept 049° to 051°)

16a	$\mathbf{B} = \begin{pmatrix} 300 \\ 500 \\ 1000 \end{pmatrix}$	B1
16b	$\mathbf{X} = \begin{pmatrix} 0.5 & 0.5 \end{pmatrix} \begin{pmatrix} 80 & 42 & 20 \\ 120 & 62 & 30 \end{pmatrix} \begin{pmatrix} 300 \\ 500 \\ 1000 \end{pmatrix}$ $= \begin{pmatrix} 0.5 & 0.5 \end{pmatrix} \begin{pmatrix} 65000 \\ 97000 \end{pmatrix}$ $= \begin{pmatrix} 81000 \end{pmatrix}$	M1 for correct matrix multiplication of any 2 matrices A1 do not award for answer left as 81000
16c	The mean / average amount of money collected from the semi-final and the final football matches. OR It represents half the total amount of money collected from the semi-final and the final football matches. OR It represents the total amount of money collected from the semi-final and the final football matches if there is a 50% discount on all tickets.	B1
17	$\frac{(2n-2)\times 180}{2n} = \frac{(n-2)\times 180}{n} + 30$ $90(2n-2) = 180(n-2) + 30n$ $3(2n-2) = 6(n-2) + n$ $6n - 6 = 6n - 12 + n$ $n = 6$	M1 for forming relationship M1 for changing to linear equation A1
18	$(2n-1)^2 + 3 = 4n^2 - 4n + 1 + 3$ $= 4n^2 - 4n + 4$ $= 4(n^2 - n + 1)$ Since $n^2 - n + 1$ is an integer, $4(n^2 - n + 1)$ is a multiple of 4.	B1 for $4(n^2 - n + 1)$ A1 for conclusion

19a	$\frac{v-20}{80}=\frac{5}{25}$ $v=36$ Speed at 20 sec = 36 m/s $=\frac{0.036}{1/3600}$ km/h =129.6 km/h	M1 for forming relationship B1 for 36 m/s at $t = 20$ sec A1 (exact ans only)
19b	Distance $=\frac{1}{2}(100+20)(25)$ $=1500$ m	M1 to find area under speed-time graph A1
19c	$\frac{100-20}{25}=2\times\frac{k-20}{62.5-25}$ $3.2=\frac{4}{75}(k-20)$ $k=80$	M1 for forming relationship between deceleration in first 25sec and acceleration after 25sec A1
20a	$PQ=PO+OQ$ $=\begin{pmatrix}-3\\1\end{pmatrix}+\begin{pmatrix}-5\\5\end{pmatrix}$ $=\begin{pmatrix}-8\\6\end{pmatrix}$ $\lvert PQ\rvert=\sqrt{(-8)^2+6^2}$ $=10$	B1 for $PQ=\begin{pmatrix}-8\\6\end{pmatrix}$ or M1 for finding length of line segment PQ A1
20b	$m=\frac{-1-5}{3-(-5)}=-\frac{3}{4}$ $-1=-\frac{3}{4}(3)+c$ $c=\frac{5}{4}$ $y=-\frac{3}{4}x+\frac{5}{4}$ Subs $y=0, x=\frac{5}{3}$ $R=(\frac{5}{3},0)$ OR	B1 for $y=-\frac{3}{4}x+\frac{5}{4}$ Or M1 for applying $m_{PQ}=m_{PR}$ A1

	$\overrightarrow{PQ}=\begin{pmatrix}-8\\6\end{pmatrix}$ $m=\frac{6}{-8}=-\frac{3}{4}$ $R(x,0)\ P(3,-1)$ $\frac{0-(-1)}{x-3}=-\frac{3}{4}$ $x=\frac{5}{3}$ $R=(\frac{5}{3},0)$ OR $PR=kPQ$ $OR-\begin{pmatrix}-3\\1\end{pmatrix}=k\begin{pmatrix}-8\\6\end{pmatrix}$ $OR=\begin{pmatrix}-8k+3\\6k-1\end{pmatrix}$ $6k-1=0$ $k=\frac{1}{6}$ $OR=\begin{pmatrix}-8(\frac{1}{6})+3\\0\end{pmatrix}=\begin{pmatrix}\frac{5}{3}\\0\end{pmatrix}$ $R=(\frac{5}{3},0)$	M1 for forming relationship A1 M1 for finding $k=\frac{1}{6}$ A1
20c	$S=(-3,0)$	B1
21	New BMI $=\frac{0.992m}{(1.02h)^2}$ $=0.95347\left(\frac{m}{h^2}\right)$ $=0.95347(\text{old BMI})$ % change $=\frac{0.95347-1}{1}\times100\%$ $=-4.65\%$ (3sf)	M1 to express new BMI in terms of old BMI B1 for 0.95347 A1

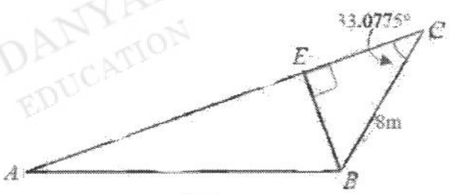
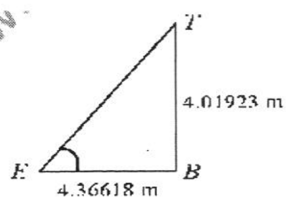
22a	$x = 7\times 5 = 35$ $y = 150-60-35 = 55$	B1 B1
22b	$\dfrac{n}{150+n}\times\dfrac{n}{150+n}=\dfrac{1}{256}$ $\dfrac{n^2}{22500+300n+n^2}=\dfrac{1}{256}$ $256n^2 = 22500+300n+n^2$ $255n^2-300n-22500=0$ $17n^2-20n-1500=0$	M1 for forming equation M1 for simplifying LHS into single fraction A1
22c	$17n^2-20n-1500=0$ $(17n+150)(n-10)=0$ $n=-\dfrac{150}{17}$ (rej), $n=10$	M1 for factorisation or quadratic formula A1 (SC1 for $n = 10$ without working)
23a	$\tan\angle ABO=\dfrac{15}{8}$ $\angle ABO = 1.0808$ rad (4 dp)	A1
23b	$\angle BAO=\pi-\dfrac{\pi}{2}-1.0808$ $=0.48999$ Area of unshaded $POB=\dfrac{1}{2}(15)(8)-\dfrac{1}{2}(15^2)(0.48999)$ 4.8761 Area of shaded region $=\dfrac{1}{2}(8^2)(1.0808)-4.8761$ $=29.709$ $=29.7\text{ cm}^2$ (3sf)	M1 to find area of sector APO or sector BOQ (accept if student converts angles to degrees to compute area) B1 for area of unshaded POB = 4.8761 A1

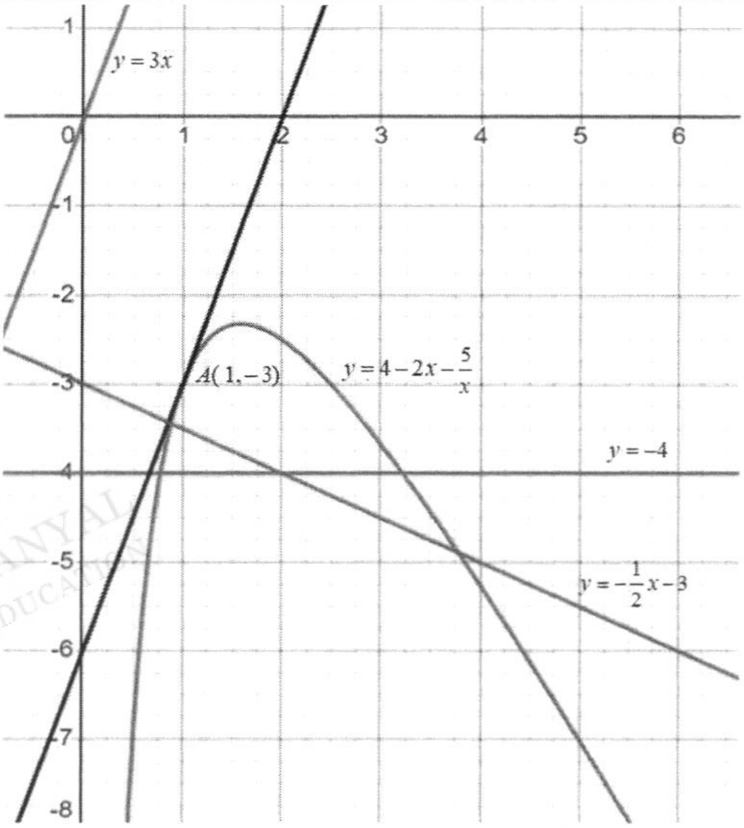
2022 MF Mathematics Preliminary Examination Paper 2 Marking Scheme

Qn		Solutions	Marks	
1	(a)	$\dfrac{(3x-y)}{(x+2y)} = \dfrac{1}{3}$ $3(3x-y) = x+2y$ $9x-3y = x+2y$ $9x-x = 2y+3y$ $8x = 5y$ $\dfrac{x}{y} = \dfrac{5}{8}$ $x : y = 5 : 8$	 M1 A1	AO1 Group the like terms together
1	(b)	$\dfrac{2-3x}{3} < \dfrac{2x-1}{6}$ Multiply the inequality by 6 $2(2-3x) < 2x-1$ $4-6x < 2x-1$ $-6x-2x < -1-4$ $-8x < -5$ $x > \dfrac{5}{8}$	 M1 A1	AO1 Form a linear inequality without bracket
1	(c)	Method 1 $\dfrac{1}{x} + \dfrac{1}{y^2} = \dfrac{1}{w-3}$ $\dfrac{1}{y^2} = \dfrac{1}{w-3} - \dfrac{1}{x}$ $\dfrac{1}{y^2} = \dfrac{x-(w-3)}{(w-3)x}$ $\dfrac{1}{y^2} = \dfrac{x-w+3}{x(w-3)}$ $y^2 = \dfrac{x(w-3)}{x-w+3}$ $y = \pm\sqrt{\dfrac{x(w-3)}{x-w+3}}$	 M1 M1 A1	AO2 Combine 2 fractions into a single fraction Make y^2 be the subject

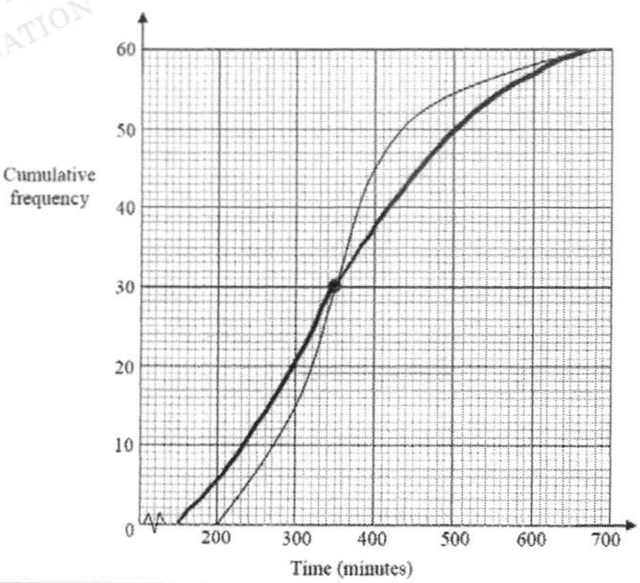
1	(c)	Method 2 Multiply the equation by $xy^2(w-3)$: $y^2(w-3)+x(w-3)=xy^2$ $y^2(w-3)-xy^2=x(w-3)$ $y^2(w-3-x)=x(w-3)$ $y^2=\frac{x(w-3)}{(w-3-x)}$ $y=\pm\sqrt{\frac{x(w-3)}{(w-3-x)}}$	M1 M1 A1	Form a non-fractional equation Make y^2 be the subject
2	(a)	Cost Price $=\$1288\times\frac{85}{100}\times\frac{100}{125}$ $=\$875.84$	M1 M1 A1	AO2 For multiply $\frac{85}{100}$ For multiply $\frac{100}{125}$
2	(b)	Amount paid by instalment $=\$125\times18=\$2250$ Amount borrowed $=\$2388-\$295=\$2093$ Total Interest $=\$2250-\$2093=\$157$ $I=\frac{PRT}{100}$ $157=\frac{2093\times R\times\frac{18}{12}}{100}$ $R=\frac{157\times100}{2093}\times\frac{12}{18}$ $R=5.00$ (3s.f)	M1 M1 A1	AO1 For Total Interest For arithmetic expression for R
2	(c)	$A=P\left(1+\frac{r}{100}\right)^n$ where $r=-x$ $1200=2000\left(1-\frac{x}{100}\right)^4$ $\left(1-\frac{x}{100}\right)^4=\frac{1200}{2000}$ $1-\frac{x}{100}=\left(\frac{12}{20}\right)^{\frac{1}{4}}$ $-\frac{x}{100}=\left(\frac{12}{20}\right)^{\frac{1}{4}}-1$ $\frac{x}{100}=1-\left(\frac{12}{20}\right)^{\frac{1}{4}}$	M1 M1	AO2 Forming equation in x For taking 4^{th} root on both sides of equation

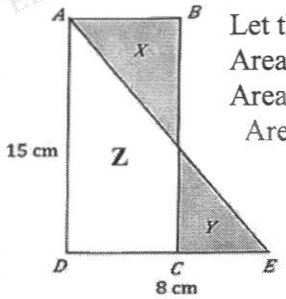
			$x = \left[1-\left(\frac{12}{20}\right)^{\frac{1}{4}}\right]\times 100$ $x = 11.9888$ $x = 12.0$ (3 s.f)	A1	
3	(a)		Total surface area $= \frac{1}{2}\times 4\pi\times 30^2 + 2\pi\times 30\times 70 + \pi\times 30^2$ $= 1800\pi + 4200\pi + 900\pi$ cm^2 $= 6900\pi$ cm^2 $= 21676.989$ cm^2 $= 21700$ cm^2 (3 s.f)	M1 M1 A1	AO1 For finding surface area of hemisphere For finding curved surface area of cylinder
3	(b)	(i)	Volume of water $= \frac{1}{2}\times\frac{4}{3}\pi\times 30^3 + \pi\times 30^2\times 70$ cm^3 $= 18000\pi + 63000\pi$ cm^3 $= 81000\pi$ cm^3 $= 81000\pi \div 1000$ litres (1 litre = 1000 cm^3) $= 81\pi$ litres $= 254.469$ litres $= 254$ litres (3 s.f)	M1 M1 A1	AO1 For volume of hemisphere OR volume of cylinder For total volume in cm^3
3	(b)	(ii)	Time taken $= 81\pi \div 3$ seconds $= 84.823$ seconds $= 1$ minutes 25 seconds	M1 A1	AO1
3	(b)	(iii)	Volume of the bath $= 81000\pi$ cm^3 $= \frac{81000\pi}{1000000}$ m^3 (1m =100cm, 1m^3 =1000000cm^3) $= 0.254469$ m^3 $\frac{1}{2}(0.4+0.6)\times 0.3\times l = 0.254469$ $l = \frac{0.254469\times 2}{0.3}$ $l = 1.69646$ m $l = 1.70$ m (3s.f)	M1 M1 A1	AO2 For converting volume from cm^3 to m^3 Forming equation to find l.

4	(a)	Area of the parallelogram $ABCD$ $= 2\times\frac{1}{2}\times15\times8\times\sin 50°$ $= 91.9253\ \text{m}^2$ $= 91.9\ \text{m}^2$ (3s.f)	M1 A1	AO1
4	(b)	$\angle ABC = 180° - 50° = 130°$ (int.$\angle s$, $AD \parallel BC$) By Cosine Rule, $AC^2 = 15^2 + 8^2 - 2\times15\times8\times\cos 130°$ $AC^2 = 443.269$ $AC = 21.0539$ m $AC = 21.1$ m (3s.f)	M1 M1 A1	AO1
4	(c)	$\angle ADC = 180° - 50° = 130°$ (int.$\angle s$, $DC \parallel AB$) By Sine Rule, $\frac{\sin\angle DAC}{15} = \frac{\sin 130°}{21.0539}$ $\sin\angle DAC = \frac{\sin 130°}{21.0539}\times15$ $\angle DAC = 33.0775°$ $\angle DAC = 33.1°$ (1d.p)	M1 A1	AO1 Make $\sin\angle DAC$ be the subject
4	(d)	$\angle ACB = \angle DAC$ ($alt.\angle s, AD \parallel BC$) $\angle ACB = 33.1°$ (1 d.p) Bearing of A from C = 180° + 33.1° = 213.1° (1 d.p)	B1	AO1
4	(e)	$\tan 15° = \frac{TB}{15}$ $TB = 15\times\tan 15°$ $TB = 4.01923$ $TB = 4.02$ m (3 s.f)	M1 A1	AO1
4	(f)	The smallest angle of θ =15° as A is farthest away from B. The greatest angle of $\theta = \angle TEB$ as E is nearest to B.  $\sin 33.0775° = \frac{BE}{8}$ $BE = 8\times\sin 33.0775° = 4.36618$ m $\tan\angle TEB = \frac{4.01923}{4.36618}$ $\angle TEB = 42.6307°$ $= 42.6$ (1d.p)  Hence $15° \le \theta \le 42.6°$	M1 M1 A1 A1	AO2 For finding shortest distance from B to AC For finding the greatest θ

5	(a)	$p = -3.7$	B1	AO1
5	(b)		 B1 B1 B1	AO1 Mark the points Accurately Draw the curve passes through all the marked points Smooth curve with correct shape
5	(c)	$2x + \frac{5}{x} = 8$ $-2x - \frac{5}{x} = -8$ $4 - 2x - \frac{5}{x} = 4 - 8$ $4 - 2x - \frac{5}{x} = -4$ Plot the line $y = -4$ From the graph, $x \approx 0.75$ *or* $x \approx 3.2$ (accepted: 0.65, 0.7, 0.8, 0.85, or 3.1, 3.15, 3.25, 3.3)	 B1 B1	AO2
5	(d)	Plot the line $y = 3x$ as guiding line From the graph, coordinates of A are $(1, -3)$	B1 B1	AO2

5	(e)	$3x^2-14x+10=0$ Divide the equation by $(-2x)$: $-\frac{3}{2}x+7-\frac{5}{x}=0$ $-\frac{5}{x}=\frac{3}{2}x-7$ Add $(4-2x)$ to both sides of the equation: $4-2x-\frac{5}{x}=4-2x+\frac{3}{2}x-7$ $4-2x-\frac{5}{x}=-\frac{1}{2}x-3$ Plot the line $y=-\frac{1}{2}x-3$, From the graph, the x-coordinates of the intersecting points between the curve and the line are $x\approx 0.85$ *or* $x\approx 3.80$ (accepted: 0.75, 0.8, 0.9, 0.95 or 3.7, 3.75, 3.85, 3.9)		M1 B1 A1 A1	AO2 For forming the equation For plotting the line
6	(a)	(i)	Area added on Day n $=1+4(n-1)$ $=4n-3$	B1	AO2
6	(a)	(ii)	$4\times 20-3=77$	B1	AO1
	(a)	(iii)	Area Added $=4n-3$ As n is a positive integer, $4n$ is always an even number. Subtracting odd number 3 from an even number will give us an odd number.	B1	AO3
6	(b)	(i)	Total area of pavement at Day 6 $=6\times 11=66$	B1	AO2
6	(b)	(ii)	$n=1,\ A=1\times 1$ $n=2,\ A=2\times 3$ $n=3,\ A=3\times 5$ From observation, $A=n\times(2n-1)$ $A=2n^2-n$	M1 A1	AO2
6	(b)	(iii)	Method 1 3 weeks = 21 days When n = 21, $A=2\times 21^2-21=861\text{m}^2$ Yes, as $861>780$, hence an area of 780 m² can be completed in 3 weeks.	M1 A1	AO3

			Method 2 $2n^2 - n = 780$ $2n^2 - n - 780 = 0$ $(2n+39)(n-20) = 0$ $n = -19.5 \quad or \quad n = 20$ Yes, since it takes only 20 days to cover 780m^2	M1 A1	
7	(a)		$\angle GAO = 90°$ (tangent $\perp$ radius) $\angle GOA = 180° - 90° - 32°$ ($\angle$ sum of Δ) $= 58°$	M1 A1	AO1 M0 if the reason is wrong
	(b)		$\angle FCD = 90°$ (rt $\angle$ in semi-circle) $\angle BCF = 106° - 90° = 16°$	M1 A1	AO2 M0 if the reason is wrong
	(c)		$\angle BDF = 16°$ ($\angle s$ in same segment) $\angle FDA = 58° \div 2 = 29°$ ($\angle$ at centre $= 2\angle$ at circumference) $\angle BDA = 16° + 29° = 45°$	M1 A1	AO2 M0 if the reason is wrong
	(d)		$\angle BAD = 180° - 106° = 74°$ ($\angle s$ in opp.segments) $\angle DEA = 180° - 74° - 29° = 77°$ ($\angle$sum of Δ)	M1 A1	AO2 M0 if the reason is wrong
8	(a)	(i)	(a) Median = 350 minutes	B1	AO1
			(b) Lower quartile = 300 Upper quartile = 400 Interquartile range = 400-300=100 minutes	B1	AO1
8	(a)	(ii)	20% spent $\geq x$ minutes on social media in a week 80% spent $< x$ minutes on social media in a week. $\frac{80}{100} \times 60 = 48$ students From the graph, 48 students spent < 420 minutes Hence $x = 420$	M1 A1	AO2
8	(a)	(iii)		B1	AO2 Any curve with same median and gentler slope for IQR

8	(b)	(i)	(a)	$\frac{8+30}{240}=\frac{38}{240}=\frac{19}{120}$	B1	AO1
			(b)	$\frac{5+40}{240}=\frac{45}{240}=\frac{3}{16}$	B1	AO1
8	(b)	(ii)		$P(\text{ at least one of them spent} \leq 40 \text{ minutes})$ $= 1-P(\text{none of them spent} \leq 40 \text{ minutes})$ $= 1-P(\text{both of them spent} > 40 \text{ minutes})$ $= 1-\frac{240-15-8}{240}\times\frac{240-15-8-1}{240-1}$ $= 1-\frac{217}{240}\times\frac{216}{239}$ $= \frac{437}{2390}$	 M1 A1	AO2
9	(a)			 Let the unshaded region be Z. Area X = Area $Y+12$ Area X + Area Z = Area Y + Area $Z+12$ Area of $ABCD$ = Area of ADE + 12 $AB\times15 = \frac{1}{2}\times8\times15 + 12$ $AB\times15 = 72$ $AB = 4.8\text{cm}$	 M1 M1 A1	AO2
9	(b)	(i)		$OC = OA + AC$ $= OA + \frac{2}{3}AB$ $= OA + \frac{2}{3}(AO+OB)$ $= a + \frac{2}{3}(-a+b)$ $= \frac{1}{3}a + \frac{2}{3}b$	 M1 A1	AO2
9	(b)	(ii)		$CD = CO + OD$ $= -OC + \frac{5}{3}OB$ $= -\left(\frac{1}{3}a+\frac{2}{3}b\right)+\frac{5}{3}b$ $= -\frac{1}{3}a + b$	 M1 A1	AO2

9	(b)	(iii)	From (ii) $\overrightarrow{CD}=-\frac{1}{3}\underset{\sim}{a}+\underset{\sim}{b}$ $\overrightarrow{EC}=\overrightarrow{EO}+\overrightarrow{OC}$ $=-\frac{5}{9}\underset{\sim}{a}+\left(\frac{1}{3}\underset{\sim}{a}+\frac{2}{3}\underset{\sim}{b}\right)$ $\overrightarrow{EC}=-\frac{2}{9}a+\frac{2}{3}\underset{\sim}{b}$ $EC=\frac{2}{3}\left(-\frac{1}{3}a+b\right)$ $EC=\frac{2}{3}CD$ $\Rightarrow$ EC is parallel to CD and C is the common point $\Rightarrow$ D, C and E are collinear.	 M1 M1 A1	AO3 For finding $\overrightarrow{EC}$ For connecting EC and CD by a scaler
		(iv)	$\frac{\text{area of } \Delta OEC}{\text{area of } \Delta OCD}$ $=\frac{EC}{CD}$ $=\frac{2}{3}$	 B1	AO2
		(v)	$\frac{\text{area of } \Delta EAC}{\text{area of } \Delta OAB}$ $=\frac{\text{area of } \Delta EAC}{\text{area of } \Delta OAC}\times\frac{\text{area of } \Delta OAC}{\text{area of } \Delta OAB}$ $=\frac{4}{9}\times\frac{2}{3}=\frac{8}{27}$	 B1	AO2
10		Real World Context Problem			AO3
	(a)	Mean $=\frac{\sum fx}{\sum f}=\frac{3321}{1000}=3.321$ Standard deviation $=\sqrt{\frac{\sum fx^2}{\sum f}-\bar{x}^2}=\sqrt{\frac{11325}{1000}-3.321^2}=0.544\ (3\text{s.f})$		B1 B1	
	(b)	Mr Chew should recommend Mr Tan to produce Model X. Because the mean for X is larger than the mean for Y, which may suggest that more people are likely to buy Model X.		B1	B0 if reason is wrong

10	(c)	For Model Y, let the missing values for **SD** and **A** be ***a*** and ***b*** respectively. Then the missing value for **SA** $= 1000 - 31 - 14 - a - b$ $= 955 - a - b$ Mean $= \dfrac{\sum fx}{\sum f} = 1.907$ $\dfrac{a + 62 + 42 + 4b + 5(955 - a - b)}{1000} = 1.907$ $4879 - 4a - b = 1907$ $4a + b = 2972$ ------(1) Standard deviation $= \sqrt{\dfrac{\sum f x^2}{\sum f} - (\bar{x})^2} = 1.611$ $\sqrt{\dfrac{a + 124 + 126 + 16b + 25(955 - a - b)}{1000} - 1.907^2} = 1.611$ $24125 - 24a - 9b = 6231.97$ $24a + 9b = 17893.03$------(2) $(1) \times 6$: $24a + 6b = 17832$--------(3) $(2) - (3)$: $3b = 61.03$ $b = 20.3$ Since b is a whole number, then $b = 20$. Hence the missing value for **A** is $b = 20$. Subst. $b = 20$ in (1) : $4a + 20 = 2972$ $a = 738$ Hence the missing value for **SD** is $a = 738$. Hence the missing value for **SA** is $955 - a - b$ $= 955 - 738 - 20$ $= 197$	M1 M1 A1 A1 A1	For forming the correct equation for mean For forming the correct equation for standard deviation Accept any correct method of solving simultaneous equations
	(d)	Mr Tan should produce Model Y. Because there are 197 people (about 20% of those surveyed) who strongly agree that they will buy Model Y, but only 2 people strongly agree that they will buy Model X. Although 347 people agree that they will buy Model X, it was not a strong agreement that they will do it. OR Mr Tan should produce Model X. Because there are 349 people who agree and strongly agree that they will buy Model X but only 217 people agree and strongly agree that they will buy Model Y.	B1 B1	B0 if reason is wrong Accept any reasonable explanation based on same idea given in mark scheme