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ST. MARGARET'S SECONDARY SCHOOL.

Preliminary Examinations 2016

CANDIDATE NAME

CLASS

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REGISTER NUMBER

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MATHEMATICS

4048/01

Paper1

19 August 2016

Secondary4 Express

2 hours

Additional Materials: NIL

READ THESE INSTRUCTIONS FIRST

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

Write in dark blue or black pen.

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

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

Answer **all** the questions.

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 .

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

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.

For Examiner's Use

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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

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

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

1 Factorise each of the following expressions completely

(a) $2x^2 + 8x - 42$,

Answer (a) _____ [2]

(b) $yz - 2y - 6 + 3z$.

Answer (b) _____ [2]

- 2 (a) Petrol costs y cents per litre. Desmond buys some petrol and it costs him x dollars. Find an expression, in terms of x and y , for the number of litres that he buys.

Answer (a) _____ litres [1]

- (b) Rashid's best timing for 2.4 km run was 9 minutes and 34 seconds. Convert his speed into metres per second.

Answer (b) _____ m/s [1]

3 Express the following expressions in their simplest form

(a) $\frac{3^n + 3^{n-1}}{3^{n+1}},$

Answer (a) _____ [2]

(b) $4x^4y^5 \div \left(-\frac{1}{2}x^2y^{-1}\right)^2.$

Answer (b) _____ [2]

4 Solve the equation, $\left(\frac{1}{2}\right)^{2x-1} + 4(7^0) = 6^2.$

Answer $x =$ _____ [3]

5 (a) Solve the equation $\frac{3x-1}{2} = 1 - \frac{x}{4}$.

Answer (a) $x =$ _____ [2]

(b) Given that $p - q = \frac{1}{12}$ and $pq = -\frac{1}{4}$, find the value of $\frac{1}{p} - \frac{1}{q}$.

Answer (b) _____ [2]

6 The speed of light is 3×10^8 m/s.

(a) Express this speed in km/h, giving your answer in standard form.

Answer (a) _____ km/h [1]

(b) Find the time taken in nanoseconds, for light to travel one kilometre.

Answer (b) _____ ns [2]

- 7 (a) Given $2x - 3 \leq \frac{2}{3}(6x - 12)$, find the smallest possible value of x if x is a perfect square.

Answer (a) $x =$ _____ [2]

- (b) Given that $-3 \leq x \leq 4$ and $-4 \leq y \leq -1$, where x and y are integers, find

- (i) the least value of $\frac{3x}{4y}$,

Answer (b)(i) _____ [1]

- (ii) the greatest value of $y^2 - x^2$.

Answer (b)(ii) _____ [1]

- 8 (a) Express 504 as the product of its prime factors.

Answer (a) _____ [1]

- (b) Find the smallest positive integer value of k for which $504k$ is a multiple of 240.

Answer (b) $k =$ _____ [1]

- 8 (c) Given that the lowest common multiple of 504 and n is 12 600, find the smallest value of n .

Answer (c) $n =$ _____ [1]

- 9 The first five terms of a sequence are

0, 3, 8, 15, 24

Find

- (a) the next term,

Answer (a) _____ [1]

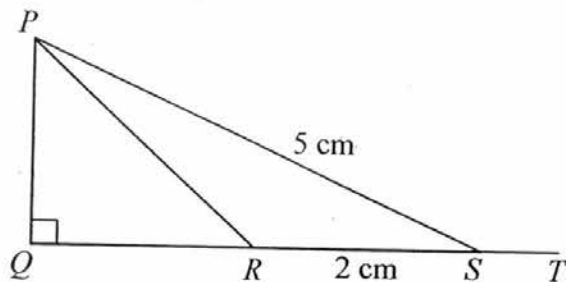
- (b) an expression for the n^{th} term,

Answer (b) _____ [1]

- (c) the 50th term.

Answer (c) _____ [1]

- 10 In the figure, $QRST$ is a straight line. Angle $PQR = 90^\circ$, $PS = 5$ cm, $RS = 2$ cm and the area of triangle $PRS = 3$ cm².



- (a) Calculate
(i) PQ ,

Answer (a)(i) _____ cm [1]

- (ii) PR .

Answer (a)(ii) _____ cm [2]

- (b) Express, as a fraction in the lowest term, the value of $\sin \angle PST - \tan \angle PRQ$.

Answer (b) _____ [1]

11 A scale of 2 cm to 1 km is used for a map.

(a) Express the scale in the form 1 : n .

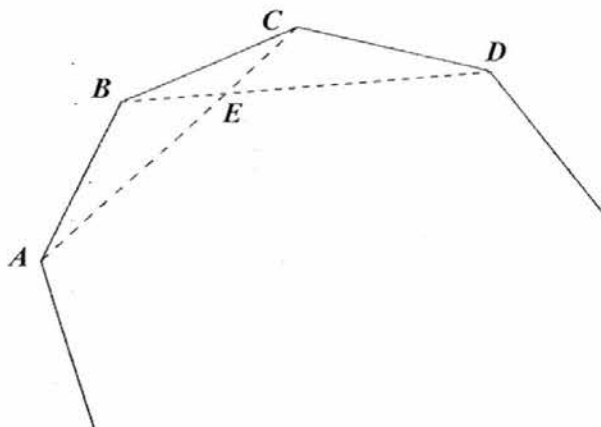
Answer (a) 1 : _____ [1]

(b) The distance between town A and town B measures 16 cm on the map.
Find the actual distance, in metres, between the two towns.

Answer (b) _____ m [1]

(c) A playground covers an actual area of 8 km^2 . Find the area of the playground on the map, leaving your answer in cm^2 .

Answer (c) _____ cm^2 [2]



The diagram shows part of a regular polygon with n sides. Given that $\angle BAC = 12^\circ$ and E is the point where the lines BD and AC intersect. Calculate

- (a) the value of n ,

Answer (a) $n =$ _____ [2]

- (b) $\angle AED$.

Answer (b) _____ $^\circ$ [1]

- 13 Solve the simultaneous equations below giving your answers in exact values.

$$1.5x - y = 3.5,$$

$$6x + 1\frac{2}{3}y = 7.$$

Answer $x =$ _____, $y =$ _____ [3]

14 (a) Given that $\varepsilon = \{x : x \text{ is an integer such that } 8 \leq x < 20\}$,

$P = \{x : x \text{ is a multiple of } 4\}$,

$Q = \{x : x \text{ is an even number}\}$ and

$R = \{x : x \text{ is a number less than } 7\}$.

(i) List the elements in set P .

Answer (a)(i) _____ [1]

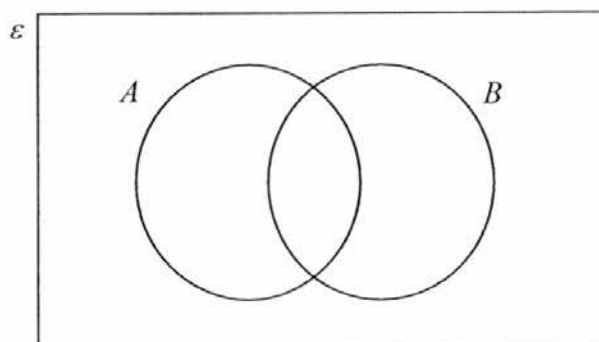
(ii) Find $n(P \cup Q)$.

Answer (a)(ii) _____ [1]

(iii) State the value of $n(R)$.

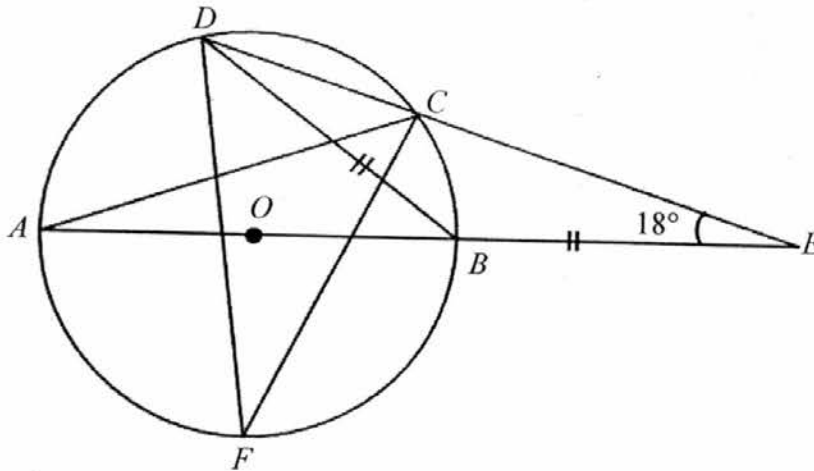
Answer (a)(iii) _____ [1]

(b) On the Venn diagram shown in the answer space, shade the set $A' \cap B$. [1]



15

AB is the diameter of the circle $AFBCD$ shown in the diagram. E is the point on AB produced, where $BD = BE$ and angle $AED = 18^\circ$. The straight line ED cuts the circle at C .



- (a) Explain why angle $CFB = 18^\circ$.

[2]

- (b) Find angle ABC .

Answer (b) _____ $^\circ$ [1]

- (c) Show that BD bisects angle ABC .

[1]

- (d) Given also that angle $BDF = 51^\circ$, calculate angle FBC .

Answer (d) _____ $^\circ$ [1]

- 16 Given that A is the point $(1, 1)$, $\overrightarrow{AB} = \begin{pmatrix} -2 \\ 3 \end{pmatrix}$, $\overrightarrow{AC} = \begin{pmatrix} 4 \\ 5 \end{pmatrix}$ and that D is the midpoint of BC . Find

(a) $\overrightarrow{BC}$,

Answer (a) _____ [1]

(b) $|\overrightarrow{AD}|$,

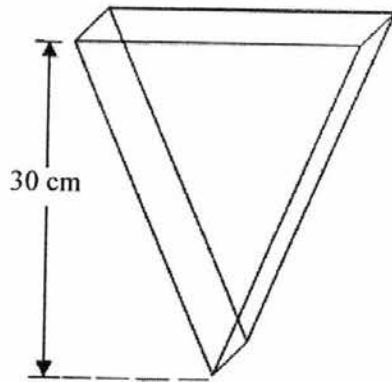
Answer (b) _____ units [2]

- (c) the coordinates of the point P such that $ABPC$ is a parallelogram using vector method.

Answer (c) (_____, _____) [2]

17

A container is a prism with a triangular cross-section. The container has a height of 30 cm. Jamie pours water into the empty container at a constant rate. She takes 9 seconds to fill the container with water. After t seconds, the depth of the water is d cm.



- (a) Find the value of d when $t = 4$.

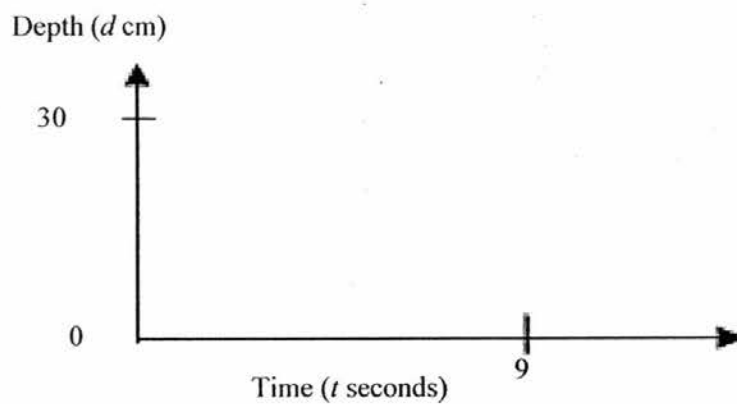
Answer (a) _____ [2]

- (b) Given that the volume of the container is 1350 cm^3 . Find the volume of the water when $t = 4$.

Answer (b) _____ cm^3 [2]

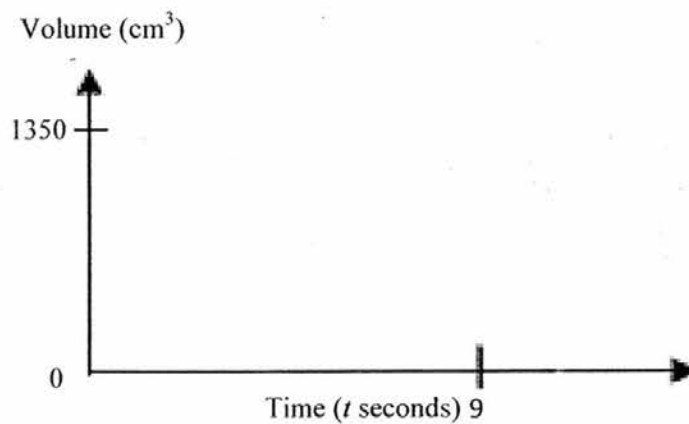
- 17 (c) On the axes in the answer space, sketch the graph showing how the
(i) depth varies during the 9 seconds,

[1]



- (ii) volume varies during the 9 seconds.

[1]



- 18 The times (in seconds) taken by 12 boys to complete the shuttle run are given below.

9 14 12 17 16 10 10 18 12 15 13 12

Find,

- (a) (i) the median,

Answer (a)(i) _____ [1]

- (ii) the interquartile range.

Answer (b)(ii) _____ [1]

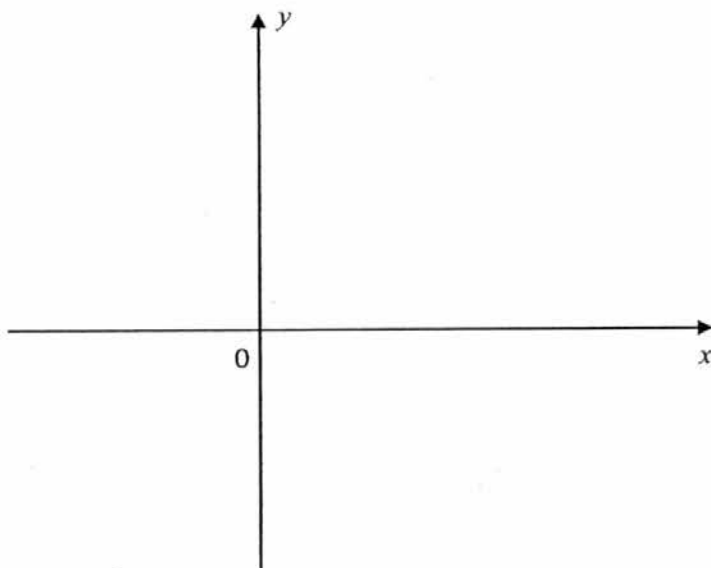
- (b) The times (in seconds) taken by 12 girls to complete the shuttle run are given below.

10 18 19 12 12 14 21 21 22 15 13 15

Compare the results of the boys and girls.

[2]

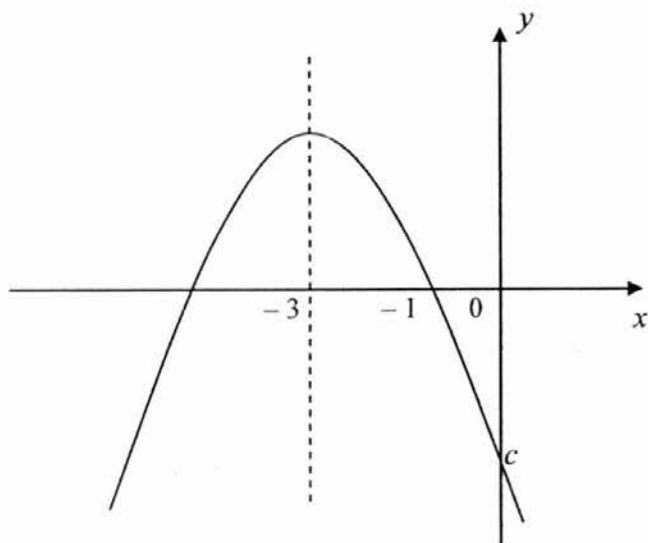
- 19 (a) Express $y = x^2 - 8x + 14$ in the form $y = (x + a)^2 + b$ and sketch $y = x^2 - 8x + 14$ in the space provided showing the turning point and y -intercept.



[2]

Answer (a) $y =$ _____ [1]

- (b) The diagram below shows a quadratic function in the form of $y = ax^2 + bx - 5$. Equation of line of symmetry is $x = -3$. Find the values of a , b and c .

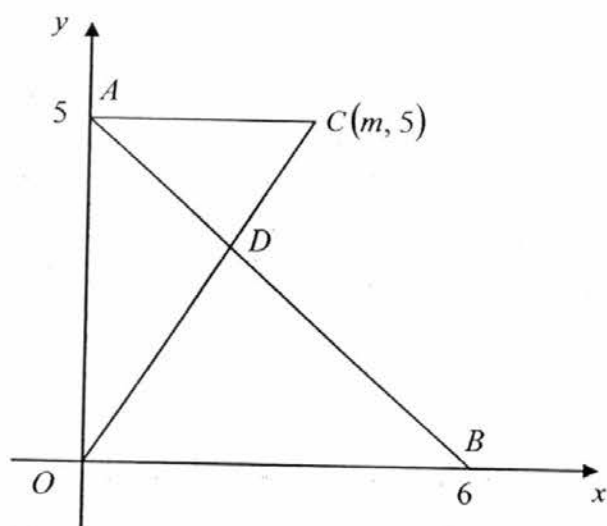


Answer (b) $a =$ _____ $b =$ _____

$c =$ _____

[3]

- 20 In the diagram below, O is the origin, A is $(0, 5)$ and B is $(6, 0)$. C is a variable point with the coordinates $(m, 5)$ and D is the point of intersection of the lines AB and OC .



- (a) Prove that triangles OBD and CAD are similar for all values of m .

[2]

- (b) Find
(i) the equation of the line AB ,

Answer (b)(i) _____ [1]

- (ii) the value of m when the length of OC is given as $\sqrt{34}$ units,

Answer (b)(ii) $m =$ _____ [1]

- (iii) using the value of m in (ii), find the coordinates of D .

Answer (b)(iii) (_____, _____) [2]

Answer Key

1 (a) $2(x+7)(x-3)$ (b) $(y+3)(z-2)$

2 (a) $\frac{100x}{y}$ litres (b) 4.18 m/s

3 (a) $\frac{4}{9}$ (b) $16y^7$

4 $x = -2$

5 (a) $x = \frac{6}{7}$ (b) $\frac{1}{3}$

6 (a) 1.08×10^9 km/h (b) 3330 ns

7 (a) $x = 4$ (b) (i) -3 (ii) 16

8 (a) $504 = 2^3 \times 3^2 \times 7$ (b) $k = 10$ (c) $n = 25$

9 (a) 35 (b) $n^2 - 1$ (c) 2499

10 (a) (i) 3 cm (ii) 3.61 cm (b) $-\frac{9}{10}$

11 (a) 1 : 50000 (b) 8000 m (c) 32 cm^2

12 (a) $n = 15$ (b) 156°

13 $x = 1\frac{26}{51}, y = -1\frac{4}{17}$

14 (a) (i) { 8, 12, 16 } (ii) 6 (iii) 0 (b) ---

15 (a) $\angle CDB = 18^\circ$ (base angles isosceles triangle), (b) 72°

$\angle CDB = \angle CFB$ (angles in the same segment),

$\therefore \angle CFB = 18^\circ$ shown

(c) $\angle ABD = 18 + 18$ (exterior angle of a triangle) (d) 111°

$= 36^\circ$

$\angle DBC = 72 - 36 = 36^\circ$

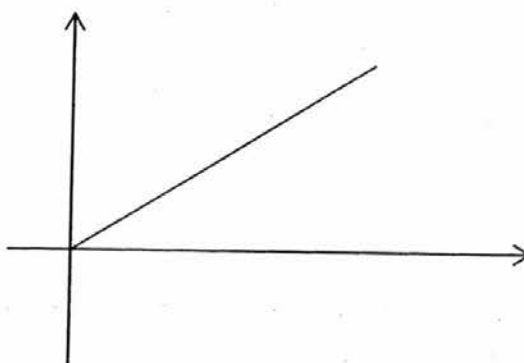
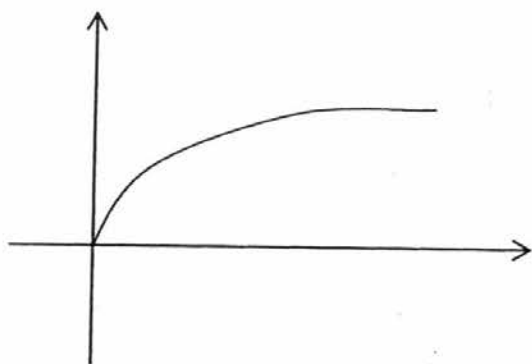
$\angle ABD = \angle DBC \therefore BD$ bisects $\angle ABC$

16 (a) $\overrightarrow{BC} = \begin{pmatrix} 6 \\ 2 \end{pmatrix}$ (b) $|\overrightarrow{AD}| = 4.12 \text{ units}$ (c) (3, 9)

17 (a) $d = 20$ (b) 600 cm^3

(c) (i)

(c) (ii)



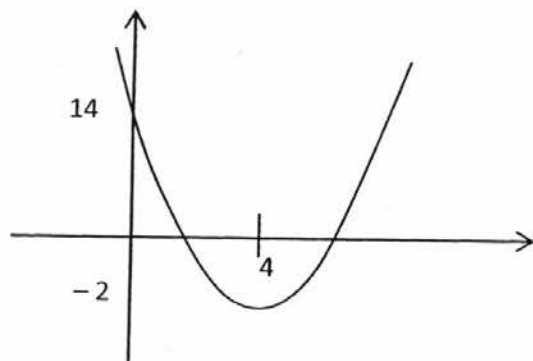
18 (a) (i) 12.5 (ii) 4.5

(b) median of girls = 15 and IQR of girls = 4.5

Boys are faster because median is smaller. Boys' performance more consistent as IQR is smaller.

19 (a)

(b) $a = -1, b = -6, c = -5$



20 (a) AC is horizontal, hence parallel to OB

(b) (i) $y = -\frac{5}{6}x + 5$

$\angle CAD = \angle OBD$ (alternate angles, $AC \parallel OB$)

(ii) $m = 3$ (iii) $(2, 3\frac{1}{3})$

$\angle ACD = \angle BOD$ (alternate angles, $AC \parallel OB$)

Since 2 corresponding angles are equal, $\therefore \triangle OBD$ and $\triangle CAD$ are similar.



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ST. MARGARET'S SECONDARY SCHOOL

Preliminary Examinations 2016

CANDIDATE NAME

CLASS

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REGISTER NUMBER

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MATHEMATICS

4048/02

Paper 2

22 August 2016

Secondary 4 Express

2 hours 30 minutes

Additional Materials: Writing Paper
 Graph Paper (1 sheet)

READ THESE INSTRUCTIONS FIRST

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

Write in dark blue or black pen on both sides of the paper.

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

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

Answer **all** the questions.

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 .

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

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 100.

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

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

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

Answer all the questions.

1. (a) Factorise $36y^2 - 100z^2$ completely. [2]
- (b) Express $\frac{5x+1}{x^2+x-6} - \frac{2}{2-x}$ as a single fraction in its simplest form. [3]
- (c) For a two-digit number, the sum of the units digit and tens digit is 5 and the difference between the units digit and tens digit is 1.
- (i) Form two simultaneous equations and solve them. [3]
- (ii) Hence state the two-digit number. [1]
- (d) (i) Make m the subject of the formula $\frac{3}{s} + \frac{p}{5} + \frac{1}{m} = 4r$. [2]
- (ii) Hence find the value of m , given that $s = 2$, $r = 1$ and $p = 3$. [1]
-

2. Peter bought some lychees for \$360. He paid \$ x for each kilogram of lychees.
- (a) Write down an expression, in terms of x , for the number of kilogram of lychees that he bought. [1]
- During the delivery, 5 kilogram of his lychees were squashed. He sold the remainder of the lychees at 60cents more per kilogram than he paid for.
- (b) Write down, in terms of x , for the sum of money he received for the remaining lychees. [1]
- He made a profit of \$171.
- (c) Write down an equation in x to represent this information and show that it reduces to $5x^2 + 174x - 216 = 0$. [3]
- (d) Solve the equation and hence find the price that he paid for each kilogram of lychees. [3]

3. (a) A bag contains 20 coloured discs. Out of these 20 discs, 8 are blue, 7 are red and 5 are yellow. Jane draws two discs from the bag at random.
- (i) Draw a tree diagram to show the probabilities of the possible outcomes. [2]

- (ii) Find, as a fraction in its simplest form, the probability that
- (a) both discs are yellow, [1]
 - (b) one disc is red and the other is blue, [1]
 - (c) both discs are of different colour. [2]
- (b) 120 students from Mega Secondary School took a Science Test and their marks are given in the following table.

Marks	Frequency
$0 < x \leq 20$	2
$20 < x \leq 30$	5
$30 < x \leq 40$	8
$40 < x \leq 50$	35
$50 < x \leq 80$	70

- (i) Calculate an estimate of the mean and standard deviation. [3]
- (ii) The mean mark for another group of student from Faith Secondary School is 42 and the standard deviation is 12.8 mark. Make two comparisons between the marks for the 2 different groups of students. [2]

4. Answer the whole of this question on a sheet of graph paper.

This following is a table of values for the graph of $y = 15 + 5x - x^2$.

x	0	1	2	3	4	5	6	7	8
y	15	19	21	a	19	15	9	b	-9

- (a) Calculate the value of a and of b . [1]
- (b) Using a scale of 2cm to 1 unit on the x axis and 2 cm to 5 unit on the y axis, draw the graph of $y = 15 + 5x - x^2$ for $0 \leq x \leq 8$. [3]
- (c) Use your graph to find the values of x when $y = 18$. [2]
- (d) By drawing a tangent, find the gradient of the curve where $x = 4.5$. [2]
- (e) By drawing a suitable straight line on the same axes, use your graph to find the solutions of the equation $\frac{13}{x} + 4 = x$. [3]

M is the midpoint of AC and $AC = 2CE$.

(a) Express each of the following, as simply as possible, in terms of a and/or b .

- (i) $\overrightarrow{AC}$ [1]
- (ii) $\overrightarrow{CE}$ [1]
- (iii) $\overrightarrow{DE}$ [1]
- (iv) $\overrightarrow{FE}$ [1]

- (b) Write down 2 facts about BC and FE . [2]

- (c) Calculate the value of

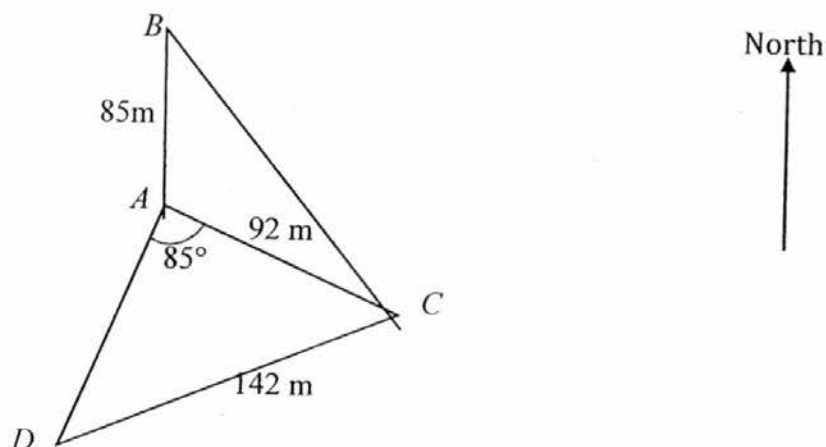
- (i) $\frac{\text{Area of } \triangle ABM}{\text{Area of } \triangle BME}$ [1]
- (ii) $\frac{\text{Area of } \triangle ABC}{\text{Area of } \triangle AFE}$ [1]
- (iii) $\frac{\text{Area of } \triangle ABM}{\text{Area of } BFEC}$ [1]

- | | Outlet A | Outlet B | Outlet C |
|--|----------|----------|----------|
|--|----------|----------|----------|

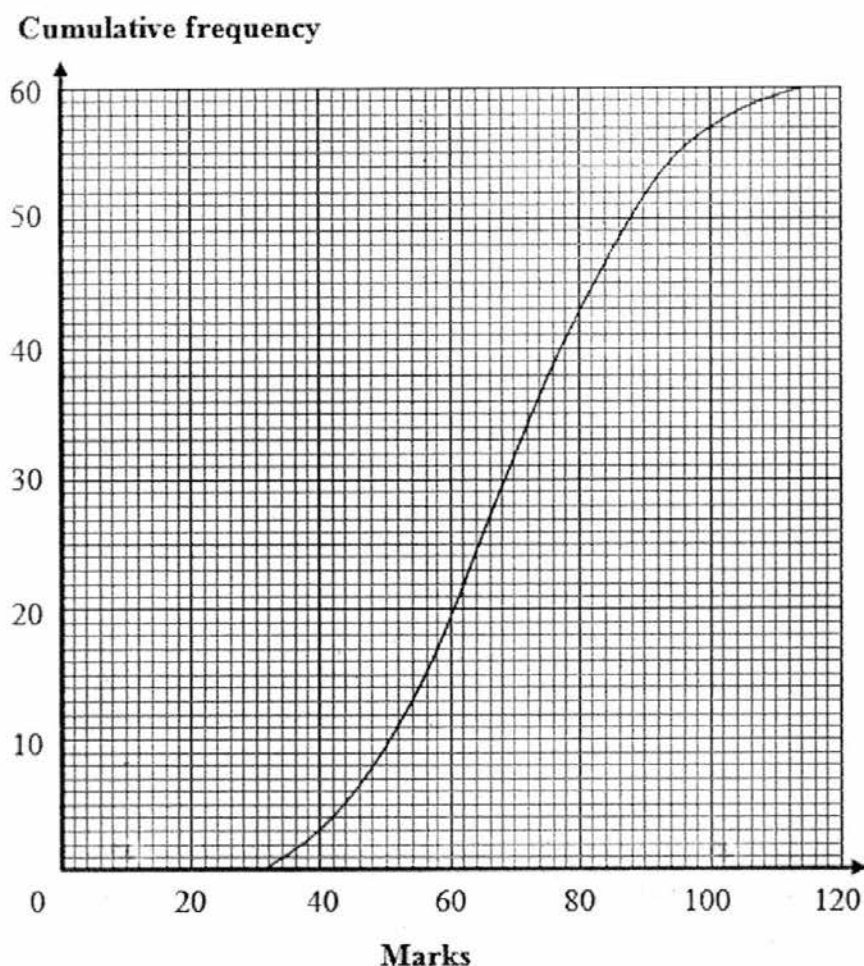
Salted Caramel	300	280	250
Chocolate	450	385	355
Sugared coated	255	275	310
Strawberry	150	140	185

- (a) Write down a 4×3 matrix N that represents the information given in the table. [1]
- (b) The selling price of salted caramel doughnuts, chocolate doughnuts, sugared coated doughnuts and strawberry doughnuts are \$2, \$1.80, \$1.30 and \$1.40 respectively. Write down a matrix P that represents this information and hence evaluate PN . [3]
- (c) Explain what the elements of matrix PN represents. [1]

- 7 In the diagram below, A, B, C and D are points on level ground. $AB = 85\text{m}$, $AC = 92\text{m}$ and $\angle DAC = 85^\circ$. B is due North of A and the bearing of D from A is 205° .



- (a) Find BC . [3]
- (b) Calculate the area of triangle ABC . [1]
- (c) Calculate $\angle ADC$. [2]
- (d) A vertical mast is at C . The angle of elevation of the top of the mast from A is 27° . Calculate the angle of elevation of the top of the mast from B . [3]
- 8 The cumulative frequency graph shows the distribution of marks of 60 students in a spelling test.

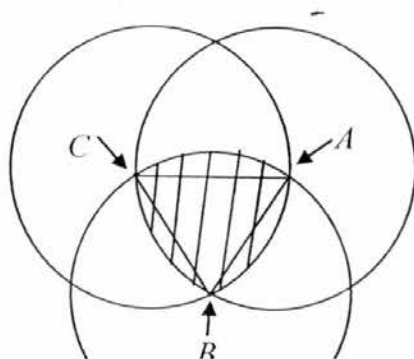


- (a) Find
- (i) the median mark. [1]
 - (ii) 65th percentile mark. [1]
- (b) Find the percentage of students who obtained more than 48 marks. [2]
- (c) Two students are chosen at random to go through to the next round of competition. Find the probability that both students obtain more than 88 marks. [2]

- 9 (a) In 2014, a factory employed 1275 workers consisting of Foreman, Craftsman and Apprentice in the ratio 1:9:5.

- (i) Find the number of Apprentices employed in 2014. [1]
- (ii) The number of workers employed in 2014 was 25% more than it was in 2013. Find the number of workers employed in 2013. [1]
- (iii) 70% of the factory's total expense are for wages and the rest is for raw materials. In 2015, wages increased by 8% and the cost of the raw material increased by 23%. Calculate the percentage increase in the total expense, assuming that the number of workers employed remained the same. [3]
- (b) Tom borrowed \$4000 from a bank at the interest rate of 15% per annum compounded monthly. He repaid \$1500 at the end of the first month, \$2000 at the end of the second month, and made a final settlement at the end of the third month.
- (i) How much did he owe the bank just after
- (a) the first payment, [2]
- (b) the second payment? [2]
- (ii) How much was the final settlement payment? [2]
- (iii) If Tom has repaid \$2000 at the end of the first month and \$1500 at the end of the second month, would the final settlement payment at the end of the third month remain the same? Explain briefly. [1]

- 10 (a) In the diagram, each circle centered A , B and C is of the same radius of 4 cm. Calculate the perimeter and the area of the shaded region.



[6]

- 10 (b) A spherical ball of radius 1 cm is completely submerged in a cylindrical container of height 30 cm and radius 3 cm. Water is then poured into the container to a depth of 18 cm. Calculate

- (i) the volume of the spherical ball, [1]
- (ii) the depth of water in the container if the spherical ball is removed from the container. [3]
- (iii) If the water in the cylindrical container is poured into a rectangular trough of length 18 cm and breadth 8 cm, what is the depth of the water in the trough? [2]

- 11 During a routine operation along an expressway one night, a car drove through a police road block without stopping. The police signalled for the car to stop but it accelerated and the police gave chase.

The speed and the time of the speeding car and the police car during the 3-minute high-speed chase along the expressway are recorded in the table below.

Time	Speed of Speeding Car (km/h)	Speed of Police Car (km/h)
1 st minute	105	90
2 nd minute	140	135
3 rd minute	155	180

- (a) Based on the information given, using a distance-time graph, determine whether the

police car will be able to overtake the speeding car and arrest the driver during the high-speed chase. Show how you arrive at your conclusion.

[4]

(b) Are there any assumptions that you may have to make?

[1]

Answer scheme

1a) $36y^2 - 100z^2 = 4(9y^2 - 25z^2) = 4(3y + 5z)(3y - 5z)$

1b)
$$\begin{aligned} & \frac{5x+1}{x^2+x-6} - \frac{2}{2-x} \\ &= \frac{5x+1}{(x-2)(x+3)} + \frac{2}{x-2} \\ &= \frac{7(x+1)}{(x-2)(x+3)} \end{aligned}$$

1ci) Let x be the tens digit and y be the units digit.

$$x + y = 5 \text{ ----- eqn 1}$$

$$y - x = 1 \text{ ----- eqn 2}$$

Solving : $x = 2$, $y = 3$

1cii) Therefore number is 23 (Answer can also be 32)

$$1\text{di}) \quad \frac{1}{m} = \frac{20rs - 15 - sp}{5s}$$

$$m = \frac{5s}{20rs - 15 - sp}$$

$$1\text{dii}) \quad \frac{10}{19} \quad \text{or} \quad 0.526$$

$$2\text{a}) \quad \frac{360}{x}$$

$$2\text{b}) \quad \left(\frac{360}{x} - 5 \right) (x + 0.6) \quad \text{or} \quad 357 - 5x + \frac{216}{x}$$

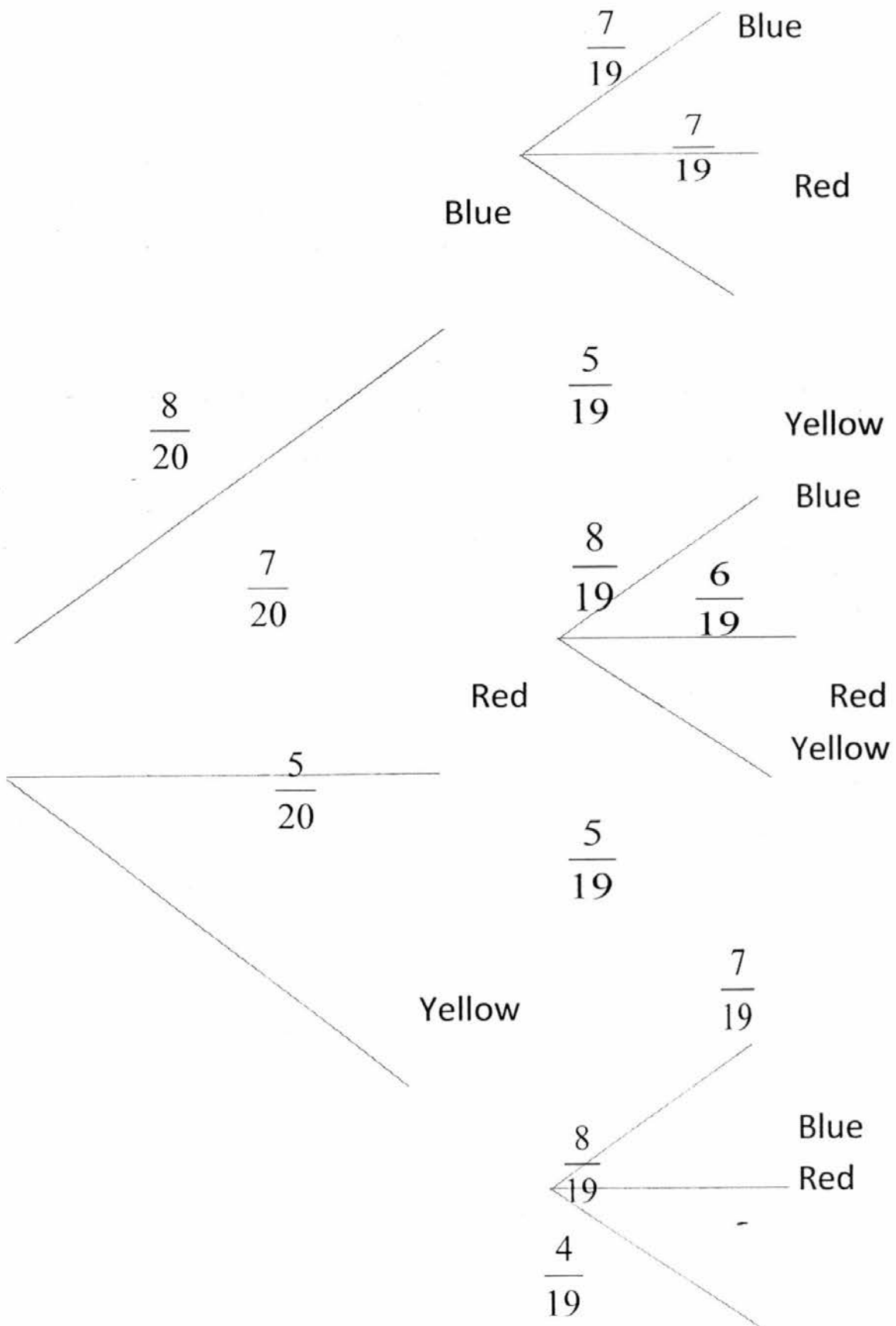
$$2\text{c}) \quad \left(\frac{360}{x} - 5 \right) (x + 0.6) - 360 = 171$$

$$5x^2 + 174x - 216 = 0$$

$$2\text{d}) \quad x = 1.20, x = -36$$

3a(i)

1st Draw 2nd Draw



Yellow

$$3a(ii)(a) \quad P(\text{both discs are yellow}) = \frac{5}{20} \times \frac{4}{19} = \frac{1}{19}$$

$$3a(ii)(b) \quad P(\text{one is blue and one is red})$$

$$= \frac{8}{20} \times \frac{7}{19} + \frac{7}{20} \times \frac{8}{19} = \frac{28}{95}$$

$$3a(ii)(c) \quad P(\text{both discs are of different colour})$$

$$= 1 - P(\text{both blue}) - P(\text{both yellow}) - P(\text{both red})$$

$$= \frac{131}{190}$$

$$3b(i) \quad \text{Mean} = 54.6$$

$$\text{SD} = 13.6$$

3b(ii) Mega Sec performed better as their mean is greater than mean for Faith_Sec.

Results for Faith Sec is more consistent as their SD is less than SD for Mega Sec.

$$4a) \quad a = 21, b = 1$$

$$4c) \quad x = 0.6, 4.3$$

$$4d) \quad -4.5 \leq \text{gradient} \leq -3.5$$

$$4e) \quad \text{Draw line } y = x + 2$$

$$x = 6.1$$

$$5a(i) \quad \overrightarrow{AC} = 2\mathbf{b} + \mathbf{a}$$

$$5a(ii) \quad \overrightarrow{CE} = \frac{1}{2}\overrightarrow{AC} = \frac{1}{2}(2\mathbf{b} + \mathbf{a})$$

$$5a(iii) \quad \overrightarrow{DE} = \overrightarrow{AE} - \overrightarrow{AD} = \frac{1}{2}(6\mathbf{b} + \mathbf{a})$$

$$5a(iv) \quad \overrightarrow{FE} = \overrightarrow{AE} - \overrightarrow{AF} = \frac{3}{2}\mathbf{a}$$

$$5(b) \quad \overline{FE} = \frac{3}{2} \overline{BC}, \text{ where } \frac{3}{2} \text{ is a scalar and FE is parallel to BC.}$$

$$5c(i) \quad \frac{\text{Area of } \triangle ABM}{\text{Area of } \triangle BME} = \frac{AM}{ME} = \frac{1}{2}$$

$$5c(ii) \quad \frac{\text{Area of } \triangle ABC}{\text{Area of } \triangle AFE} = \left(\frac{2}{3}\right)^2 = \frac{4}{9}$$

$$5c(iii) \quad \frac{\text{Area of } \triangle ABM}{\text{Area of } BFEC} = \frac{2}{5}$$

$$6a) \quad N = \begin{pmatrix} 300 & 280 & 250 \\ 450 & 385 & 355 \\ 255 & 275 & 310 \\ 150 & 140 & 185 \end{pmatrix}$$

$$6b) \quad P = (2 \quad 1.80 \quad 1.30 \quad 1.40)$$

$$PN = (2 \quad 1.80 \quad 1.30 \quad 1.40) \begin{pmatrix} 300 & 280 & 250 \\ 450 & 385 & 355 \\ 255 & 275 & 310 \\ 150 & 140 & 185 \end{pmatrix}$$

$$PN = [1951.50 \quad 1806.50 \quad 1801]$$

- 6c) The total amount collected from the sales of the four types of doughnuts in each of the outlet respectively.

7(a) $\angle BAC = 120^\circ$

$$BC = \sqrt{85^2 + 92^2 - 2(85)(92)\cos 120^\circ} = 153\text{m (3sf)}$$

7(b) Area = 3390 m²

7(c) $\angle ADC = 40.2^\circ$

7(d) length of mast = $92\tan 27^\circ$
Angle of elevation = 17.0°

8a(i) Median = 68 marks

8a(ii) 65th percentile mark = 76 marks

8(b) - $\frac{52}{60} \times 100\% = 86.7\%$

8(c) P(both obtained more than 88 marks)

$$= \frac{10}{60} \times \frac{9}{59} = \frac{3}{118}$$

9(a)(i) No of apprentices = 425

9(a)(ii) number of workers = 1020

9a(iii) 12.5% increase

9bi(a) Amount owed after first payment

$$= \$4000 \left(1 + \frac{\frac{15}{12}}{100} \right) - 1500 = \$2550$$

9bi(b) Amount owed after second payment

$$= \$2550 \left(1 + \frac{\frac{15}{12}}{100} \right) - 2000 = \$581.88$$

9b(ii) Final settlement = $\$581.875 \left(1 + \frac{\frac{15}{12}}{100} \right) = \589.15

9b(iii) The final settlement will be different. This is because if \$2000 is paid at the end of the first month, the principal sum used to calculate the next payment will be different and will eventually lead to a different final settlement.

10a) Perimeter = $3 \times \text{arc length } AB = 3 \times 4 \left(\frac{\pi}{3} \right) = 12.6 \text{ cm}$

Area = $3 \times \text{area of segment} + \text{area of triangle}$

$$= 3 \times \left(\frac{1}{2} (4)^2 \left(\frac{\pi}{3} \right) - \frac{1}{2} (4)^2 \sin \frac{\pi}{3} \right) + \frac{1}{2} (4)^2 \sin \frac{\pi}{3}$$

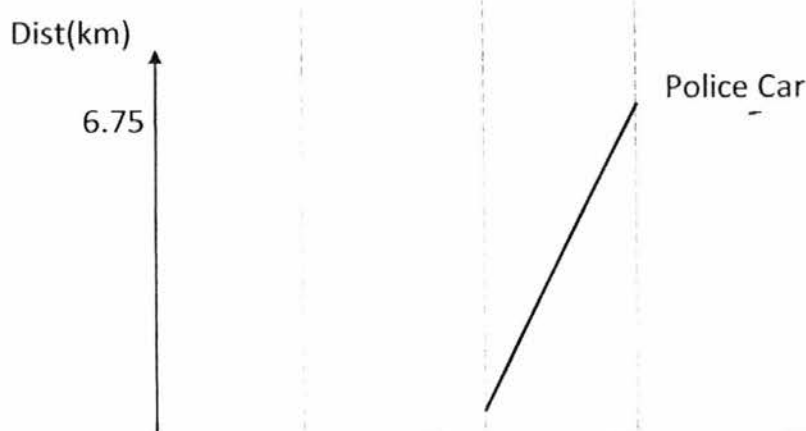
$$= 11.3 \text{ cm}^2$$

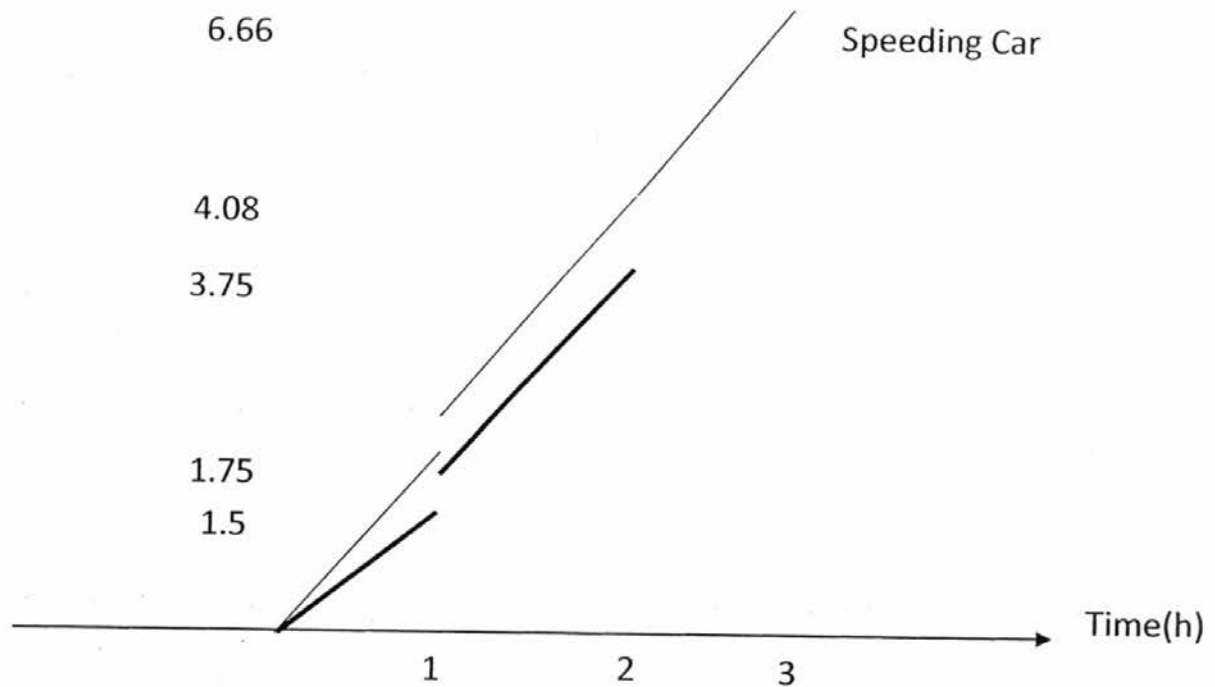
10b(i) Vol of spherical ball = 4.19 cm^3

10b(ii) Depth of water = 17.9 cm

10b(iii) Depth of water = 3.51 cm

11





11(i) From the distance time graph, the police car and the speeding car will meet somewhere between the 2nd and 3rd minute. Hence the police car will be able to overtake the speeding car and arrest the driver.

11(ii) Possible assumptions :

- The flow of traffic on the expressway is smooth
- Both cars did not stop along the way
- Both cars are travelling on the same expressway