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Answer all questions.

1 (a) Calculate $\frac{9 + \sqrt{81 - 4 \times 2 \times (-4)}}{4}$.

Write down the first five digits on your calculator display.

Answer (a) [1]

(b) Write your answer to part (a) correct to two decimal places.

Answer (b) [1]

Chocolate cookies recipe

75 g butter
50 g sugar
A few drops of vanilla essence
75 g cocoa powder
80 g flour
Makes 12 cookies

Mandy wants to make 27 chocolate cookies.
How many grams of flour will she need?

Answerg [2]

3 Petrol costs x cents per litre.
James buys some petrol and it costs him y dollars.
Find an expression, in terms of x and y , for the amount of petrol that James buys.

Answerlitres [2]

For
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use

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4 The table shows the colour and model of 20 cars.

Model of car	Colour of car	
	White	Green
Honda	7	4
Toyota	3	6

(a) A car is chosen at random. What is the probability that it is a green Toyota?

Answer (a) [1]

(b) What is the probability of choosing a green Honda or a white Toyota?

Answer (b) [1]

5 List all the integers that satisfy the inequality $-1 < 2x + 3 \leq 5$.

Answer [2]

6 The first four terms of a sequence are

100, 96, 92, 88.

(a) Write down the next two terms.

Answer (a)and..... [1]

(b) Find an expression for the n th term of this sequence.

Answer (b) $T_n = \dots$ [1]

- (c) The k th term in the sequence is 20.
Find the value of k .

Answer (c) $k = \dots$ [1]

- 7 Benjamin wishes to deposit \$ 15 000 in a bank for 8 years.
The bank offers two schemes as below.

Scheme A : Compound interest at 4 % per annum.

Scheme B : Simple interest at 4.5 % per annum.

Which scheme should Ben take? Show your working clearly.

Answer Ben should take scheme $\dots$ [3]

- 8 It is given that $v^2 = u^2 - 2gs$.

- (a) Find the positive value of v when $u = 30$, $g = 9.8$ and $s = 24$.

Answer (a) $v = \dots$ [1]

- (b) Express u in terms of g , s and v .

Answer (b) $u = \dots$ [2]

- 9 y is inversely proportional to x^2 .
Some values of y and x are given in the table below.

x	3	4
y	4	p

Find

- (a) the formula relating x and y ;

Answer (a) $\dots$ [2]

- (b) the value of p .

Answer (b) $p = \dots$ [1]

10 (a) Expressing your answers as a power of 7, find

(i) $\frac{1}{49}$.

Answer (ai)

[1]

(ii) $\sqrt[3]{7}$.

Answer (ati)

[1]

(b) Given that $5^{-2} \times 5^n = 1$, find the value of n .

Answer (b) $n =$

[2]

11 (a) When written as a product of their prime factors,

p is $2^3 \times 3^6$,
 q is $2 \times 3^2 \times 5$,
 r is $2^2 \times 3 \times 7$.

Find

(i) the LCM of p , q and r , giving your answers as the product of its prime factors.

Answer (ai)

[1]

(ii) the greatest number that will divide p , q and r exactly.

Answer (a(ii))

[1]

(b) A number has exactly eight factors.
 Two of its factors are 8 and 20.
 List all the factors of the number.

Answer (b)

[2]

12 (a) Express $x^2 - 4x - 21$ in the form $(x-a)^2 + b$.

Answer (a)

[2]

(b) Hence, solve $x^2 - 4x - 21 = 0$.

Answer (b) $x =$ or [2]

15 Solve

(a) $3y + 6 = 7(y - 2)$,

Answer (a) $y = \dots\dots\dots$ [2]

(b) $\frac{1}{5}a - 7 = 2$.

Answer (b) $a = \dots\dots\dots$ [2]

16 (a) Find the interior angle of a regular octagon.

Answer (a) $\dots\dots\dots^\circ$ [2]

13 Factorise fully

(a) $5x^2 - 20$.

Answer (a) $\dots\dots\dots$ [2]

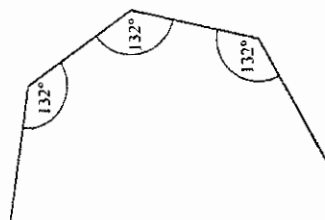
(b) $2x^2 + 7x - 15$.

Answer (b) $\dots\dots\dots$ [2]

14 The scale of a map is 1 : 500 000.

(a) The distance between two towns is 4.2 km.
Find in cm, its distance on the map.Answer (a) $\dots\dots\dots$ cm [2](b) On the map, the area of a town is 0.21 cm^2 .
Calculate the actual area of the town, in square kilometres.Answer (b) $\dots\dots\dots \text{km}^2$ [2]

(b)



Sam says that the diagram above shows part of a regular polygon.
Is he correct?
Show your working.

Answer (b) [2]

17 Simplify fully

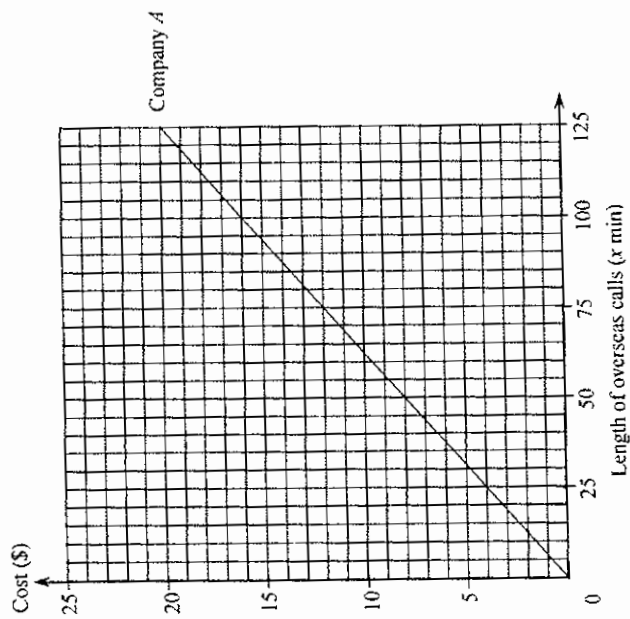
(a) $\frac{x}{2y} \div \frac{4x^2y}{5}$

Answer (a) [2]

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

Answer (b) [2]

18 The graph below shows the overseas call charges imposed by a mobile phone company A.
Company A charges a fixed rate for each minute of overseas call.



(a) Find the fixed rate charged by Company A.

Answer (a) \$/per.min [2]

(b) Another Company B charges a basic service cost of \$5 plus a fixed rate of 20 cents per minute for each minute of overseas call.

Draw a line on the grid above to show this information. [2]

20

19 The table below shows the parking times, in minutes, of 30 cars.

Parking time (minutes)	$0 < x \leq 40$	$40 < x \leq 80$	$80 < x \leq 120$	$120 < x \leq 160$
Number of cars	4	12	x	4

(a) Find the value of x .

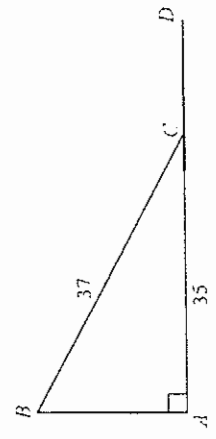
Answer (a) [1]

(b) State the modal class.

Answer (b) [1]

(c) Calculate an estimate for the mean waiting time of the cars.

Answer (c) mins [2]



In the diagram, ACD is a straight line, $\angle BAC = 90^\circ$, $AC = 35$ cm and $BC = 37$ cm.

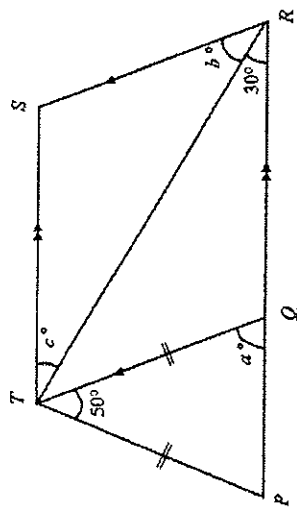
Find

(a) $\angle ABC$.

Answer (a) $^\circ$ [2]

(b) AB .

Answer (b) cm [2]



In the diagram, PQR is a straight line, $PT = QT$ and $QRST$ is a parallelogram.
 $\angle PTQ = 50^\circ$ and $\angle QRT = 30^\circ$.

Find

(a) $\angle a$,

Answer (a)° [1]

(b) $\angle b$,

Answer (b)° [1]

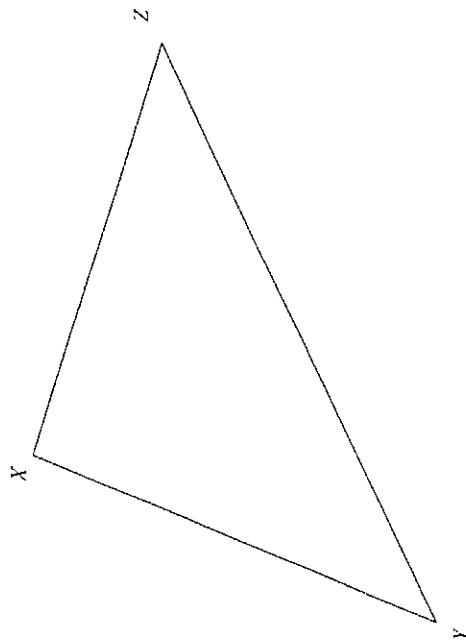
(c) $\angle c$,

Answer (c)° [1]

(d) reflex $\angle TPQ$.

Answer (d)° [1]

22 Triangle XYZ is drawn in the answer space below.



(a) Construct the bisector of angle XYZ . [1]

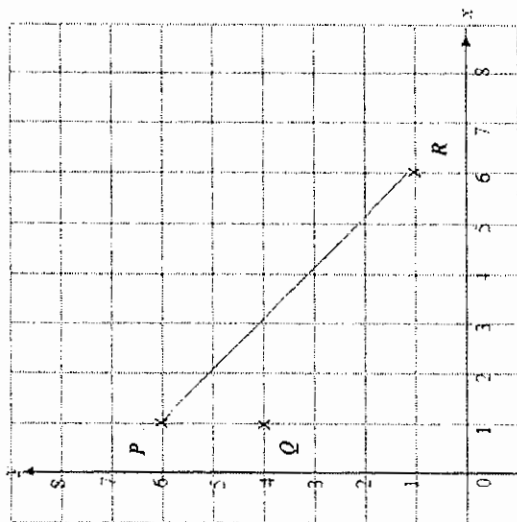
(b) Construct the perpendicular bisector of XZ . [1]

(c) The point P is on the bisector of angle XYZ and is nearer to X than Z .
 Mark and label a possible position of point P . [1]

(d) Triangle XYZ is a scale drawing of a park.
 The scale is 1 cm to 20 m.
 Find the actual length of distance XY in metres.

Answer (d)m [1]

The points $P(1,6)$, $Q(1,4)$, $R(6,1)$ and S are the vertices of a kite.



(a) Write down the coordinates of S .

Answer (a) (.....) [1]

(b) Calculate the length PR .

Answer (b) units [2]

(c) Determine the equation of line PR .

Answer (c) $y = \dots\dots\dots$ [3]

End of Paper 1

Qns	Mark Scheme	Marks	Remarks
1	4.9075	B1 2	
(b)	4.91	B1	
2	27×80 12 $= 180g$	M1 2	
3	x cents = 1 litre $100 y$ cents = $\frac{100y}{x}$ litres	A1 2	B1 for expressing Sy into 100y cents.
4	(a) $\frac{3}{10}$	B1 2	
(b)	$\frac{7}{20}$	B1	
5	$-4 < 2x \leq 2$ $-2 < x \leq 1$ Integers: $-1, 0, 1$	M1 2	
(a)	84 and 80	A1	
(b)	$104 - 4n$	B1	For both correct ans
(c)	$n = 21$	B1	
7	Scheme A: $1 = 15000 \left(1 + \frac{4}{100} \right)^8 - 15000 = 5528.54$ Scheme B: $1 = \frac{15000(4.5)(8)}{100} = 5400$ He should choose Scheme A as total interest is higher.	M1 3	
(a)	20.7	B1 3	
(b)	$u^2 = v^2 + 2gs$ $u = \pm \sqrt{v^2 + 2gs}$	M1	
9	(a) $4 = \frac{k}{3^2}$ $k = 36$ $y = \frac{36}{x^2}$ (b) 2.25	A1 3	
10	(ai) 7^{-2}	M1	
(aii)	7^2	A1 4	
(b)	$-2 + n = 0$ $n = 2$	M1	
11	(ai) $2^4 \times 3^6 \times 5 \times 7$	A1 4	

12	(a) $x^2 - 4x + \left(\frac{-4}{2}\right)^2 - 21 - \left(\frac{-4}{2}\right)^2$ $= (x-2)^2 - 25 = 0$ $(x-2)^2 = 25$ $x-2 = \pm 5$ $x = -3 \text{ or } 7$	M1 A1	4	B1 for listing the factors of 8 and 20.
13	(a) $5(x^2 - 4)$ $= 5(x+2)(x-2)$ use of the cross method $(2x-3)(x+5)$	M1 A1	4	A1 for both correct answers
14	(a) $1 \text{ cm} = 5 \text{ km}$ $\frac{4.2}{5} \times 1$ $= 0.84 \text{ km}$	M1 A1	4	
15	(a) $1 \text{ cm}^2 = 25 \text{ km}^2$ $0.21 \times 25 = 5.25 \text{ km}^2$	M1 A1	4	
16	(a) $3y+6 = 7y-14$ $y = 5$ (b) $\frac{1}{5}a = 9$ $a = 45$	M1 A1	4	
17	(a) $\frac{(n-2) \times 180}{n} - 132$ or $\frac{360}{(180-132)} = 7.5$ $n = 7.5$ It is not a regular polygon as it cannot have 7.5 sides $\frac{x}{2y} \times \frac{5}{4x^2y} = \frac{5}{8xy^2}$	M1 A1	4	

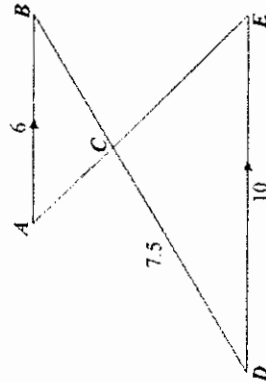
18	(b) $\frac{2x+2x-3}{(2x-3)^2} = \frac{4x-3}{(2x-3)^2}$ (a) $\frac{20}{125} = \$0.16/\text{min}$	M1 A1	4	
19	(b) $\frac{20}{125} = \$0.16/\text{min}$ (c) $\frac{20}{125} = \$0.16/\text{min}$	M1 A1	4	
20	(a) $\frac{20}{125} = \$0.16/\text{min}$ (b) $\frac{20}{125} = \$0.16/\text{min}$	M1 A1	4	
21	(a) $\frac{20}{125} = \$0.16/\text{min}$ (b) $\frac{20}{125} = \$0.16/\text{min}$ (c) $\frac{20}{125} = \$0.16/\text{min}$ (d) $\frac{20}{125} = \$0.16/\text{min}$	M1 A1 B1 B1	4	
22	(a) & (b)		4	

Section A (44 marks)

Answer all the questions in this section.

- 1 An aeroplane flies a distance of 15339 km from Singapore to New York. The average speed of the aeroplane is 725 km/h.
Calculate the flight time, in hours and minutes, correct to the nearest minute. [3]
- 2 (a) Given that $5.3 \times 10^{-11} = b \times 10^{-7}$, find the value of b . [1]
(b) In 1960, the population of Singapore was approximately 1650000. 1650000 can be written as x billion. Find the value of x . [1]
(c) The storage capacity of an external hard disk is 350 gigabytes. How many photographs can be stored if the average file size of a digital photograph is 2.5 megabytes? [2]
- 3 Alan and Elly are in a coffee shop.
Alan buys three cups of coffee and two cups of tea for \$6.60.
Elly buys four cups of coffee and three cups of tea.
She pays with a \$10 note and receives change of 80 cents.
(a) Write down a pair of simultaneous equations to represent this information. Use c to represent the cost, in dollars, of a cup of coffee and t to represent the cost, in dollars, of a cup of tea. [2]
(b) Solve your simultaneous equations to find c and t . [2]

- 4 In the diagram below, ACE and BCD are straight lines and AB is parallel to DE .



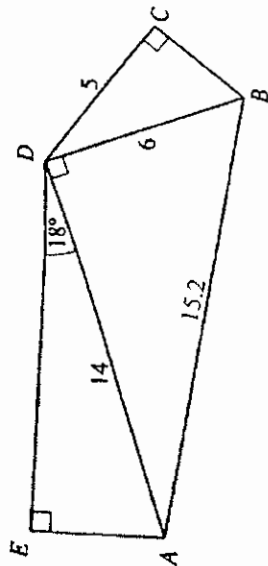
- (a) Show that triangles ABC and EDC are similar. [2]
- (b) Given that $AB = 6$ cm, $CD = 7.5$ cm and $DE = 10$ cm, calculate BC . [2]

- 5 The results of a survey of the number of televisions in 40 households are given in the table below.

Number of televisions	1	2	3	4
Number of households	8	17	12	3

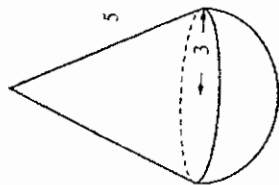
- (a) Find the median number of televisions. [1]
- (b) Calculate the mean number of televisions per household. [2]
- (c) The same information above can be shown in a pie chart. Find the angle which represents the number of households which have less than 3 televisions. [2]

6



In the pentagon $ABCDE$, angles BCD , BDA and AED are each 90° and angle ADE is 18° .
 $CD = 5$ cm, $BD = 6$ cm, $AD = 14$ cm and $AB = 15.2$ cm.

- (a) Calculate
 - (i) angle CDB , [2]
 - (ii) AE . [2]
- (b) State the diameter of the circle through A , B and D . [1]



The diagram shows a solid toy made from a cone and a hemisphere. The cone and the hemisphere both have radius of 3 cm. The cone has a slant height of 5 cm. Calculate

- the volume of the toy.
- the surface area of the toy.

8 A shopkeeper buys some plates from a manufacturer for \$10 each.

- The shopkeeper sells a plate for \$12. Calculate the percentage profit.
- The shopkeeper buys 240 plates and sells 180 at \$12 each. The rest were sold to a café for a total of \$540. Calculate the percentage discount given to the café.
- The manufacturer makes a profit of 60% when he sells each plate for \$10. Calculate the cost of manufacturing each plate.

9 (a) Factorise $2a^2 - 4b + ac$ completely.

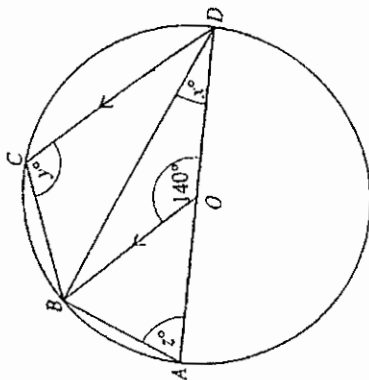
(b) Solve the equation $\frac{2x+3}{7} - \frac{3-x}{4}$.

(c) Simplify $\frac{4x^2 - 9y^2}{2x^2 + 3xy}$.

Section B (16 marks)

Answer any two questions from this section. Each question carries 8 marks.

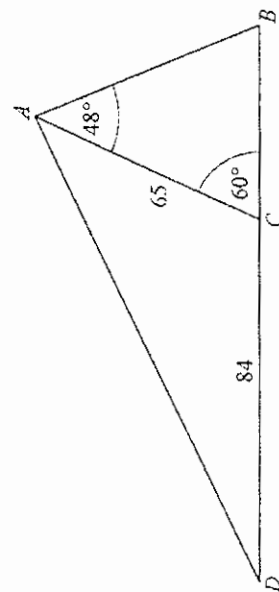
10 (a)



In the diagram, the points A, B, C and D lie on a circle, centre O . AOD is a diameter, OB is parallel to DC and $\angle BOD = 140^\circ$. Find

- x .
- y .
- z .

(b)



A, B, C and D are four points on horizontal ground.

BCD is a straight line.

$AC = 65$ m and $CD = 84$ m.

$\angle CAB = 48^\circ$ and $\angle ACB = 60^\circ$.

- Show that $AB = \frac{65 \sin 60^\circ}{\sin 72^\circ}$.
- Calculate AD .

- 11 Answer the whole of this question on a single sheet of graph paper.

The variables x and P are connected by the equation $P = 2x + \frac{100}{x}$.

Some corresponding values of x and P , correct to one decimal place, are given in the following table.

x	2	4	6	8	10	12	14	16
P	q	33.0	28.7	28.5	30.0	32.3	r	38.3

- (a) Calculate the values of q and r . [2]

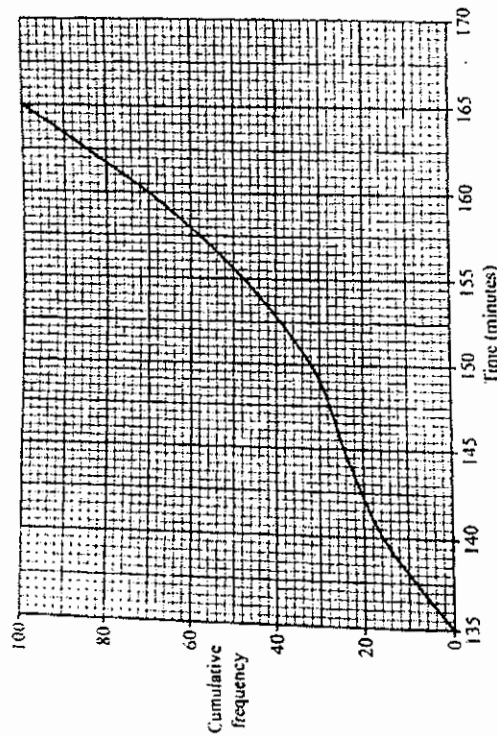
- (b) Using a scale of 2 cm to 2 units, draw a horizontal x -axis for $2 \leq x \leq 16$.
Using a scale of 2 cm to 5 units, draw a vertical y -axis for $20 \leq P \leq 60$. [2]

Draw the graph of $P = 2x + \frac{100}{x}$ for $2 \leq x \leq 16$. [2]

- (c) Use your graph to find the values of x when $2x + \frac{100}{x} = 32$. [2]

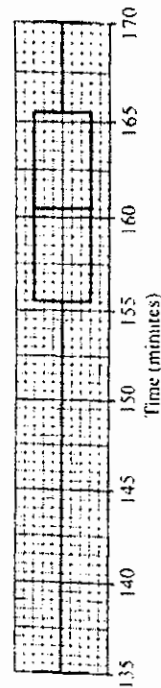
- (d) By drawing a tangent, find the gradient of the curve $P = 2x + \frac{100}{x}$ when $x = 4$. [2]

- 12 (a) The cumulative frequency graph shows the distribution of the times of the first 100 runners to finish a city marathon in 2013.



- (i) Find the interquartile range. [2]
(ii) Find the percentage of runners who took longer than 150 minutes to finish the marathon. [2]

The box-and-whisker plot below represents the distribution of the times of the first 100 runners to finish the city marathon in 2014.



- (iii) "The runners in 2014 were quicker on average."
State whether you agree or disagree with this statement, giving a reason for your answer. [2]
(b) In a group of 17 boys, 5 are Malay and the remaining are Chinese. Two boys are chosen at random. Find the probability that both boys are of the same race. [2]

End of Paper 2

Qns	Mark Scheme	Marks	Remarks
1	Time = $\frac{15339}{725}$ ≈ 21.15724 ≈ 21 h 9.43448 min ≈ 2 h 9 min	3	
2	(a) 0.00053 (bi) 0.00165 (bit) 350×10^9 2.5×10^6 $= 140000$	4	
3	(a) $3c + 2t = 6.60$ $4c + 3t = 9.20$ solving either using substitution or elimination method. $c = 1.40, t = 1.20$	4	A1 for correct values for both t and c . e.c.f. for M1 and A1 for equations in 3(a).
4	(a) $\angle ABC = \angle EDC$ (alternate $\angle$) $\angle BAC = \angle DEC$ (alternate $\angle$) $\angle ACB = \angle ECD$ (vertically opp. $\angle$) Since all angles are the same, $\triangle ABC$ and $\triangle EDC$ are similar. (b) $\frac{6}{10} \times 7.5$ $= 4.5$ cm	4	
5	(a) 2 (b) $\frac{1(8) + 2(17) + 3(2) + 4(3)}{40}$ $= 2.25$ (c) $\frac{25}{40} \times 360^\circ$ $= 225^\circ$	5	
6	(ai) $\cos \angle CDB = \frac{5}{6}$ $\angle CDB = 33.6^\circ$ (aii) $\sin 18^\circ = \frac{AF}{14}$ $AF = 4.3262 \dots \approx 4.33$ cm (b) 15.2 cm (a) Vertical height = 4 cm $\text{Vol} = \frac{1}{3} \pi (3^2 \times 4) + \frac{1}{2} \left(\frac{4}{3} \times \pi \times 3^3 \right)$ $= 94.24778 \dots \approx 94.2$ cm ³ (b) $SA = \pi(3)(5) + 2\pi(3^2)$	5	Correct use of formula for cone and hemisphere

8	(a) $\frac{12-10}{10} \times 100\%$ $= 20\%$ (b) Price per plate = $\frac{540}{60} = \$9$ % discount = $\frac{12-9}{12} \times 100\%$ $= 25\%$ (c) $160\% = 10$ $\frac{10}{160} \times 100 = \6.25	B1 M1 M1 A1 M1 A1	6
9	(a) $2(a-2b) + c(a-2b)$ $(2+c)(a-2b)$ (b) $8x + 12 = 21 - 7x$ $15x = 9$ $x = \frac{3}{5}$ (c) $\frac{(2x-3y)(2x+3y)}{x(2x+3y)}$ $= \frac{2x-3y}{x}$	M1 A1 M1 A1 M2 A1	7
10	(ai) 20° (aii) 110° (aiii) 70° (bi) $\frac{65}{\sin 72^\circ} = \frac{AB}{\sin 60^\circ}$ $AB = \frac{65 \sin 72^\circ}{\sin 60^\circ}$ (bii) $AD^2 = \sqrt{84^2 + 65^2 - 2(84)(65) \cos 120^\circ}$ $AD = 129.3870 \dots \approx 129$ m (a) $q = 54.0$ $r = 35.1$	B1 B1 B1 M1 A1 M2 A1 B1 B1	8
11	(a) $q = 54.0$ $r = 35.1$	B1 B1	8

(b)	Points plotted correctly - P1 Smooth curve - C1	P1 C1		
(c)	$x = 4.3$ or 11.7 (± 0.1)	BI, BI		
(d)	Appropriate tangent drawn Gradient = -4.25 (± 0.5)	M1 A1		
12	(ai) $161 - 145$ (± 0.5) $= 16$	M1 A1	8	
	(aii) $\frac{100 - 32}{100} \times 100$ $= 68\%$	M1 A1		
	(aiii) Median in 2014 = 160.5 mins Median in 2013 = 155.5 mins Disagree, as they took a longer time than the runners in 2013.	M1 A1		M1 for calculation of both medians
	(b) $\left(\frac{5}{17} \times \frac{4}{16} \right) + \left(\frac{12}{17} \times \frac{11}{16} \right)$ $= \frac{19}{34}$	M1 A1		