For Examiner's Use

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Answer **all** the questions.

1 The estimated number of voters in an election, rounded off to 3 significant figures, is 23200.

Write down

(a) the smallest possible number of voters,

(b) the largest possible number of voters.

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

(b) ..... [1]

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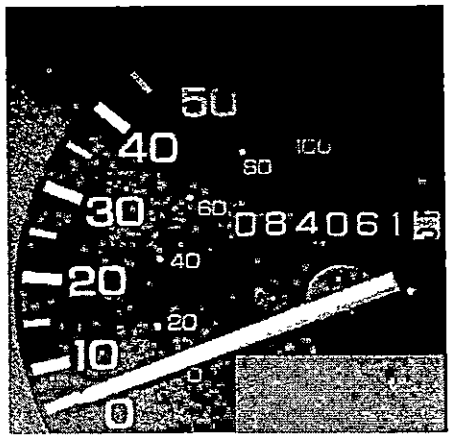
2 Evaluate

$$6900\left(1+\frac{2.75}{100}\right)^3,$$

leaving your answer correct to 2 decimal places.

Answer ..... [2]

3 (a) The diagram shows part of an odometer in a car, used to track the distance travelled by the car.
The initial reading shows 084061 km.



Harrydrove the car from Singapore to Kuala Lumpur.
He stopped at Kuala Lumpur and noticed that the odometer reading has changed to 084415 km.

Calculate the distance he had travelled in metres.

(b) Harry visited Perdana Botanical Garden in Kuala Lumpur.
The area of the garden is 918 000 m^2.

Calculate the area of the garden in square kilometres.

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

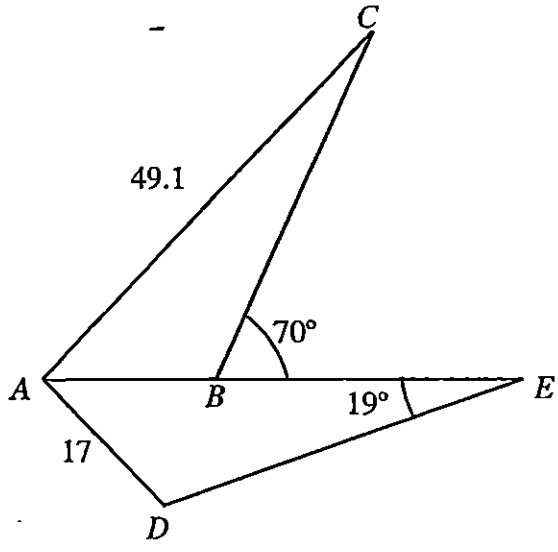
(b) ..... km^2 [1]

4 In the diagram, $\Delta ABC \equiv \Delta ADE$.
$AC = 49.1$ cm, $AD = 17$ cm, $\angle DEB = 19°$ and $\angle EBC = 70°$.

Find

(a) the length of BE,

(b) $\angle CAB$.



Answer (a) $BE =$ ..... cm [1]

(b) $\angle CAB =$ .....° [1]

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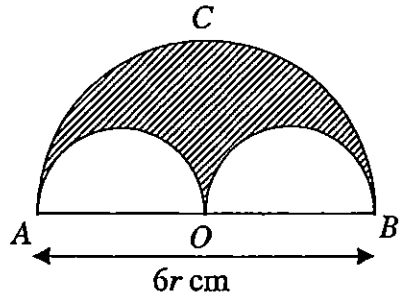
5 In the diagram, ABC represents a semicircular card with centre O and diameter $6r$ cm.
Two equal semicircles were cut away such that what remains of the card is the shaded region as shown.
It is given that the area of the shaded region is 36π cm^2.

Calculate the value of r.



Answer $r =$ ..... [3]

6 (a) Solve the inequality $\frac{x+3}{12} \geq \frac{2x-5}{4}$.

(b) Write down all positive integer values of x such that $x$satisfies $\frac{x+3}{12} \geq \frac{2x-5}{4}$.

Answer (a) ..... [2]

(b) ..... [1]

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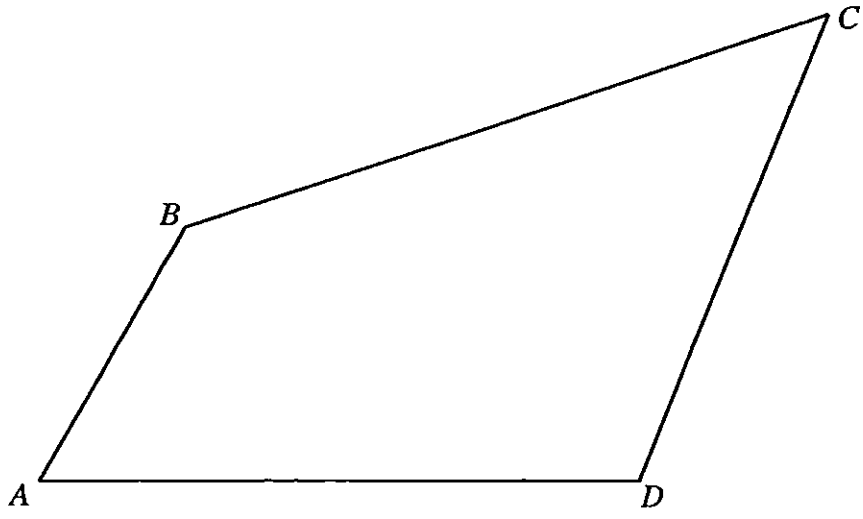
7 Express as a single fraction in its simplest form

$$\frac{-6x}{(2x-3)(2x+3)} - \frac{x}{3-2x}.$$

Answer ..... [3]

8 The quadrilateral $ABCD$ is drawn in the answer space below.

Answer (a) and *(b)*



(a) Construct

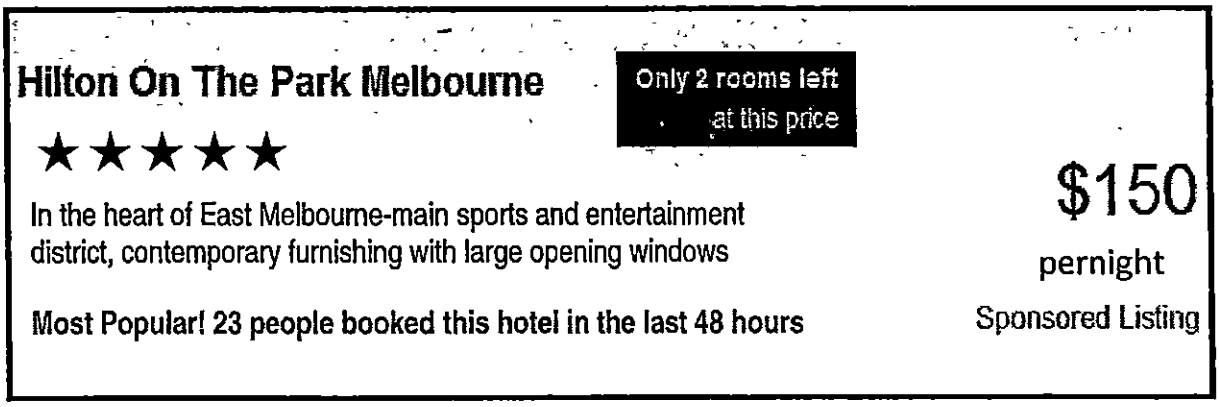
(i) the perpendicular bisector of BC, [1]

(ii) the bisector of $\angle BAD$.
Label all your constructions clearly. [1]

(b) The point Q is a point in the quadrilateral $ABCD$ such that Q is equidistant from the lines AB and $AD$and nearer to point$C$ than to point B.

Mark a possible position for point Q. [1]

9 Jennifer saw the following online advertisement from Booking.com.



The price of renting a hotel room displayed on the advertisement is $37\frac{1}{2}$% less than the normal price.

(a) Calculate the normal price of renting a hotel room per night.

(b) Jennifer paid a total of $517.50, inclusive of breakfast, for a 3-night stay. Calculate the amount she paid for the breakfast each day.

Answer *(a)* $ ..... [2]

(b) $ ..... [2]

10 The cost of a gold bracelet, $\$C$, changes with its mass, m grams.
The table below gives some corresponding values of C and m.

Cost ($\$C$)	312.50	1152	1800
Mass (m grams)	25	48	60

(a) Show that C is directly proportional to m^2.

(b) Anna bought a gold bracelet of mass$P$ gramsfor \$242.
Brenda brought a \$1000 dollar note to buy a similar gold bracelet with mass 200% more than that of Anna's.
Do you think Brenda will have enough cash to buy the bracelet?
Show your working clearly.

Answer (a) .....

..... [2]

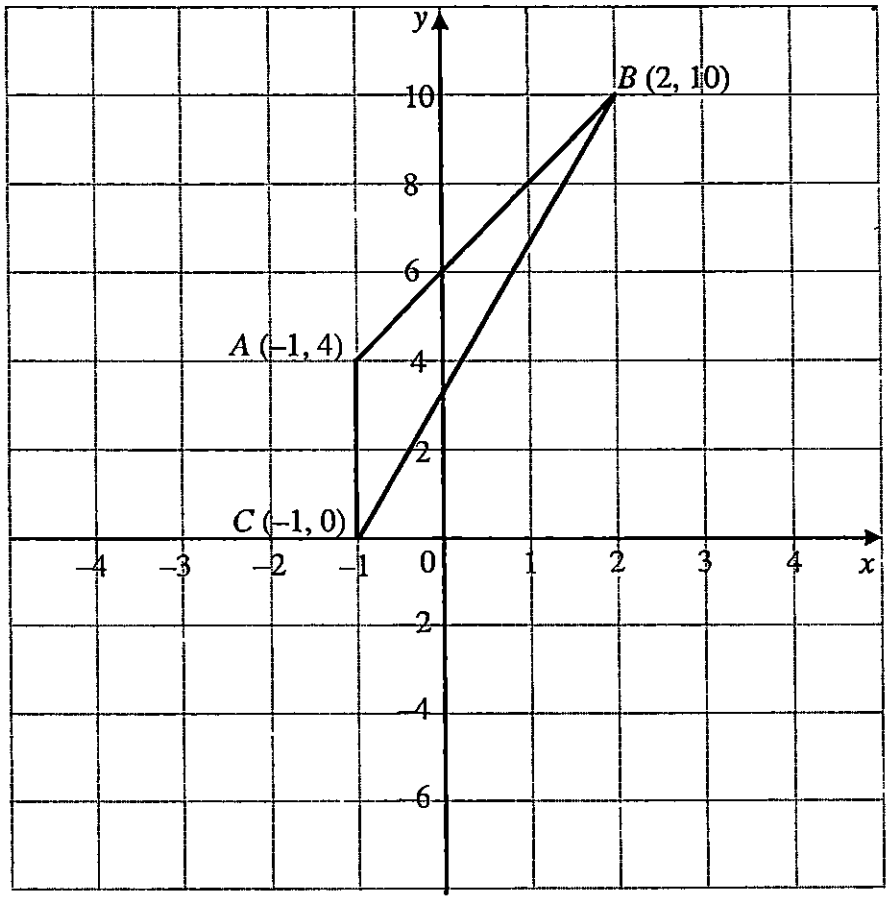
(b) .....

.....

.....

..... [2]

11 The diagram shows a triangle ABC.
A is the point $(-1, 4)$, B is the point $(2, 10)$ and C is the point $(-1, 0)$.



(a) Write down the gradient of the line AB.

(b) A line l, parallel to AB, passes through the point $(-2, 4)$.
Write down the equation of the line l.

(c) $ABDC$ is a trapezium with AC parallel to BD.
The area of the trapezium is 18 units^2.
Find the coordinates of point D.

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

(b) ..... [1]

(c) D (..... , ...) [2]

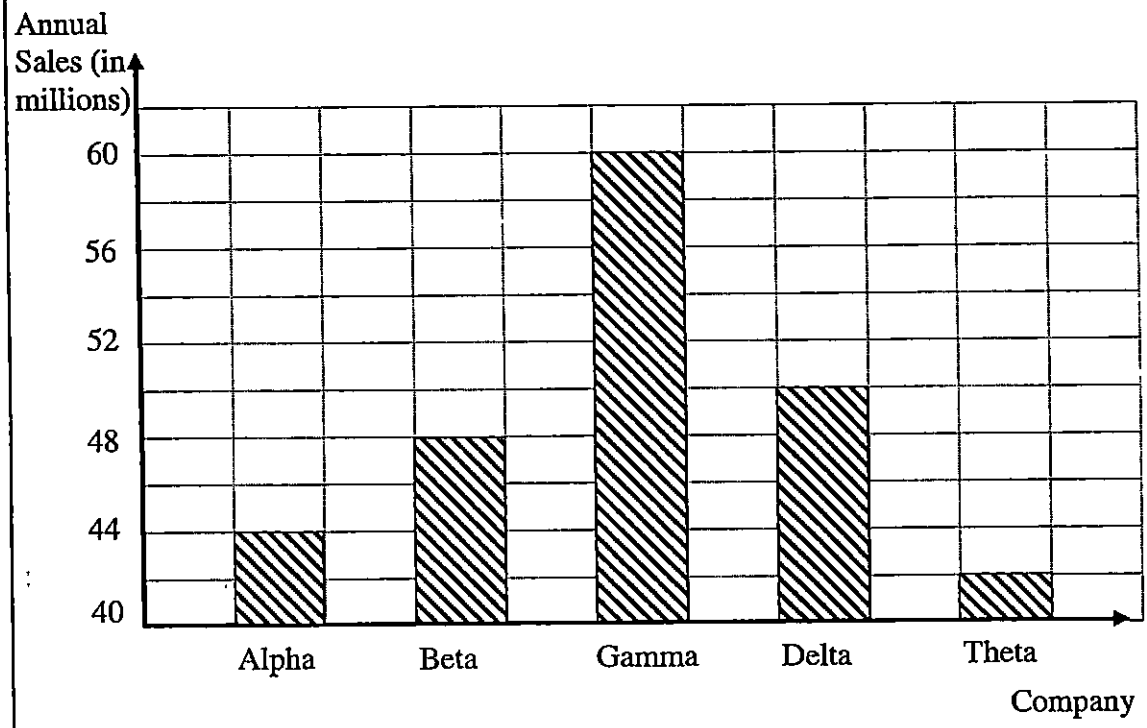
12 (a) Given that $(2x-y)^2 = 40$ and $x^2 - xy = -26$, find the possible values of y.

(b) Given that $4a^2 - 13ab + 9b^2 = 0$ and $a \neq b$, find the value of $\dfrac{4a+9b}{2a+3b}$.

Answer (a) $y =$ .....or..... [2]

(b) ..... [3]

13 The bar graph shows the annual sales of five branches of a company.



(a) Find the ratio of the annual sales for Alpha to that of Beta branch.

(b) Gamma claimed that its annual sales are twice that of Delta branch.
Do you agree with the statement? Explain your answer.

(c) Express the annual sales of Theta as a percentage of the total annual sales for all the five branches.

(d) The manager wants to plan the manpower allocation for next year.
Explain why representing the above information in a pie chart will help him do this planning better.

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

(b) .....

..... [1]

(c) ..... % [2]

(d) .....

..... [1]

14 (a) Solve $5-(6-y)^2=1$.

(b) (i) Solve $3p^2=8p$.

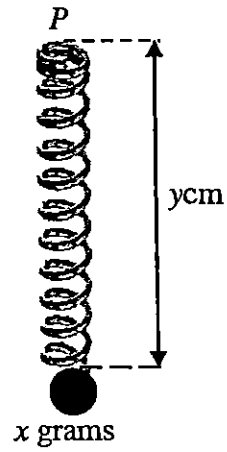
(ii) Hence solve the equation $6(1-3x)^2-16(1-3x)=0$.

Answer *(a)* $y=$.....or ..... [2]

(b)(i) $p=$..... or ..... [2]

(ii) $x=$ ..... or ..... [2]

15 A spring was suspended from a fixed point P.
When an object of mass x grams is attached to its lower end, the spring is stretched so that its length is y cm, as shown in the diagram.



It is given that x and y are connected by the equation $y = ax + b$, where a and b are constants.

The table below shows the results of two experiments.

Mass (x grams)	40	80
Length (y cm)	38	42

(a) Using the information in the table above Keith came out with the equation
$$38 = 40a + b.$$
Write down another equation in terms of a and b.

(b) Solve the two equations to find the value of a and the value of b.

(c) Find the mass of the object attached to the spring when its length is 47 cm.

(d) What does the value of b represent?

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

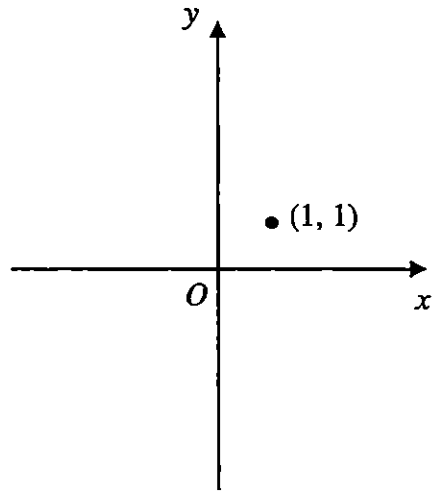
(b) a = ..., b =..... [3]

(c)..... g [1]

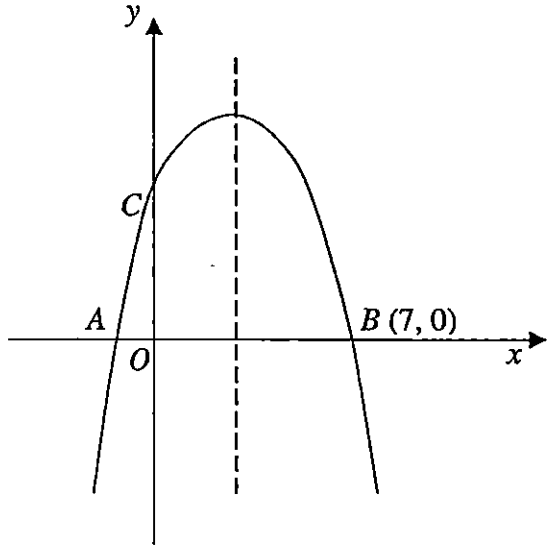
(d)..... [1]

16 (a) The point (1, 1) is marked on the diagram below.
Sketch the graph of $y = 1 + 2x^2$ in the answer space provided.

Answer (a) [2]



(b) The sketch of the graph $y = -x^2 + px + q$ is shown in the diagram below.
The graph cuts the x-axis at points A and $B(7, 0)$, and cuts the y-axis at point C.
$x = 3$ is the line of symmetry of the graph.



(i) Write down the coordinates of the point A.

(ii) Find the value of p and q.

(iii) Write down the coordinates of the point C.

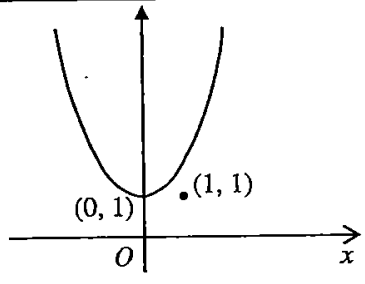
Answer (b)(i) $A($..... , ...$)$ [1]

(ii) $p =$ ..... , $q =$ ..... [2]

(iii) C (..... , ...) [1]

END OF PAPER

Answer Key

1(a)	23 150	12(a)	$y = \pm 12$
1(b)	23 249	12(b)	2.4
2	7485.05 (2 dp)	13(a)	11 : 12
3(a)	354 000 m	13(b)	No, as the ratio of gamma : theta is 60 : 50 which is 6 : 5 and not 2 : 1
3(b)	0.918 km^2	13(c)	17.2% (3 sf)
4(a)	32.1 cm	13(d)	Using pie chart the manager is able to obtain the proportion of the annual sales of each branch compared to the total annual sales of the company.
4(b)	51°	14(a)	$y = 4$ or $y = 8$
5	4	14(b)(i)	$p = 0$ or $p = 2\frac{2}{3}$
6(a)	$x \leq 3\frac{3}{5}$	14(b)(ii)	$x = \frac{1}{3}$ or $x = -\frac{5}{9}$
6(b)	3, 2, 1, 0, –1, ...	15(a)	$42 = 80a + b$
7	$\frac{x}{(2x+3)}$	15(b)	$a = \frac{1}{10}$, $b = 34$
8	See construction attached	15(c)	130 g
9(a)	\$240	15(d)	b represents the original length of the spring
9(b)	\$22.50	16(a)	
10(a)	$\frac{C}{m^2} = \frac{312.5}{25^2} = \frac{1152}{48^2} = \frac{1800}{60^2} = 0.5$ $\because \frac{C}{m^2}$ is a constant, C and m^2 are in direct proportion.	16(b)(i)	$A(-1, 0)$
10(b)	C = \$2178 $\therefore$ she won't have enough cash to buy the bracelet.	16(b)(ii)	$p = 6, q = 7$
11(a)	2	16(b)(iii)	$C(0, 7)$
11(b)	$y = 2x + 8$		
11(c)	D (2, 2)		

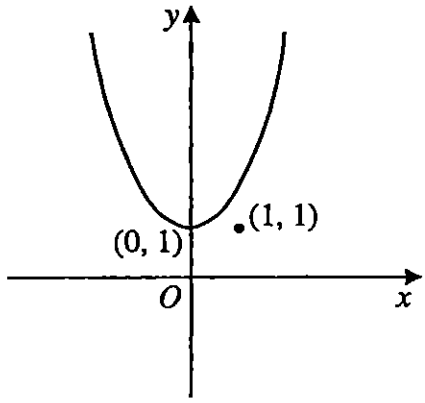
Mid Year Examination 2014 Marking Scheme
Sec 2 Express Mathematics Paper 1

Question No.		Marking Point	Marks Awarded	Total Marks	Remarks
1	(a)	23 150	B1	1	Working need not be shown
	(b)	23 249	B1	1	
2		7485.05 (2 dp)	B2	2	Working need not be shown B1 for 7485... seen
3	(a)	Distance travelled $= 84\,415 - 84\,061$ $= 354$ km $= 354\,000$ m	B1	1	
	(b)	$918\,000$ m^2 $= 0.918$ km^2	B1	1	
4	(a)	$AB = AD = 17$ cm $AE = AC = 49.1$ cm $BE = 49.1 - 17 = 32.1$ cm	B1	1	
	(b)	$\angle ACB = \angle AED = 19°$ $\angle CAB = 70° - 19° = 51°$	B1	1	Alternative method $180° - 110° - 19°$ $= 51°$
5		$\frac{\pi(3r)^2}{2} - \pi\left(\frac{3}{2}r\right)^2 = 36\pi$ $\frac{9\pi r^2}{2} - \frac{9\pi r^2}{4} = 36\pi$ $\frac{9\pi r^2}{4} = 36\pi$ $r^2 = 16$ $r = 4$	M1 M1 A1	3	
6	(a)	$\frac{x+3}{12} \geq \frac{2x-5}{4}$ $x+3 \geq 3(2x-5)$ $x+3 \geq 6x-15$ $5x \leq 18$ $x \leq 3\frac{3}{5}$ or $x \leq 3.6$	M1 A1	2	Allow M1 for answer without the inequality sign
	(b)	1, 2, 3	B1	1	
7		$= \frac{-6x}{(2x-3)(2x+3)} + \frac{x}{2x-3}$	M1		

Question No	Marking Point	Marks Awarded	Total Marks	Remarks
	$= \frac{-6x+x(2x+3)}{(2x-3)(2x+3)}$ $= \frac{-6x+2x^2+3x}{(2x-3)(2x+3)}$ $= \frac{2x^2-3x}{(2x-3)(2x+3)}$ $= \frac{x(2x-3)}{(2x-3)(2x+3)}$ $= \frac{x}{(2x+3)}$	M1 A1	3	
8 (a)	See construction attached	B2	2	B1 for correct and accurate construction of perpendicular bisector B1 for correct and accurate construction of angle bisector
(b)	See construction attached Point Q marked on the diagram	B1	1	
9 (a)	Let x be the normal price of the hotel $\frac{62.5}{100} \times x = 150$ $x = 150 \times \frac{100}{62.5}$ $= \$240$	M1 A1	2	
(b)	Total amount $= 517.50 - 3(150)$ (for breakfast) $= 67.50$ Amount for breakfast each day $= 67.50 \div 3 = \$22.50$	M1 A1	2	
10 (a)	$\frac{C}{m^2} = \frac{312.5}{25^2} = \frac{1152}{48^2} = \frac{1800}{60^2} = 0.5$ $\because \frac{C}{m^2}$ is a constant, C and m^2 are in direct proportion.	M1 A1	2	
(b)	When the mass is increased by 200%, new mass $= 3P$ $C = 0.5(3P)^2$ $C = 9(0.5P^2)$ $C = 9 \times 242$ $= \$2178$	M1		Alternative method $C = 0.5m^2$ $242 = 0.5m^2$ $m = 22\,\text{g}$ $\frac{300}{100} \times 22 = 66\,\text{g}$ $C = 0.5(66)^2 = \$2178$

Question No.		Marking Point	Marks Awarded	Total Marks	Remarks
		$\therefore$ she won't have enough cash to buy the bracelet.	A1	2	Must show working
11	(a)	Gradient of $AB = \frac{10-4}{3} = 2$	B1	1	
	(b)	$y = 2x + 8$	B1	1	Answer may be obtained either by calculation or drawing the line
	(c)	Let y be the distance of the unknown parallel side			
		$\frac{1}{2}(4+y)3 = 18$	M1		Award M1 for other alternative method eg. 18 – area of ΔABC
		$4 + y = 12$			
		$y = 8$			
		D (2, 2)	A1		
12	(a)	$(2x-y)^2 = 40$			
		$4x^2 - 4xy + y^2 = 40$	M1		
		$4(x^2 - xy) + y^2 = 40$			
		$4(-26) + y^2 = 40$			
		$y^2 = 144$			
		$y = \pm 12$	A1	2	
	(b)	$4a^2 - 13ab + 9b^2 = 0$			
		$(4a-9b)(a-b) = 0$			
		$a - b = 0$ or $4a - 9b = 0$ (rejected since $a \neq b$) $4a = 9b$	M1		
		$\frac{4a+9b}{2a+3b}$			Alternative method
		$= \frac{4a+4a}{2a+\frac{4}{3}a}$	M1		$\frac{9b+9b}{\frac{9}{2}b+3b}$
		$= \frac{8a}{\left(\frac{10}{3}a\right)}$			$= \frac{18b}{\left(\frac{15}{2}b\right)}$
		$= 2.4$	A1	3	$= 2.4$
13	(a)	$44 : 48 = 11 : 12$	B1	1	
	(b)	No, as the ratio of gamma : theta is 60 : 50 which is 6 : 5 and not 2 : 1	B1	1	

Question No	Marking Point	Marks Awarded	Total Marks	Remarks
(c)	Total sales = $44+48+60+50+42$			
	Percentage = $\frac{42}{244}\times 100\%$	M1		
	$= 17.2\%$ (3 sf)	A1	2	
(d)	Using pie chart the manager is able to obtain the proportion of the annual sales of each branch compared to the total annual sales of the company.	B1	1	
14 (a)	$5-(6-y)^2=1$			
	$(6-y)^2=4$	M1		
	$6-y=2$ or $6-y=-2$			
	$y=4$ or $y=8$	A1	2	A1 for both answers
(b) (i)	$3p^2-8p=0$			
	$p(3p-8)=0$	M1		
	$p=0$ or $3p-8=0$			
	$p=2\frac{2}{3}$	A1	2	A1 for both answers
(ii)	$6(1-3x)^2-16(1-3x)=0$			
	$2\left[3(1-3x)^2-8(1-3x)\right]=0$			
	From (i), $p=0$ or $p=2\frac{2}{3}$			
	$1-3x=0$ or $1-3x=2\frac{2}{3}$	M1		
	$x=\frac{1}{3}$ or $x=-\frac{5}{9}$	A1	2	A1 for both answers
15 (a)	$42=80a+b$	B1	1	
(b)	$38=40a+b$ ------(1)			
	$42=80a+b$ ------(2)			M1 – substitution / elimination method
	(2) – (1), $4=40a$	M1		
	$a=\frac{1}{10}$, $b=38-4=34$ cm	A2	3	A1 each for correct value of a and b
(c)	$47=\frac{1}{10}x+34$			
	$x=(47-34)10=130$ g	B1	1	
(d)	b represents the original length of the spring	B1	1	

Question No.	Marking Point	Marks Awarded	Total Marks	Remarks
16 (a)		B2	2	B1 – minimum curve B1 – cuts y-axis at 1
(b) (i)	$A(-1, 0)$	B1	1	
(ii)	$-(x+1)(x-7)=0$ $-(x^2-6x-7)=0$ $-x^2+6x+7=0$	M1		
	$\Rightarrow p=6, q=7$	A1	2	
(iii)	$C(0, 7)$	B1	1	

聖嬰中學
HOLY INNOCENTS' HIGH SCHOOL

MID-YEAR EXAMINATION 2014
SECONDARY 2 EXPRESS

MATHEMATICS **4016/02**

Paper 2

Name : _____ **Date** : **14 May 2014**

Register No : _____ **Duration** : **1 h 30 min**

Class : _____

Additional Materials: 4 sheets of Writing Paper
1 sheet of Graph Paper

INSTRUCTIONS TO STUDENTS

Write your index number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, 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.
Calculators should be used 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 marks for this paper is 60.

Setter: Mrs Lo Sock Kui

This paper consists of 6 printed pages, inclusive of this cover page.

Answer all the questions

1 On 1 January 2010, Mr Wong exchanged Malaysian Ringgit (MYR) 50 000 for Singapore dollars (SGD) at a rate of SGD 35.58 = MYR 100.

(a) Calculate the sum of money in Singapore dollars that he received for the MYR 50 000. [1]

(b) He then deposited this sum of money in a bank which paid a simple interest of 2.5% per annum for a year.
On 1 January 2011, he withdrew all the money and exchanged them for Malaysian Ringgit at a rate of SGD 38.61 = MYR 100.

(i) Calculate the sum of money that Mr Wong received in Malaysian Ringgit. [3]

(ii) Calculate the percentage change in the amount of money owned by Mr Wong, in Malaysian Ringgit, from 1 January 2010 to 1 January 2011. [2]

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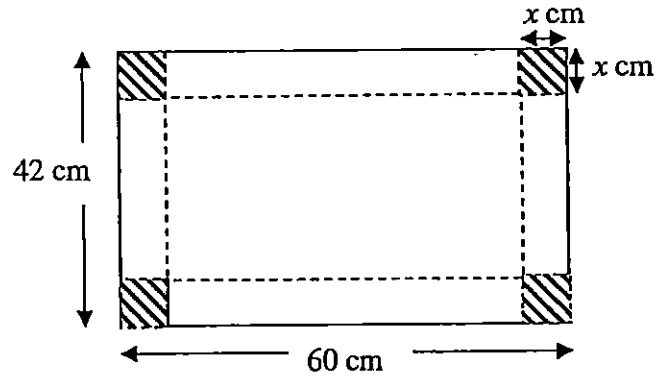
2 A rectangular sheet of metal is 60 cm long and 42 cm wide.
The four shaded squares of sides x cm are cut from the four corners and the remaining metal sheet is folded up at the ends to form an open rectangular box.



(a) Write down the dimensions of the base of the open box in terms of x. [1]

(b) The area of the base of the box constructed is 2128 cm^2.
Write down an equation in x to represent this information, and show that it reduces to $x^2 - 51x + 98 = 0$. [3]

(c) Solve the equation $x^2 - 51x + 98 = 0$. [2]

(d) Find the volume of the open rectangular box. [1]

3 (a) A map is drawn to a scale of 1 : 40 000.

(i) This scale can be expressed as 1 cm represents n km.
Find the value of n. [1]

(ii) The distance between two towns on the map is 30 cm.
Find the actual distance, in kilometres, between the two towns. [1]

(iii) A park is represented by an area of 24 cm^2 on the map.
Find, in square centimetres, the area representing the park on another map whose scale is 1 : 25 000. [2]

(b) The height of the water, h cm, in a cylinder is inversely proportional to the square of its diameter, d cm.

(i) When the diameter is 5 cm, the height of the water is 14 cm.
Find the formula connecting h and d. [2]

(ii) Find the height when the diameter is 7 cm. [1]

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4 A sequence of diagrams consisting of black and white small triangles is shown below.


Diagram 1


Diagram 2

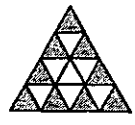


Diagram 3

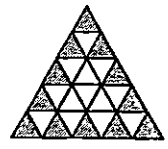


Diagram 4

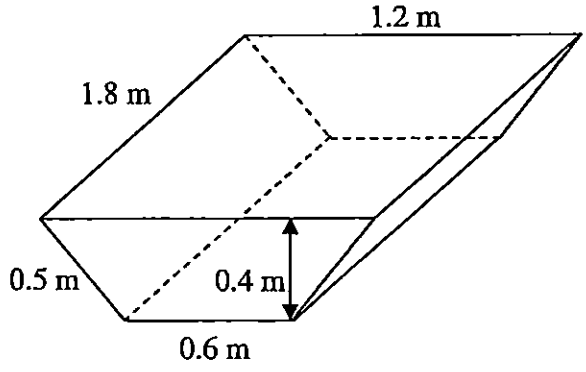
Diagram	1	2	3	4	.....	n
Total number of triangles	4	9	16	25	.....	x
Number of black triangles	3	6	9	p	.....	y
Number of white triangles	1	3	7	q	.....	z

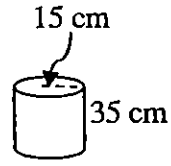
(a) Write down the values of p and q. [2]

(b) Find, in terms of n, expressions for x, y and z. [3]

(c) Diagram k contains a total of 2304 triangles. Find the value of k. [2]

5 The figure shows a tray shaped as a trapezoidal prism with the dimensions given in metres.





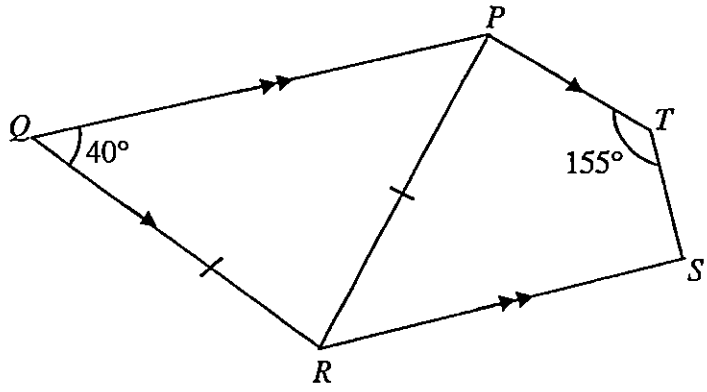
(a) Calculate the volume of the tray in cm^3. [2]

(b) Water is poured into the tray using a cylindrical container of radius 15 cm and height 35 cm.

Calculate the minimum number of times the container is used to fill the tray completely with water. [3]

(c) Calculate the total surface area of the tray in contact with the water when it is completely filled. [3]

6 (a) In the diagram, QP is parallel to RS, QR is parallel to PT and $QR = PR$.
$\angle PTS = 155°$ and $\angle PQR = 40°$.



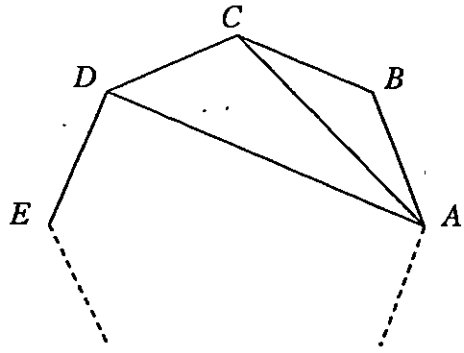
Calculate

(i) $\angle RPT$, [1]

(ii) reflex $\angle SRQ$, [1]

(iii) $\angle TSR$. [2]

(b) $ABCDE.....$ represents part of a regular octagon.



Calculate

(i) $\angle ABC$, [2]

(ii) $\angle ACD$. [2]

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

The variables x and y are connected by the equation $y = x^2 + x - 3$.

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

x	−3	−2	−1	0	1	2	3
y	3	−1	p	−3	−1	3	9

(a) Calculate the value of p. [1]

(b) Using a scale of 2 cm to represent 1 unit, draw a horizontal x-axis for $-3 \le x \le 3$.
Using a scale of 2 cm to represent 2 units, draw a vertical y-axis for $-4 \le y \le 10$.

On your axes, plot the points given in the table and join them with a smooth curve. [3]

(c) Use your graph to find

(i) the least value of y, [1]

(ii) the solution of $x^2 + x - 3 = 0$, [2]

(iii) the equation of the line of symmetry. [1]

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8 (a) It is given that $V = \frac{1}{3}\pi r^2 h$, $r > 0$.

(i) Evaluate V when $r = 6$, $h = 14$ and $\pi = 3.142$. [1]

(ii) Express r in terms of V, h and π. [2]

(b) (i) Factorise completely $4mn^2 - 8pn^2 - m + 2p$. [3]

(ii) Simplify $\frac{2x^2}{y} \div \frac{4xy^3}{3}$. [1]

(c) Solve the equation $\frac{2}{x} = \frac{7}{x-5}$. [2]

END OF PAPER

Sec 2 Express MYE 2014 Paper 2 (Answers)

Qn	Answer
1a	SGD 177 90
1bi	MYR 47228.05 (Money is corrected to 2 dec. pl)
1bii	5.5439% (exact answer) *or* 5.54 % (to 3 sig fig)
2a	Dimensions are $(60-2x)$ cm by $(42-2x)$ cm. *or* $(60-2x)$ cm $\times (42-2x)$ cm. *or* length = $(60-2x)$ cm and breadth = $(42-2x)$ cm.
2b	$(60-2x)(42-2x)=2128$ ⋮ $x^2-51x+98=0$ (shown)
2c	$x=2$ *or* $x=49$ (rej)
2d	4256 cm^3
3ai	$n=0.4$
3aii	12 km
3aiii	61.44 cm^2
3bi	$hd^2=350$ height = $7\frac{1}{7}$ cm *or* 7.14 cm (to 3 sig. fig.)
4a	p = 12 , $q=13$
4b	$x=(n+1)^2$ *or* n^2+2n+1 $y=3n$ $z=(n+1)^2-3n$ *or* n^2-n+1
4c	$k=47$
5a	648000cm^3
5b	27
5c	36000 cm^2 *or* 3.6 m^2
6ai	100°
6aii	220°
6aiii	65°
6bi	135°
6bii	112.5°
7a	$P=-3$
7ci	-3.2 ± 0.1
7cii	–2.3 and 1.3
7ciii	$x=-½$
8ai	527.856 *or* 528
8aii	$R\,r=\sqrt{\frac{3V}{\pi h}}$
8bi	$(2n-1)(2n+1)(m-2p)$
8bii	$\frac{3x}{2y^4}$
8c	$x=-2$

Sec 2 Express MYE 2014 Paper 2

Marking Scheme

1a	SGD $(50\,000 \div 100) \times 35.58$ $=$ SGD 177 90 [B1]
1bi	Int $=$ SGD $17790 \times \frac{2.5}{100}$ $=$ SGD 444.75 [M1] *OR* Amt $=$ SGD $17790 \times \frac{102.5}{100}$ [M1] $=$ SGD 18234.75 MYR $\frac{17790 + 444.75}{38.61} \times 100$ [M1] $=$ MYR 47228.05 [A1]
1bii	Percentage change $= \frac{50\,000 - 47228.05}{50\,000} \times 100\%$ [*ecf* M1 *for showing computation of the amt changed*] $= 5.5439\ \%$ (*exact answer.*) [A1]
2a	Dimensions are $(60-2x)$ cm by $(42-2x)$ cm. [B1] *OR* length $= (60-2x)$ cm and breadth $= (42-2x)$ cm. [B1]
2b	$(60-2x)(42-2x) = 2128$ [B1] $2520 - 120x - 84x + 4x^2 = 2128$ $4x^2 - 204x + 392 = 0$ [M1] $x^2 - 51x + 98 = 0$ (shown) [A1]
2c	$x^2 - 51x + 98 = 0$ $(x-49)(x-2) = 0$ [M1] $x = 49$ (rej) *or* $x = 2$ [A1]
2d	Vol $= 2128 \times 2$ $= 4256\ \text{cm}^3$ [B1]
3ai	$n = 0.4$ [B1]
3aii	Actual dist $= 30 \times 0.4$

	$= 12$ km [B1]
3aiii	Actual area $= 24 \times 0.16$ $= 3.84$ km^2 [M1] Area on map $= 3.84 \div 0.0625$ $= 61.44$ cm^2 [A1]
3bi	$hd^2 = k$ $14(5)^2 = k$ $k = 350$ [M1] $hd^2 = 350$ [A1]
3bii	$h(7)^2 = 350$ $h = 7\frac{1}{7} cm$ [B1] *OR*: $h = 7.14$ cm
4a	$p = 12, \quad q = 13$ [B1 each]
4b	$x = (n+1)^2$ *or* $x = n^2 + 2n + 1$ [B1] $y = 3n$ [B1] $z = (n+1)^2 - 3n$ or $z = n^2 - n + 1$ [B1]
4c	$(k+1)^2 = 2304$ [M1] $k + 1 = 48$ $k = 47$ [A1]
5a	Vol of tray $= \frac{1}{2} \times 40 \times (120 + 60) \times 180$ [M1] $= 648000$ cm^3 [A1]
5b	Vol of cylindrical can

	$=\pi\times15^2\times35$ *OR* $=7875\pi.\text{cm}^3$ [M1] *OR*: 24743.25 cm^3 if using $\pi=3.142$ Min no. of times $=\frac{648000}{7875\pi}$ [*ecf* M1] $=26.19$ ≈ 27 [A1]
5c	Surface area in contact with water $=2\times\frac{1}{2}\times0.4\times(1.2+0.6)+0.6\times1.8+2\times0.5\times1.8$ [M2 for any two of the computation shown] $=3.6\ \text{m}^2$ [A1] or 36000 cm^2 [A1] (if computed using measurements in cm)
6ai	$\angle RPT=180°-2\times40°$ (Int $\angle$s) $=100°$ [B1]
6aii	$\angle QRS=180°-40°$ (int $\angle$s) $=140°$ Reflex $\angle SRQ=360°-140°$ $=220°$ [B1]
6aiii	$\angle TSR=360°-100°-40°-155°$ [M1] $=65°$ [A1] *Or* $\angle TSR=25°+40°$ (int $\angle$s) [M1] $=65°$ [A1]
6bi	Ext $\angle$ of octagon $=360°\div8$ $=45°$ [M1] $\angle ABC=180°-45°$ $=135°$ [A1]
6bii	$\angle BCA=45°\div2$ (ext $\angle$ of Δ) $=22.5°$ [M1] $\angle ACD=135°-22.5°$ $=112.5°$ [A1]
7a	$p=-3$ [B1]

7b	Refer to graph. *Draw axes and plot all points given. [P2] [P1 if there are more than 3 errors] Draw smooth curve through all points [C1] [–1 m] If axes/graph not labelled or wrong scale is used. **No marks to be awarded if graph is not drawn.*
7ci	Least value of $y = -3.2 \pm 0.1$ [B1]
7cii	$x = -2.3$ or 1.3 [B1 each]
7ciii	$x = -\frac{1}{2}$ [B1]
8ai	$V = \frac{1}{3}\pi r^2 h$ $= \frac{1}{3}(3.142)(6)^2(14)$ $= 527.856$ [B1]
8aii	$V = \frac{1}{3}\pi r^2 h$ $3V = \pi r^2 h$ $r^2 = \frac{3V}{\pi h}$ [M1] *or* $r^2 = \frac{V}{\frac{1}{3}\pi h}$ [M1] $r = \sqrt{\frac{3V}{\pi h}}$ [A1]
8bi	$4mn^2 - 8pn^2 - m + 2p$ $= 4n^2(m-2p) - (m-2p)$ [M1] $= (4n^2 - 1)(m-2p)$ [M1] $= (2n-1)(2n+1)(m-2p)$ [A1]
8bii	$\frac{2x^2}{y} \div \frac{4xy^3}{3}$ $= \frac{2x^2}{y} \times \frac{3}{4xy^3}$ $= \frac{3x}{2y^4}$ [B1]

8c	$\frac{2}{x}=\frac{7}{x-5}$ $2(x-5)=7x$ $2x-10=7x$ [M1] $-5x=10$ $x=-2$ [A1]