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Answer all the questions.

- 1 (a) A basket of grapes has a total mass of 820 grams.
Given that the mass of the basket is 0.09 kilograms, find, in grams, the mass of the grapes.
- (b) A string has a total length of 1.375 metres.
Adam cuts equal pieces of length 12.5 cm from the string.
How many pieces can be cut from the string?

Answer (a) g [1]
(b) [1]

- 2 Given that x is an integer, $5 \leq x < 10$ and $x \neq 7$, write down
- (a) the possible values of x ,
- (b) the greatest value of x such that x is a prime number.

Answer (a) [1]
(b) [1]

- 3 The estimated number of voters in an election, rounded off to 3 significant figures, is 23 200.

Write down

- (a) the smallest possible number of voters,
(b) the largest possible number of voters.

Answer (a) [1]

(b) [1]

-
- 4 Evaluate

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

leaving your answer correct to 2 decimal places.

Answer [2]

- 5 (a) Given that $p = -4$, evaluate $3p^2 - p$.
- (b) Expand and simplify $4(3x - 2y) - (2 - 5y)$.

Answer (a) [1]

(b) [2]

- 6 \$105 is to be divided between Andy and Betty in the ratio 3 : x.
- (a) Write down an expression, in terms of x for Betty's share.
- (b) Given that Betty received \$60, form an equation in terms of x and solve the equation to find the value of x

Answer (a) [1]

(b) $x =$ [2]

- 7 (a) Solve the inequality $15 - 4x \geq 2x + 1$.
- (b) Write down the largest rational value of x such that x satisfies $15 - 4x \geq 2x + 1$.

Answer (a) [2]

(b) [1]

8 Solve

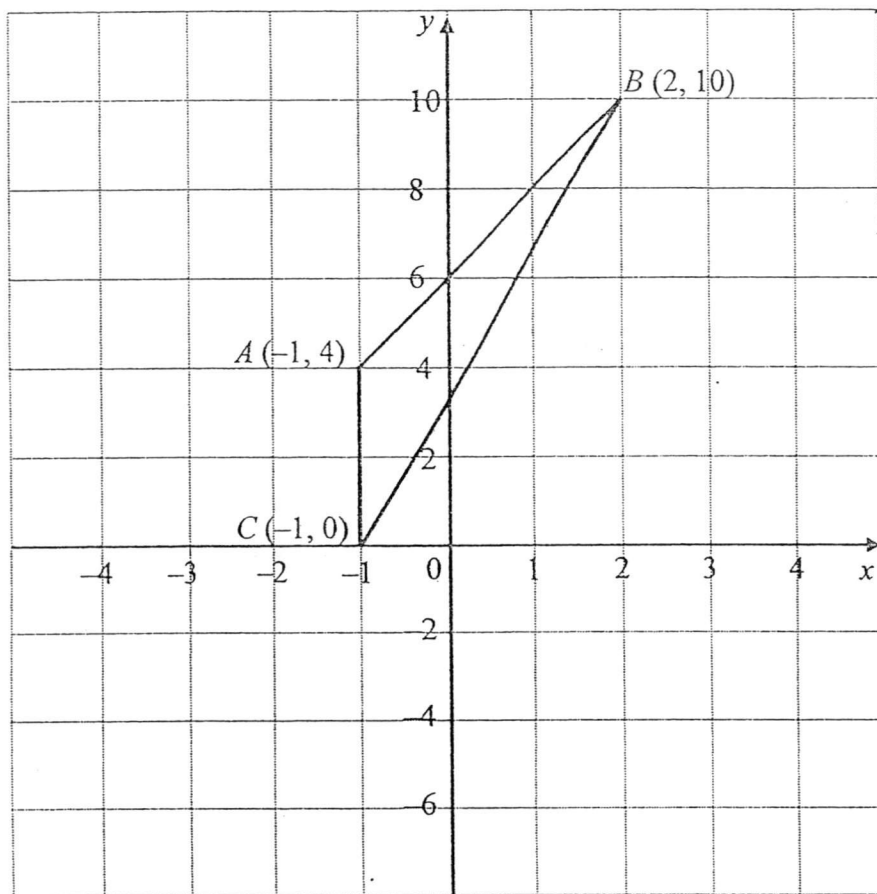
(a) $1 - \frac{2}{x} = 5,$

(b) $\frac{y}{4} - \frac{y+3}{2} = 0.$

Answer (a) $x =$ [1]

(b) $y =$ [2]

- 9 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) $ABDC$ is a trapezium with AC parallel to BD .
The area of the trapezium is 21 units^2 .

Find the coordinates of point D .

Answer (a) [1]

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

- 10 Jennifer saw the following online advertisement from Booking.com.

Hilton On The Park Melbourne
★★★★★
In the heart of East Melbourne-main sports and entertainment district, contemporary furnishing with large opening windows
Most Popular! 23 people booked this hotel in the last 48 hours

Only 2 rooms left
at this price

\$150
per night
Sponsored Listing

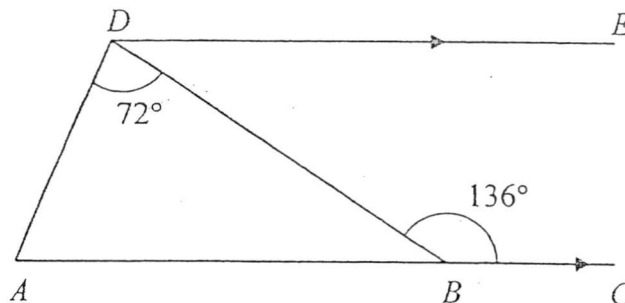
The price of renting a hotel room displayed on the advertisement is 25% less than the normal price.

- (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]

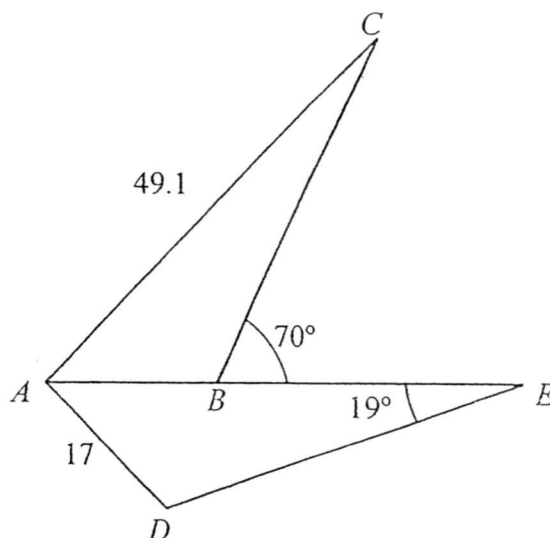
- 11 (a) In the diagram, ABC is a straight line and DE is parallel to ABC .
 $\angle ADB = 72^\circ$ and $\angle DBC = 136^\circ$.
 Find $\angle ADE$.



- (b) In the diagram, $\triangle ABC \cong \triangle ADE$.
 $AC = 49.1$ cm, $AD = 17$ cm, $\angle DEB = 19^\circ$ and $\angle EBC = 70^\circ$.

Find

- (i) the length of BE ,
 (ii) $\angle CAB$.



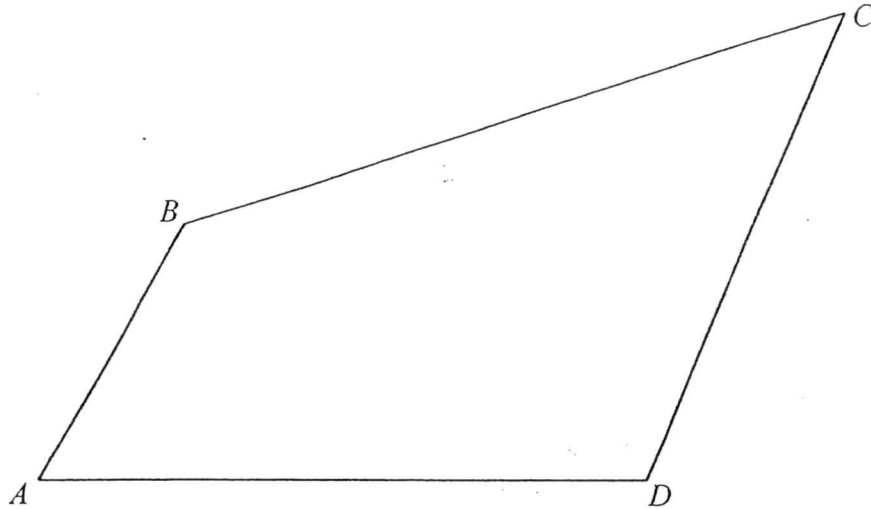
Answer (a) $\angle ADE = \dots\dots\dots^\circ$ [2]

(b)(i) $BE = \dots\dots\dots$ cm [1]

(ii) $\angle CAB = \dots\dots\dots^\circ$ [1]

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

Answer (b) and (c)



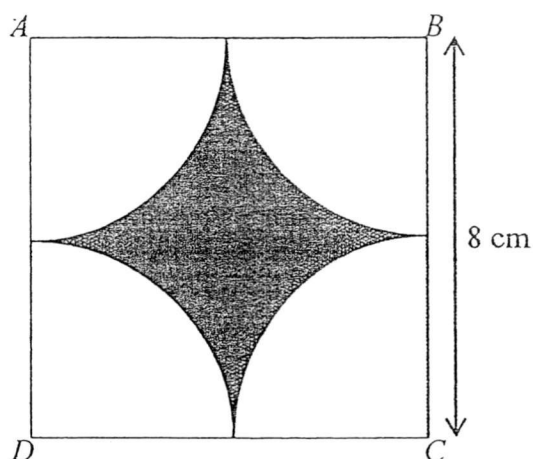
- (a) Measure the smallest interior angle of the quadrilateral. [1]
- (b) Construct
- (i) the perpendicular bisector of BC , [1]
- (ii) the bisector of $\angle BAD$. [1]
- Label all your constructions clearly.
- (c) The point Q is a point in the quadrilateral $ABCD$ such that Q is equidistant from the lines AB and AD and nearer to point C than to point B .

Mark a possible position for point Q .

Answer (a)° [1]

- 13 In the diagram, $ABCD$ represents a square card.
Four quarter circles of equal dimensions are cut out of it, leaving behind the shaded part.
It is given that the length of each side of the square is 8 cm.

- (a) Calculate the shaded area.
- (b) Ribbon of length x cm is used to wrap around the perimeter of the shaded part completely.
Find the minimum integer value of x .
[Take $\pi = 3.142$]



Answer (a) cm^2 [2]

(b) [2]

- 14 (a) Expressed as the product of prime factors,
 $90 = 2 \times 3^2 \times 5$ and $36 = 2^2 \times 3^2$.

Use these results to find

- (i) the lowest common multiple of 90 and 36, leaving your answer in index notation,
- (ii) the smallest positive integer value of m such that $\frac{90}{2m}$ is a perfect square.
- (b) Ellen has a piece of coloured paper 90 cm. by 36 cm.
The entire piece of paper is cut into identical squares to make greeting cards.
Assuming that there is no paper left behind or wasted, find
- (i) the largest possible area of each greeting card,
- (ii) the number of greeting cards obtained.

Answer (a)(i) [1]

(ii) [1]

(b)(i) cm² [2]

(ii) [1]

- 15 Lollipops are packed into small boxes and packets.
The total number of lollipops, L , sold by selling x boxes and y packets is given by

$$L = 10x + 4y.$$

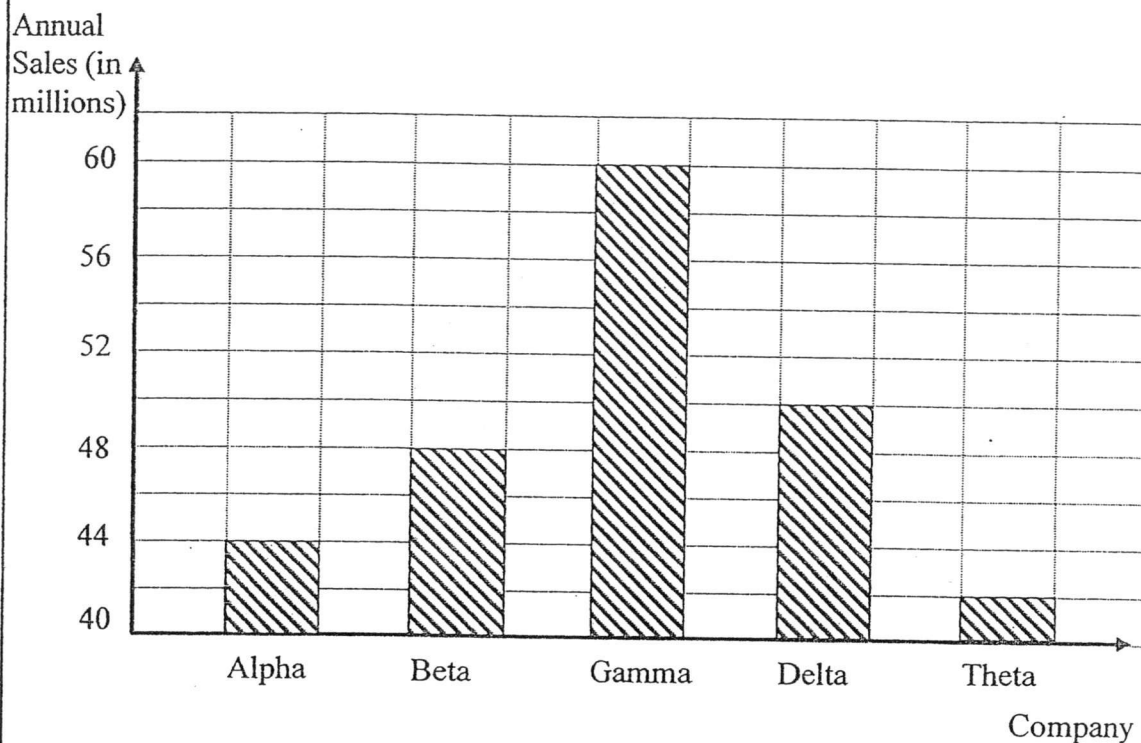
- (a) Find the total number of lollipops sold from selling 3 boxes and 5 packets of lollipops.
- (b) What do the coefficients of x and y represent?
- (c) Cherie bought x boxes and 2 packets of lollipops.
Given that she bought a total of 78 lollipops, find the value of x .

Answer (a) [2]

(b) [2]

(c) $x =$ [1]

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



- Find the ratio of the annual sales for Alpha to that of Beta branch.
- Gamma claimed that its annual sales are twice that of Delta branch. Do you agree with the statement? Explain your answer.
- Express the annual sales of Theta as a percentage of the total annual sales for all the five branches.
- 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]

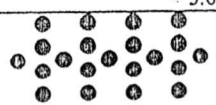
1	(a)	Mass of grapes = $820 - 0.09(1000)$ = $820 - 90$ = 730 g	B1	1	Working need not be shown
	(b)	$1.375 \times 100 = 137.5$ cm No of pieces = $137.5 + 12.5$ = 11	B1	1	Working need not be shown
2	(a)	$5 \leq x < 10$ and $x \neq 7$ $x = 5, 6, 8, 9$	B1	1	Working need not be shown
	(b)	$x = 5$	B1	1	Working need not be shown
3	(a)	23 150	B1	1	Working need not be shown
	(b)	23 249	B1	1	
4		7485.05 (2 dp)	B2	2	Working need not be shown B1 for 7485... seen
5	(a)	$3p^2 - p$ $p = -4, 3(-4)^2 - (-4) = 52$	B1	1	Working need not be shown
	(b)	$= 12x - 8y - 2 + 5y$ $= 12x - 3y - 2$	M1 A1	2	
6	(a)	Betty's share $= \frac{105}{x+3} \times x$ $= \frac{105x}{x+3}$	B1	1	
	(b)	$\frac{105x}{x+3} = 60$ $105x = 60x + 180$ $45x = 180$ $x = 4$	M1 A1	2	
7	(a)	$15 - 4x \geq 2x + 1$ $-4x - 2x \geq 1 - 15$ $-6x \geq -14$ $x \leq 2\frac{1}{3}$ cao	M1 A1	2	cao – allow M1 for answer without the inequality sign

(b)	Largest rational = $2\frac{1}{3}$	B1	1	
8 (a)	$\frac{2}{x} = -4$ $x = -\frac{1}{2}$	B1	1	Working must be shown. No marks for correct answer without working
(b)	$\frac{y}{4} - \frac{y+3}{2} = 0$ $\frac{y-2(y+3)}{4} = 0$ $y-2y-6=0$ $y=-6$	M1 A1	2	
9 (a)	Gradient of $AB = \frac{10-4}{3} = 2$	B1	1	
(b)	Let y be the distance of the unknown parallel side $\frac{1}{2}(4+y)3 = 21$ $4+y = 14$ $y = 10$ $D(2, 0)$	M1 A1	2	Award M1 for other alternative method eg. 21 – area of $\triangle ABC$
10 (a)	Let x be the normal price of the hotel $\frac{75}{100} \times x = 150$ $x = 150 \times \frac{100}{75} = \200	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	
11 (a)	$\angle BDE = 180^\circ - 136^\circ = 44^\circ$ $\angle ADE = 72^\circ + 44^\circ = 116^\circ$	M1 A1	2	
(b) (i)	$AB = AD = 17$ cm $AE = AC = 49.1$ cm $BE = 49.1 - 17 = 32.1$ cm	B1	1	
(ii)	$\angle ACB = \angle AED = 19^\circ$ $\angle CAB = 70^\circ - 19^\circ = 51^\circ$	B1	1	<u>Alternative method</u> $180^\circ - 110^\circ - 19^\circ = 51^\circ$
12 (a)	Smallest interior angle is	B1	1	
(b)	See construction attached	B2	2	B1 for correct and

Question	Answer	Mark	Remarks
(c)	See construction attached Point Q marked on the diagram	B1	1 accurate construction of perpendicular bisector B1 for correct and accurate construction of angle bisector
13 (a)	Shaded area = $(8 \times 8) - (\pi \times 4^2)$ = $64 - 16\pi$ = 13.728 cm^2	M1	2
(b)	Circumference of 1 circle = $2\pi \times 4$ = 8π = 25.136 Min length of ribbon needed is 26 cm	A1 M1 A1	2 M1 - 25.136 seen
14 (a) (i)	LCM = $2^2 \times 3^2 \times 5$	B1	1
(ii)	$\frac{90}{2 \times 5} = 3^2$ $m = 5$	B1	1
(b) (i)	HCF = $2 \times 3^2 = 18$ Largest area = 18×18 = 324 cm^2	M1 A1	2
(ii)	No of greeting cards = $\frac{90}{18} \times \frac{36}{18}$ = 5×2 = 10	B1	1
15 (a)	$L = 10x + 4y$ $x = 3, y = 5, L = 10(3) + 4(5)$ = 50 Total lollipops = 50	M1 A1	2
(b)	Coefficient of x represents the number of lollipops in each box and coefficient of y represents the number of lollipops in each packet.	B2	2 B1 each for correct representation of coeff of x and y .
(c)	$L = 10x + 4y$		

Question	Answer	Mark	Remarks
	$78 = 10x + 4(2)$ $10x = 70$ $x = 7$	B1	1 Award B1 for correct answer obtained without solving linear equation
16 (a)	$44 : 48 = 11 : 12$	B1	1
(b)	No, as the ratio of Gamma : Delta is $60 : 50$ which is $6 : 5$ and not $2 : 1$	B1	1
(c)	Total sales = $44 + 48 + 60 + 50 + 42$ Percentage = $\frac{42}{244} \times 100\%$ = 17.2% (3 sf)	M1 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
17 (a)	$42 = 80a + b$	B1	1
(b)	$38 = 40a + b$ -----(1) $42 = 80a + b$ -----(2) (2) - (1), $4 = 40a$ $a = \frac{1}{10}, b = 38 - 4 = 34 \text{ cm}$	M1 A2	3 M1 - substitution / elimination method A1 each for correct value of a and b
(c)	$47 = \frac{1}{10}x + 34$ $x = (47 - 34)10 = 130 \text{ g}$	B1	1
(d)	b represents the original length of the spring	B1	1

Marking Scheme to 2014 Sec 2 NA Math Mid-Year Exam

	Working / Answers	Marks
1(a)	$3200 + 850x$	B1
(b)(i)	$3200 + 850x \leq 20\,000$ $850x \leq 16800$ $x \leq 19.8$	M1 A1
(b)(ii)	Max number of children = 19	B1
2(a)	\$9.47	B1
(b)	GST = $107\% \times 136.16$ = \$145.69	B1
(c)	Amount of electricity used = $\frac{59.43}{0.23}$ = 258 kWh	B1
(d)	Utility bill for February 2014 (without GST) = $(110\% \times \$59.43) + (70\% \times \$36.20) + \$25.38 + \5.68 + \$9.47 = \$131.243 Utility bill for January 2014 (without GST) = \$136.16 Percentage increase = $\frac{\$136.16 - \$131.243}{\$136.16} \times 100\%$ = $\frac{\$4.917}{\$136.16} \times 100\%$ = 3.61%	M1 M1 A1
3(a)	 4th pattern : $5 + 5 + 5 + 5 + 1 = 21$	B2
(b)	41 buttons	B1
(c)	$T_n = 5n + 1$	B1
(d)	$5n + 1 = 276$ $5n = 275$ $n = 55$	M1 A1
4(a)(i)	$1 : 500\,000$ $1 \text{ cm} : 5 \text{ km}$ Length on map = $\frac{17}{5} = 3.4 \text{ cm}$	B1
(a)(ii)	$1 \text{ cm}^2 : 25 \text{ km}^2$ Actual area = 30×25 = 750 km^2	M1 A1
4(b)(i)	$25 \text{ cm}^2 : 4 \text{ km}^2$ $? \text{ cm}^2 : 20 \text{ km}^2$ Area on map = $25 \times 5 = 125 \text{ cm}^2$	B1

4(b)(ii)	$\sqrt{25 \text{ cm}^2} : \sqrt{4 \text{ km}^2}$ $5 \text{ cm} : 2 \text{ km}$ $1 \text{ cm} : 0.4 \text{ km}$ $1 \text{ cm} : 40\,000 \text{ cm}$ $1 : 40\,000$ In the form $\frac{1}{r}$, the scale is $\frac{1}{40000}$	M1 [linear scale] A1
5(a)	$\frac{x}{70}$	B1
(b)	$\frac{x}{60}$	B1
(c)(i)	$\frac{x}{60} - \frac{x}{70} = \frac{1}{2}$ $\frac{70x - 60x}{4200} = \frac{1}{2}$ $\frac{10x}{4200} = \frac{1}{2}$ $\frac{x}{420} = \frac{1}{2}$	M1 [formed equation] M1 A1
(c)(ii)	$2x = 420$ $x = 210$ Total time = $\frac{x}{70} + \frac{x}{60}$ = $\frac{210}{70} + \frac{210}{60}$ = 6.5 hours.	A1 A1
6(a)	Area of trapezium ABFE = $\frac{1}{2} \times 20 \times (2.5 + 1)$ = 35 m^2	M1 A1
(b)(i)	Volume of prism = area of trapezoidal cross-section $\times$ width of pool = 35×12 = 420 m^3	B1
(b)(ii)	Total surface area in contact with water = $35 \times 2 + (2.5 + 20.1 + 1) \times 12$ = 353.2 m^2	M1 – area of 2 trapezoidal bases M1 – area of 3 lateral surfaces A1
7(a)(i)	$An = k$ $20 \times 18 = k$ $360 = k$ $An = 360$	B1
(a)(ii)	k is the total sum/amount of money that is distributed.	B1
(a)(iii)	$An = 360$ $6 \times n = 360$ $n = 60$	B1

7(b)(i)	$\frac{y}{x^3} = k$, where k is a constant $\frac{135}{3^3} = k$ $k = 5$ $\frac{y}{x^3} = 5$ or $y = 5x^3$	M1 [for value of k] A1
(b)(ii)	When $y = 625$, $625 = 5x^3$ $x^3 = 125$ $x = \sqrt[3]{125}$ $x = 5$	M1 A1
8(a)	$m = 5$	B1
(b)	Drawing of graph - Correct axis and scale with arrows - Correct points plotted - Line passes through all points and eqn of line	G1 G1 G1
(c)	Initial height = 3 cm	B1
(d)	From graph, time = 5 secs ± 0.1	B1
(e)(i)	Gradient = 0.5 or $\frac{1}{2}$	B1
(e)(ii)	The gradient represents the rate of change of height per second. or For every 1 second, the height is increased by 0.5 cm.	B1



聖嬰中學

HOLY INNOCENTS' HIGH SCHOOL

MID-YEAR EXAMINATION 2014
SECONDARY 2 NORMAL (ACADEMIC)

MATHEMATICS

4042/02

Paper 2

Name : _____

Date : 14 May 2014

Register No : _____

Duration : 1 h 30 min

Class : _____

Additional Materials needed: 4 sheets of writing paper,
1 sheet of graph paper.

Instructions to Candidates

Write your register 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 50.

Setter: Mrs Chang Poh Joo

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

Answer all the questions.

- 1 Mr Chong and Mrs Lin plan an educational trip to Taiwan.
Each adult has to pay \$1 600 and each student has to pay \$850.

It is given that x number of students are going for the trip.

- (a) Find an expression, in terms of x , for the total cost for the trip. [1]
- (b) It is given that the total cost for the trip must not be more than \$20 000.
(i) Form an inequality involving x and solve it. [2]
(ii) Hence state the maximum number of students who can go for the trip without exceeding the budget. [1]

- 2 The diagram shows Susie's utility bill for the month of January 2014, part of which has been torn away.

Electricity Services	\$59.43
Water Services	\$36.20
Gas Services	\$25.38
Refusal Removal	\$5.68
Water Conservation Tax	\$9.
Total	\$136.16

- (a) What is the amount payable for Water Conservation Tax? [1]
- (b) The total amount shown in the diagram is not inclusive of 7% GST. Calculate the total amount she has to pay, inclusive of GST. [1]
- (c) The rate of electricity usage is \$0.23 per kWh. Find the amount of electricity used, in kWh, leaving your answer correct to 3 significant figures. [1]
- (d) For the month of February 2014, the cost for electricity usage was increased by 10% and the cost for water usage was decreased by 30%.

Assuming the cost for gas usage, the refusal removal fee and the water conservation tax remains unchanged, find the decrease in the total cost of the utility bill as a percentage of the total cost for the month of January 2014, excluding the GST. [3]

- 3 James used a number of buttons to make a series of patterns. The first 3 patterns are shown below.



Pattern 1



Pattern 2



Pattern 3

The table below shows the number of buttons in each pattern.

Pattern	Number of buttons
1	$5 + 1 = 6$
2	$5 + 5 + 1 = 11$
3	$5 + 5 + 5 + 1 = 16$
...	...
n	T_n

- (a) Draw Pattern 4 and write down the number of buttons used in making the pattern. [2]
- (b) How many buttons are there in Pattern 8? [1]
- (c) Write down a formula for T_n , the number of buttons in Pattern n . [1]
- (d) Which pattern contains 276 buttons? [2]

- 4 (a) Map A is drawn to a scale of 1 : 500 000.
- (i) Find the length, in cm, of a road on the map if the road is 17 km long. [1]
- (ii) On the map, the area representing a lake is 30 cm^2 . Calculate the actual area of the lake, giving your answer in km^2 . [2]
- (b) The actual area of a lake is 4 km^2 . It is represented on map B by an area of 25 cm^2 .
- (i) The actual area of a plantation is 20 km^2 . Find its area, in cm^2 , on map B. [1]
- (ii) Find the scale of map B in the form $\frac{1}{r}$. [2]

- 5 Town P and Town Q are x km apart. A car travelled from Town P to Town Q at an average speed of 70 km/h.

- (a) Write down an expression, in terms of x , for the number of hours taken to travel from Town P to Town Q. [1]

The car returned from Town Q to Town P by the same route.

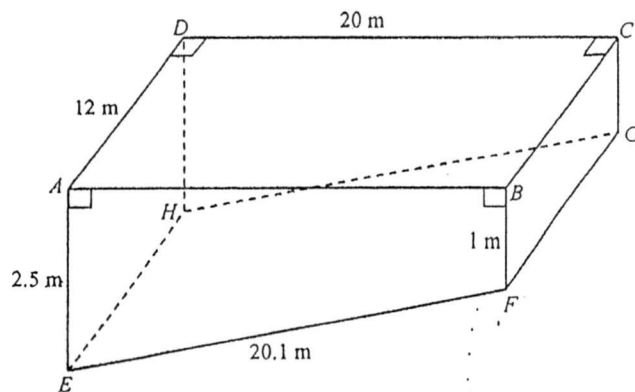
The average speed for the return journey was 10 km/h less than its average speed when it travelled from Town P to Town Q.

- (b) Write down an expression, in terms of x , for the number of hours taken to travel from Town Q to Town P. [1]

The return journey took 30 minutes longer than the journey from Town P to Town Q.

- (c) (i) Form an equation in x , and show that it reduces to $\frac{x}{420} = \frac{1}{2}$. [3]
- (ii) Solve the equation and find the total time taken for the entire journey. [2]

- 6 The figure represents a swimming pool whose cross-section is a trapezium $ABFE$.
The pool is 20 m long, 12 m wide, 2.5 m deep at one end and 1 m deep at the other end.
 $EF = 20.1$ m.



- (a) Show that the area of the cross-section $ABFE$ is 35 m^2 . [2]
- (b) The pool is filled with water up to its brim.
- (i) Find the volume of water in the swimming pool. [1]
- (ii) Find the total surface area of the swimming pool that is in contact with water. [3]

- 7 (a) A sum of money is distributed among a number of members in a committee.

The amount of money each person gets, $\$A$, is inversely proportional to the number of members, n , in the committee.

When there are 18 members, the amount of money each person gets is $\$20$.

- (i) Find an equation connecting A and n in the form $An = k$, where k is a constant. [1]
- (ii) Interpret the meaning of k found in (a)(i). [1]
- (iii) If the amount of money each person gets is $\$6$, find the number of members in the committee. [1]
- (b) It is given that y is directly proportional to x^3 . When $x = 3$, $y = 135$.
- (i) Find an equation connecting x and y . [2]
- (ii) Find the value of x when $y = 625$. [2]

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

A container is being filled with water flowing at a constant rate from a tap. After t seconds, the height of the water, h cm, is given by the function $h = 3 + 0.5t$.

The table below gives some values of t and the corresponding values of h .

t	0	4	8
h	3	m	7

- (a) Find the value of m . [1]
- (b) Use a scale of 2 cm to represent 1 unit on the horizontal t -axis for $0 \leq t \leq 8$ and a scale of 2 cm to represent 1 unit on the vertical h -axis for $0 \leq h \leq 7$. On your axes, draw the graph of $h = 3 + 0.5t$. [3]
- (c) State the initial height of the water in the container. [1]
- (d) Using your graph, find the time taken for the water to reach a height of 5.5 cm. [1]
- (e) (i) Write down the gradient of the graph. [1]
- (ii) Interpret the meaning of the gradient of the graph. [1]

-End-of-Paper-