Candidate Name:	Class:	Index No:

DUNMAN SECONDARY SCHOOL

Where ..... discernment, discipline, daring, determination & duty become a part of life.

MID YEAR EXAMINATION 2016

SECONDARY 2 EXPRESS

MATHEMATICS

0800 – 1030 11th May 2016

Additional Materials: Writing Paper (3 sheets), Graph Paper (1 sheet)

READ THESE INSTRUCTIONS FIRST

CALCULATOR MODEL

Write your name, index 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.

Write your answers in the spaces provided in the question paper for Section A and on the writing paper provided for Section B.

Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.

The use of a scientific calculator is expected, where appropriate.

You are reminded of the need for clear presentation in your answers.

The number of marks is given in brackets [ ] at the end of each question or part question.

The total number of marks for this paper is 100.

Accuracy		Presentation		Total marks deducted
Errors	Qn No.	Errors	Qn No.	
Fractions		Units		
Rounding off (SF and DP)		Labels and Statements		
Simplification		Symbols		

This question paper consists of 16 printed pages including the cover page.

[Turn over

SECTION A (60 MARKS)

ANSWER ALL QUESTIONS ON THE QUESTION PAPER.

1 Given that $2x+\frac{x}{3}\geq 28$.

(a) Solve the inequality.

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

(b) Hence state the smallest value of x if x is a prime number.

Answer (b) $x =$ ..... [1]

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2 (a) Factorise completely $2m^3-72m$.

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

(b) Simplify $\frac{1}{5}a(a-2)-3\left(1-\frac{1}{7}a\right)$.

Answer (b)..... [2]

3 Solve the equation $\frac{3}{x-2} - \frac{7}{2x+1} = 0$.

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

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4 Given that m is inversely proportional to the square of n. It is known that $m = 8$ for a particular value of n. When n is increased by 200%, find

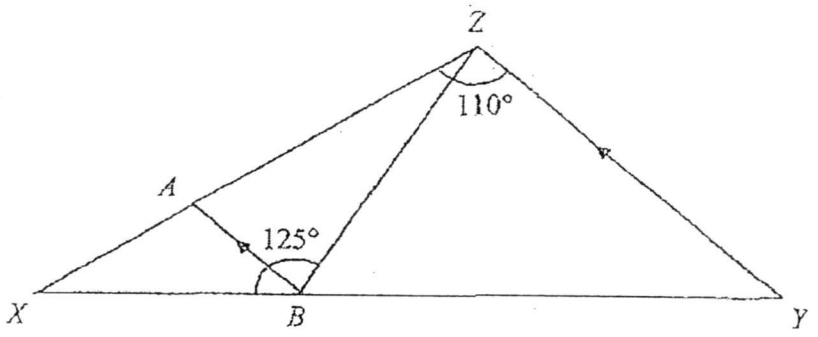
(a) the value of m,

Answer (a) $m =$ ..... [2]

(b) the percentage change in the value of m.

Answer (b) ..... % [2]

5 In the diagram, XBY and XAZ are straight lines, AB is parallel to ZY, $\angle XZY = 110°$, $\angle XBZ = 125°$ and $\angle ABX = \frac{8}{25}\angle XBZ$.



Stating the reasons, calculate,

(a) $\angle ABY$,

Answer (a) $\angle ABY =$ .....° [2]

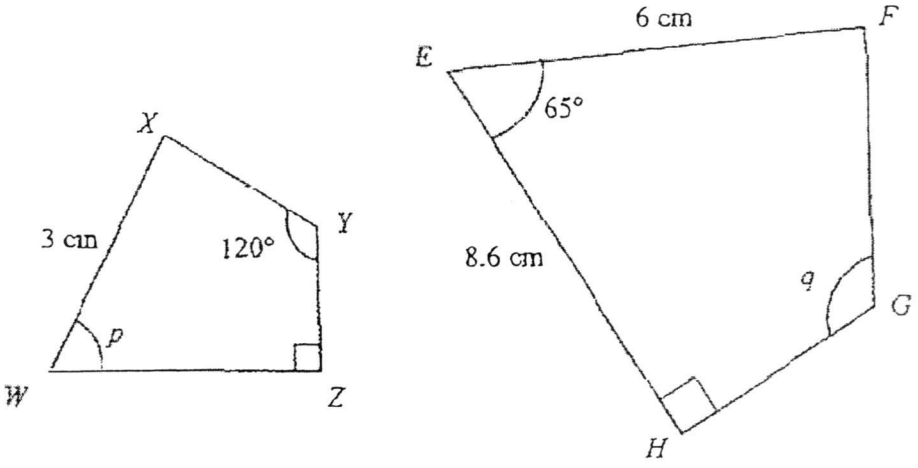
(b) $\angle AXB$.

Answer (b) $\angle AXB =$ .....° [2]

(c) State 2 triangles that are similar.

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

6 Polygons $WXYZ$ and $EFGH$ are similar. Given that $XW = 3$ cm, $EF = 6$ cm, $EH = 8.6$ cm, $\angle FEH = 65°$ and $\angle XYZ = 120°$.



Find

(a) the value of p and q,

Answer (a) p = ...° [1]

q = ...° [1]

(b) the scale factor of enlargement,

Answer (b) ..... [1]

(c) WZ.

Answer (c) WZ = ...cm [2]

7 (a) John drove at a speed of $(4v^2 + 3v)$ km/h for 2 hours from Town A to Town B. Then he continued his journey to Town C at a speed of $(v^2 + 12v - 3)$ km/h for 3 hours. Find, an expression in terms of v, the total distance of John's journey. Simplify your answer.

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

(b) If $v = 5$, find the total distance John travelled.

Answer (b).....km [1]

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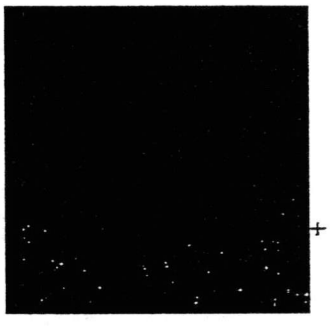
8 (a) Given that $x - y = 4$ and $x^2 - y^2 = 28$, find the value of $(x+y)^2$.



$+ y)^2$ =..... [3]

8 (b) Simplify $\dfrac{(x+3)^2}{x^2+4x+3} \div \dfrac{3x+9}{x+1}$

Answer (b)..... [4]

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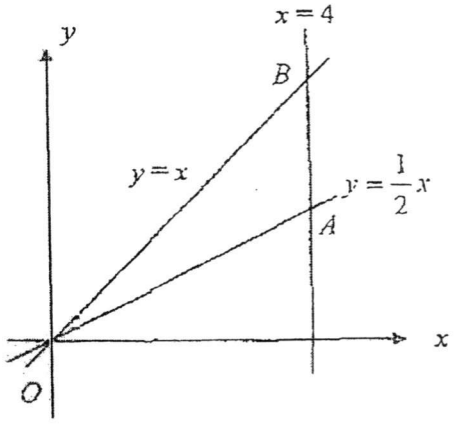
9 The diagram shows the graph of $y = x$, $y = \dfrac{1}{2}x$ and $x = 4$.



(a) Find the coordinates of A and B.

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

B ..... [1]

(b) Find the area of ΔAOB.

Answer (b) Area of ΔAOB =..... units^2 [2]

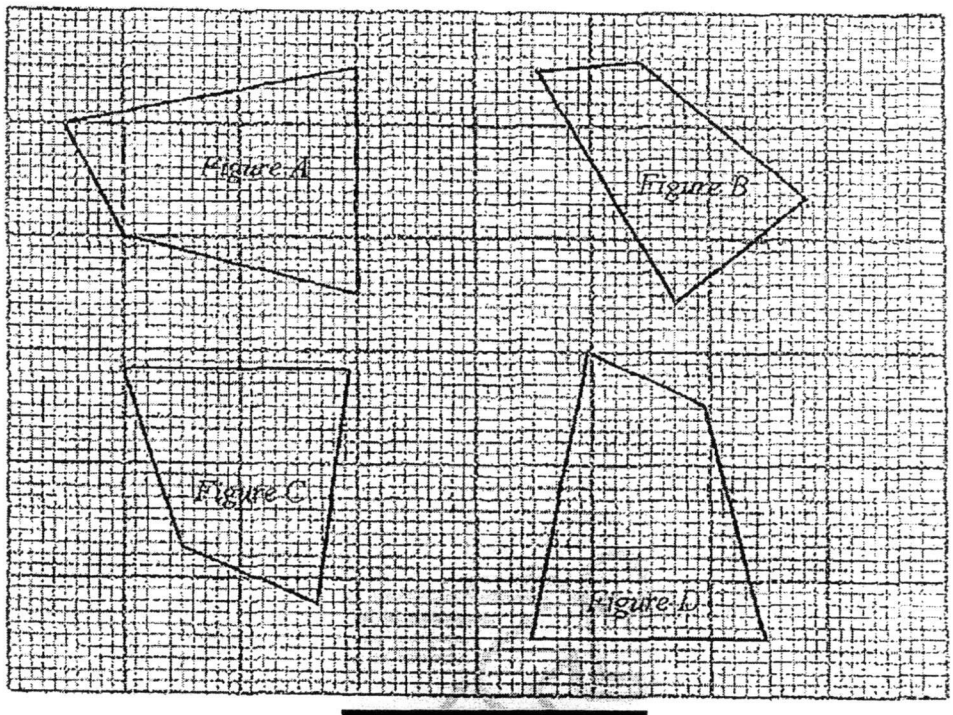
10 (a) Given that $a = \dfrac{3kx^2}{p - x^2}$, express x in terms of a, k and p.

Answer (a) ..... [3]

(b) Hence find the values of x if $a = 3$, $k = 1$ and $p = 2$.

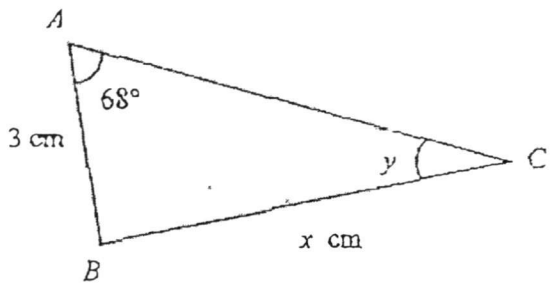
Answer (b) $x =$ ..... or ..... [2]

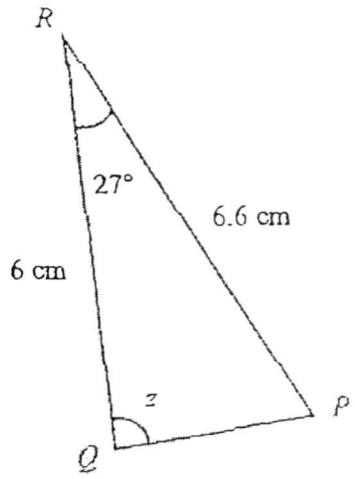
11 State the 2 figures which are congruent.



[redacted]re ..... and ..... [1]

12 ΔABC is congruent to ΔPQR.





Find the value of

(a) x,

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

(b) y,

Answer (b) $y =$ ..... ° [1]

(c) z.

[redacted] = ... ° [2]

13 (a) Factorise fully $10x^2 - 5xy - 4px + 2py$.

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

(b) Hence simplify $\dfrac{6x^2 - 3xy}{10x^2 - 5xy - 4px + 2py}$.

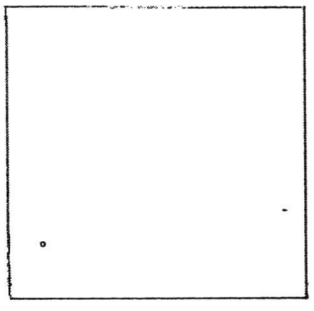
Answer (b)..... [2]

14 Each pattern in the sequence below consists of a number of X.

				X X X X
			X X X	X X X X
		X X	X X X	X X X X
	X	X X	X X X	X X X X
Pattern number	1	2	3	4

(a) Draw Pattern number 5 in the space provided below.

Answer (a) [1]



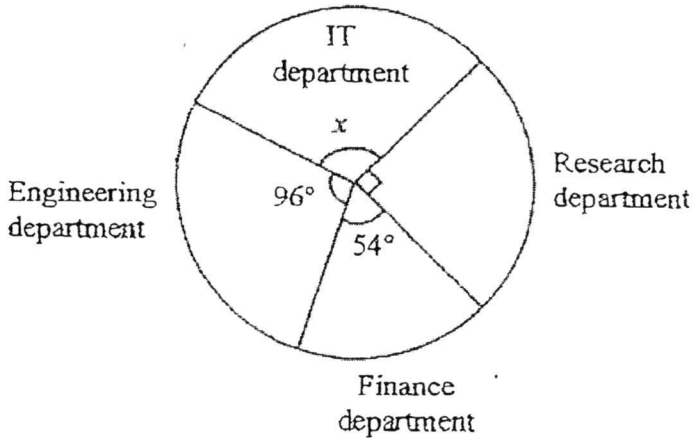
(b) Write down an expression, in terms of n, for the number of X in Pattern number n.

Answer (b) Pattern number n = ... [1]

(c) Explain if it is possible for a pattern to have 322 X.
Show your working clearly.

Answer (c).....
.....
.....
.....
..... [2]

15 The distribution of staff in the four departments of a company is represented in the pie chart shown below. There are 15 staff in the Research department.



(a) Calculate the value of x.

Answer (a) $x =$ .....° [1]

(b) Express the number of staff in the Finance department as a fraction of the total number of staff in the company.

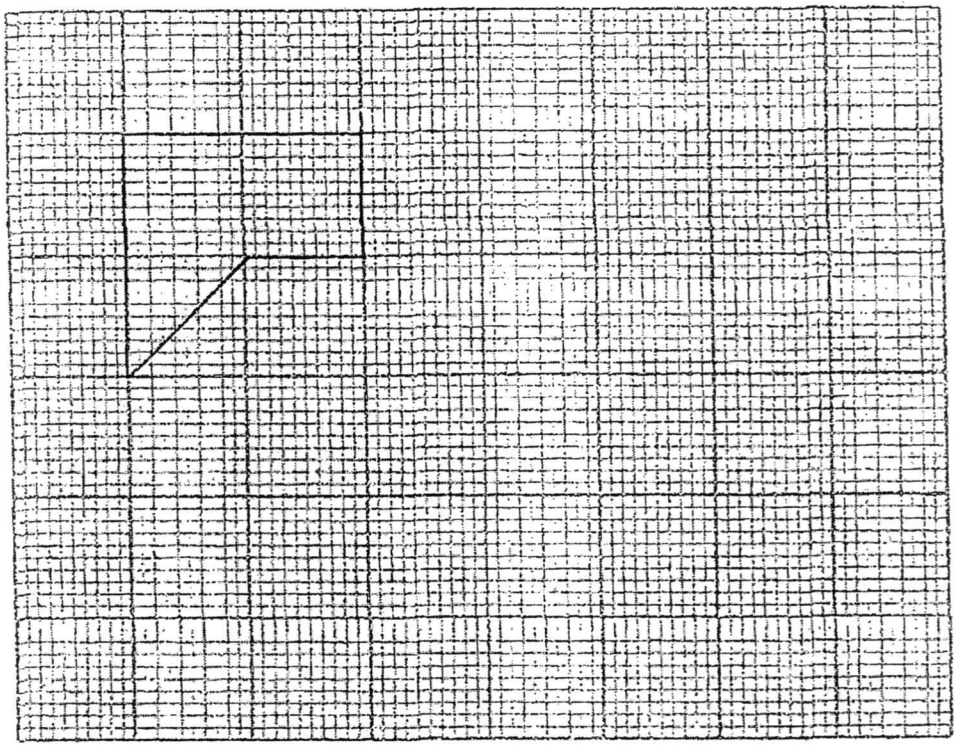
Answer (b) ..... [1]

(c) Find the total number of staff in the company.

Answer (c) ..... staff [1]

16 Using the grid below, draw a scale diagram of the figure shown below with a scale factor $\frac{3}{2}$. [1]

Answer



--- End of Section A ---

SECTION B (40 MARKS)

ANSWER ALL THE QUESTIONS ON THE WRITING PAPER PROVIDED.

17 (a) Factorise $4b^2 + 13b + 3$. [1]

(b) **Hence** find two factors of 41 303. [2]

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18 A scale of 2 cm to 1500 m is used for Map A.

(a) Find the scale of Map A in the form of $1 : r$, where r is an integer. [2]

(b) The perimeter of a school is 1.125 km. Determine the map perimeter of the school on Map A. [2]

(c) A shopping mall occupies an area of 4 cm^2 on the Map A. Determine the map area of the shopping mall drawn on a Map B with a scale of 1 cm to 0.3 km. [4]

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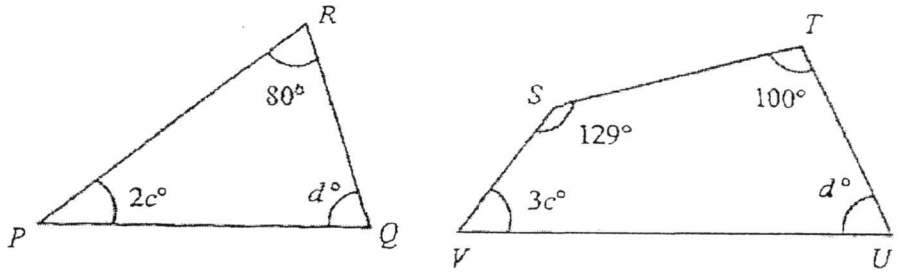
19 PQR is a triangle and $STUV$ is a quadrilateral.



(a) Using the information shown in the diagrams, write down two equations in terms of c and d. [2]

(b) Solve these equations to find the value of c and d. [3]

20 (a) (i) Express $\frac{2p-1}{p^2-2p}-\frac{5-3p}{p^2-3p+2}$ as a fraction in its simplest form. [3]

(ii) Hence solve $\frac{2p-1}{p^2-2p}\frac{5-3p}{p^2-3p+2}=\frac{5p^2}{p(p^2-3p+2)}$. [2]

(b) Given that $\frac{2x-3y}{x-y}=\frac{3}{4}$, find the value of $\frac{5x}{3y}$. [4]

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

The variables x and y are connected by the equation $x-\frac{1}{2}y=-3$. Some values of x and the corresponding values of y are given in the table.

x	-2	0	0.5	1
y	2	6	p	8

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

(b) Using a scale of 4 cm to 1 unit, draw a horizontal x-axis for $-3\le x\le 1$.
Using a scale of 2 cm to 1 unit, draw a vertical y-axis for $-1\le y\le 8$.
On your axes, draw the graph of $x-\frac{1}{2}y=-3$. [3]

(c) Using the graph, find
(i) the value of x when $y=2.6$, [1]
(ii) the **coordinates** of the x-intercept. [1]

(d) Find the gradient of graph. [1]

[Question 22 is printed on the next page]

22 The Outdoor Table shown below is made of cypress wood. Cypress is a beautiful solid wood that can be stained in different colors. It has a fine grain character that shows off the beauty of wood while retaining a smooth texture.

The table shows the mass, m (*grams*), of cypress wood and its corresponding volume, v (cm^3).

Mass (m grams)	51	102	153
Volume (v cm^3)	100	200	300

(a) Determine, with working, whether m and v are in direct proportion. [2]

(b) Find the equation connecting m and v. [1]

The price list of the cypress wood planks is given by the table below.

		Length of wood planks	
		180 cm	240 cm
Cross-sectional area of wood planks	2.5 cm × 10 cm	\$5.40	\$6.52
	2.5 cm × 20 cm	\$8.80	\$11.06

The Outdoor Table is made up of eight (2.5 cm × 10 cm × 18[redacted] cm) cypress wood planks and four (2.5 cm × 20 cm × 240 cm) cypress wood planks.

(c) Determine the total volume, in cm^3, of cypress wood used for the Outdoor Table. [2]

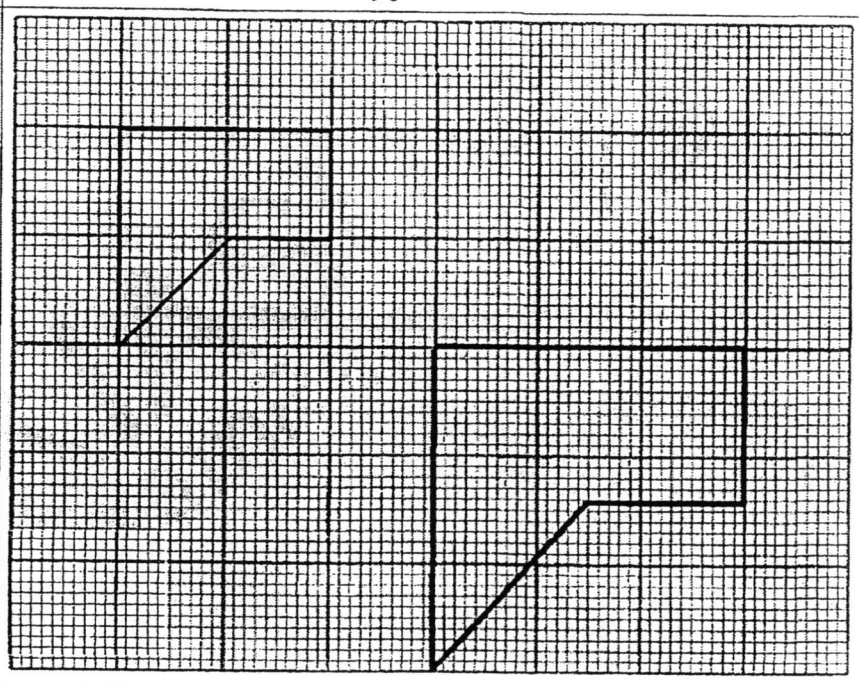
(d) If oak wood cost \$1.75 per 1000 cm^3, determine which type of wood is cheaper for making the Outdoor Table? [3]

--- End of Section B ---

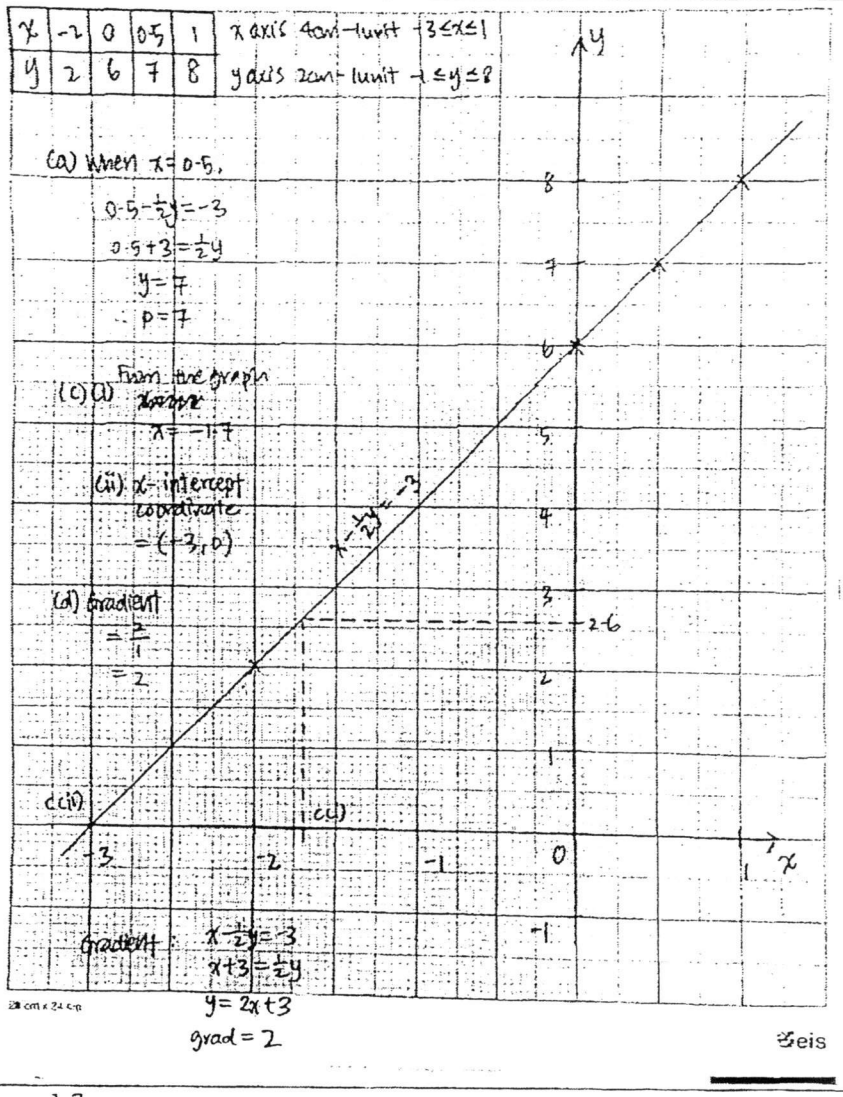
2016 Mid-Year Exam Sec 2 Express Maths Marking Scheme

Section A [60 marks]		
1	(a)	$\frac{7}{3}x \geq 28$ $x \geq 12$
	(b)	13
2	(a)	$2m(m^2-36)$ $2m(m+6)(m-6)$
	(b)	$\frac{1}{5}a^2-\frac{2}{5}a-3+\frac{3}{7}a$ $\frac{1}{5}a^2+\frac{1}{35}a-3$
3		$3(2x+1)=7(x-2)$ or $\frac{3(2x+1)-7(x-2)}{(2x+1)(x+2)}=0$ $6x+3=7x-14$ $x=17$
4	(a)	$8=\frac{k}{n^2}$ $m=\frac{8}{9}$
	(b)	$\frac{8-\frac{8}{9}}{8}\times 100\%$ $=-88\frac{8}{9}\%$ *Alt. method* $\frac{\frac{1}{9}\left(\frac{k}{n^2}\right)-\frac{k}{n^2}}{\frac{k}{n^2}}\times 100\%$ $=-88\frac{8}{9}\%$
5	(a)	$\angle ABX=\frac{8}{25}(125)=40°$ $\angle ABY=180°-40°=140°$ (adj. ∠s on a str. line)
	(b)	$\angle BAX=110°$ (corresp. ∠s, AB // ZY) $\angle AXB=180°-110°-40°=30°$ (∠sum of ΔAXB)
	(c)	ΔABX and ΔZYX
6	(a)	$p=\angle W=\angle E=65°$ $q=\angle G=\angle Y=120°$
	(b)	$\frac{EF}{WX}=\frac{6}{3}=2$

	(c)	$\frac{WZ}{EH}=\frac{1}{2}$ $WZ = 4.3$ cm
7	(a)	$8v^2 + 6v + 3v^2 + 36v - 9$ $= 11v^2 + 42v - 9$
	(b)	$11(5)^2 + 42(5) - 9 = 476$ km
8	(a)	$(x+y)(x-y)=28$ $(x+y)=7$ $(x+y)^2=49$
	(b)	$\frac{(x+3)^2}{(x+3)(x+1)}\times\frac{x+1}{3(x+3)}$ $=\frac{1}{3}$
9	(a)	$A(4, 2)$ $B(4, 4)$
	(b)	Area of ΔAOB $=\frac{1}{2}(4)(4)-\frac{1}{2}(4)(2)$ $= 4$ units² *Alt. method* $AB = 2$ Area $=\frac{1}{2}(2)(4) = 4$ units²
10	(a)	$a(p-x^2)=3kx^2$ $(a+3k)x^2=ap$ $x=\pm\sqrt{\frac{ap}{a+3k}}$
	(b)	$x=\pm\sqrt{\frac{(3)(2)}{(3)+3(1)}}$ $x=\pm1$
11		*Figure A* and *D*
12	(a)	$x = 6$ cm
	(b)	$y = 27°$
	(c)	$z = 180° - 27° - 68°$ $z = 85$
13	(a)	$5x(2x-y)-2p(2x-y)$ $=(2x-y)(5x-2p)$
	(b)	$\frac{3x(2x-y)}{(2x-y)(5x-2p)}$ $=\frac{3x}{5x-2p}$

14	(a)	X X X X X X X X X X X X X X X X X X X X X X X X X
	(b)	Pattern number $n = n^2$
	(c)	$\sqrt{322} = 17.9$ is <u>not a square number</u>. <u>Not possible</u> to have a pattern with 322 squares.
15	(a)	$x = 360° - 96° - 54° - 90° = 120°$
	(b)	$\frac{54}{360} = \frac{3}{20}$
	(c)	Total number of staff $= 360 \times \frac{15}{90} = 60$
16		
Section B [40 marks]		
17	(a)	$(4b+1)(b+3)$
	(b)	41303 $= 4b^2 + 13b + 3$ By observation, $b = 100$ The 2 factors are 401 & 103.
18	(a)	2 cm : 150000 cm = 1 : 75000 <u>*Alt. method*</u> 1 cm : 750 m = 1 : 75000

	(b)	Map perimeter = $1.125 \times \frac{2}{1.5}$ =1.5 cm
	(c)	Area scale of Map A = 1 cm² : 0.5625 km² Actual area of shopping mall = 4 (0.5625) = 2.25 km² Area scale of Map B = 1 cm : 0.09 km² Map area of shopping mall on Map B = 2.25 / 0.09 = 25 cm²
19	(a)	$2c + d + 80 = 180$ or $2c + d = 100$ --- (1) $3c + d + 100 + 129 = 360$ or $3c + d = 131$ --- (2)
	(b)	Eq (2) – Eq (1) : or Substitution method (show the substituted equation $c = 31$ $d = 38$
20	(a)(i)	$\frac{(2p-1)(p-1) - p(5-3p)}{p(p-1)(p-2)}$ $= \frac{2p^2 - 2p - p + 1 - 5p + 3p^2}{p(p-1)(p-2)}$ $= \frac{5p^2 - 8p + 1}{p(p-1)(p-2)}$ *Alt. method* $\frac{(2p-1)(p-1)}{p(p-1)(p-2)} - \frac{p(5-3p)}{p(p-1)(p-2)}$ common denominator $\frac{2p^2 - 2p - p + 1}{p(p-1)(p-2)} - \frac{5p - 3p^2}{p(p-1)(p-2)}$ expansion
	(a)(ii)	$\frac{5p^2 - 8p + 1}{p(p-1)(p-2)} = \frac{5p^2}{p(p-1)(p-2)}$ $5p^2 - 8p + 1 = 5p^2$ $-8p + 1 = 0$ $p = \frac{1}{8}$
	(b)	$4(2x - 3y) = 3(x - y)$ $8x - 12y = 3x - 3y$ $5x = 9y$ $\frac{5x}{3y} = 3$
21	(a)	$p = 7$

	(b)	
	(c)(i)	$x = -1.7$
	(c)(ii)	Co-ordinate of x-intercept = (–3, 0)
	(d)	Gradient = 2
22	(a)	$\frac{m}{v} = \frac{51}{100} = \frac{102}{200} = \frac{153}{300} = 0.51$ Since $\frac{m}{v}$ is a constant, m and v are in direct proportion.
	(b)	$m = 0.51v$ or $m = \frac{51}{100}v$ or $v = 1\frac{49}{51}m$ or $v = \frac{100}{51}m$
	(c)	Total volume = 8 (2.5)(10)(180) + 4 (2.5)(20)(240) = 84000 cm^3
	(d)	Total cost = 8 (\$5.40) + 4 (\$11.06) = \$87.44 Price of cypress per 1000 cm^3 = \$87.44 / 84 = \$1.04 (3s.f.)

		Alt. method Total cost of oak wood = \$1.75 × 84 = \$147 Cypress wood is cheaper for making the Outdoor Table.