8

CHIJ ST. THERESA'S CONVENT

MID-YEAR EXAMINATION 2016

SECONDARY 2 EXPRESS

CANDIDATE NAME			
CLASS		INDEX NUMBER	

MATHEMATICS

Paper 1

12 May 2016

1 hour 15 minutes

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

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 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 answers in terms of π.

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 50.

This document consists of **11** printed pages.

Answer **all** the questions.

1 **(a)** Calculate $\dfrac{8.37^2}{2.68+4.33}$.

Write down the first five digits on your calculator display.

Answer ..... [1]

(b) Write your answer to part **(a)** correct to 1 significant figure.

Answer ..... [1]

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2 Factorise completely $x^4 - 5x^3 + 6x^2$.

Answer ..... [2]

---

3 Solve the simultaneous equations

$$21x + 28y - 36 = 0,$$
$$15x + 52 = 14y.$$

Answer $x =$ .....

$y =$ ..... [2]

---

4 The scale of a map is 5 cm : 2 km.

(a) Write this scale in the form 1 : n.

Answer 1 : ..... [1]

(b) The actual area of a park is 24.7 km^2.
Find the area, in square centimetres, of the park on the map.

Answer ..... cm^2 [2]

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5 **(a)** Factorise fully $24x^2 - 6xy + 16x - 4y$.

Answer ..... [2]

(b) Hence, simplify $\frac{24x^2 - 6xy + 16x - 4y}{4x(3x+2)^3} \times \frac{3x+2}{4(x-y)}$.

Answer ..... [1]

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6 **(a)** Simplify $7x(2x-3) - 11x(-1-2x) - 8(9-2x)$.

Answer ..... [2]

(b) Factorise fully your answer to part **(a)**.

Answer ..... [2]

---

7 Solve the equation $(2x-1)(2x+3)=4x-(2x+1)(x+8)$.

Answer ..... [4]

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8 **(a)** Given that $x^2-y^2=7$ and $x+y=7$. Find $5xy$.

Answer ..... [3]

(b) **Without using a calculator**, evaluate 207^2.

Answer ..... [2]

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9 The figures below are formed by identical squares.

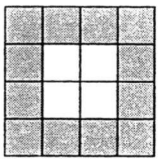


Figure 1

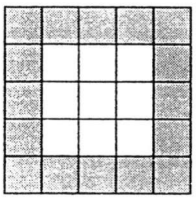


Figure 2

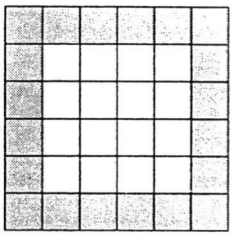


Figure 3

The following table records the number of squares on each side, unshaded squares and shaded squares.

Figure	1	2	3	...	n
Number of squares on each side	4	5	6	...	x
Number of unshaded squares	4	9	16	...	y
Number of shaded squares	12	16	20	...	z

(a) Write down, in terms of n, a formula for x, y and z.

Answer $x =$ .....

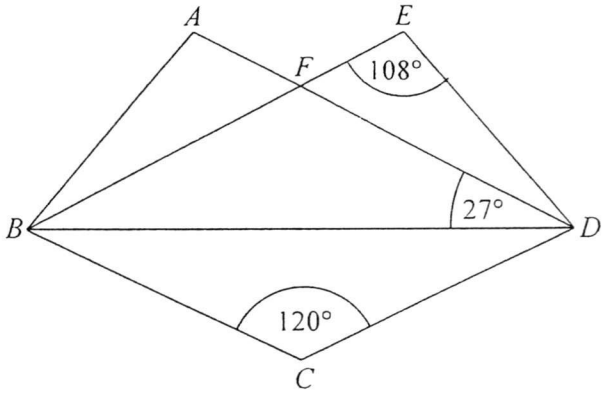
$y =$ .....

$z =$ ..... [3]

(b) Find the number of unshaded squares for the figure with 480 shaded squares.

Answer ..... [2]

10 In the diagram, quadrilaterals $ABCD$ and $EDCB$ are congruent.
Angle $BED = 108°$, angle $FDB = 27°$ and angle $BCD = 120°$.



Find

(a) angle EBD,

Answer ..... ° [1]

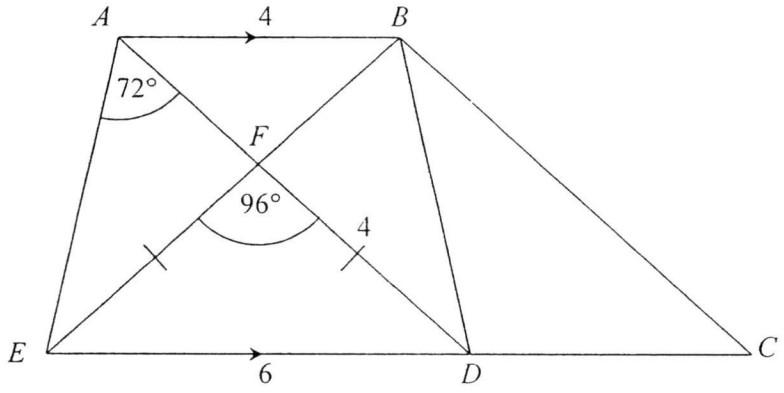
(b) angle AFB,

Answer ..... ° [2]

(c) angle ABC.

Answer ..... ° [2]

11 In the diagram, AB is parallel to EC, AD and EB meets at F, $AB = 4$ cm, $ED = 6$ cm, $EF = DF = 4$ cm, angle $EAD = 72°$ and angle $EFD = 96°$.



Given that triangles AFE and BFD are congruent, and triangles ABF and DEF are similar.

(a) Find

(i) angle BDF,

Answer ..... ° [2]

(ii) angle BAF,

Answer ..... ° [2]

(iii) BE.

Answer ..... cm [2]

(b) Given that $ABCD$ is a parallelogram, explain why triangle ABD is congruent to triangle CDB.

Answer .....

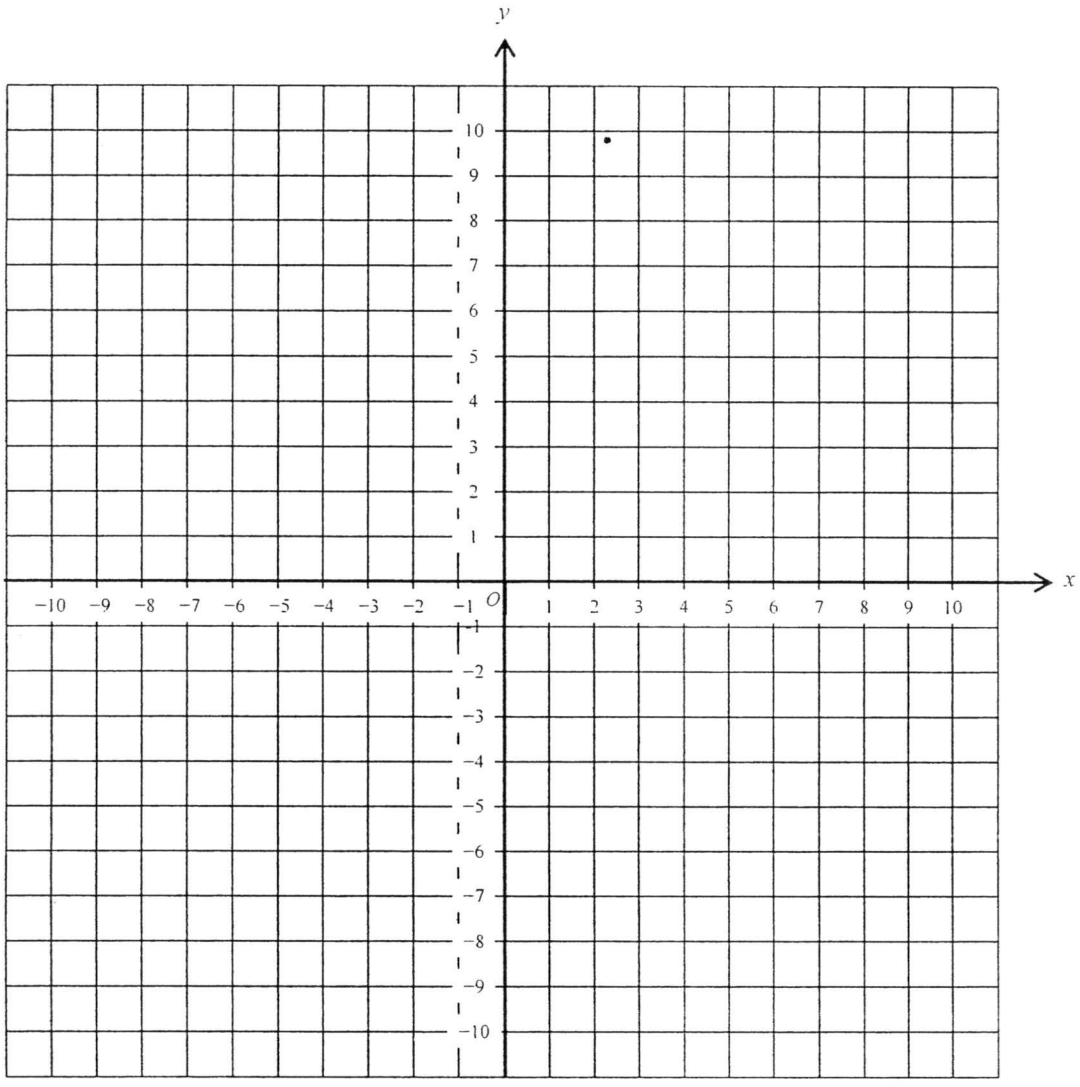
.....

.....

.....

..... [1]

12 **(a)** On the grid draw and label the graphs of $5x - 2y = 4$ and $3x + 2y = 12$.



[4]

(b) **Use your graph** to write down the solutions of the simultaneous equations

$$5x - 2y = 4,$$
$$3x + 2y = 12.$$

Answer $x =$ .....

$y =$ ..... [1]

(c) **(i)** On the same grid draw the graph of $y = \frac{5}{2}x$. [1]

(ii) Is there any solution for the simultaneous equations

$$5x - 2y = 4,$$

$$y = \frac{5}{2}x?$$

Answer ..... [1]

(iii) Justify your answer to **(c)(ii)**.

Answer .....

.....

..... [1]

~~~ End of Paper 1 ~~~
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Answer **all** the questions.

1 **(a)** Expand and simplify $6x^2 + 9 - (4x - 3)^2$. [2]

(b) **(i)** Factorise completely $20x^2 - 5$. [2]

(ii) Simplify $\dfrac{20x^2 - 5}{2x^2 - 9x + 4}$. [2]

(c) It is given that $s = T\sqrt{\dfrac{s+1}{x}}$.

(i) Find T when $s = 15$ and $x = \dfrac{1}{4}$. [1]

(ii) Express x in terms of s and T. [2]

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2 Sam cycles for $60(x-1)$ minutes at a speed of $(2x+5)$ km/h.
He then jogs for 30 minutes at a speed of $x(x+1)$ km/h.
He covered a total distance of 75 km.

(a) Write down an expression, in terms of x, for the distance he cycled. [1]

(b) Write down an expression, in terms of x, for the distance he jogged. [1]

(c) Form an equation in x and show that it reduces to

$$5x^2 + 7x - 160 = 0.$$ [3]

(d) Solve the equation $5x^2 + 7x - 160 = 0$. [2]

(e) Hence, find his **average** speed, in km/h, for his whole journey. [2]

---

3 **(a)** Simplify $\frac{16x^2}{2y^4} \div \frac{2x}{4y^3}$. [2]

(b) Solve the equation $15t^2 = 6t$. [2]

(c) Express as a single fraction in its simplest form.

(i) $\frac{7x}{(x+1)^2} + \frac{3x+1}{x+1}$ [2]

(ii) $\frac{3}{7-x} - \frac{2}{3-2x}$ [2]

---

4 **(a)** The sum of the digits of a two-digit number is 7.
A new number is formed by reversing the order of the digits of the two-digit number.
When the two-digit number is subtracted from the new number, the difference is 9.

(i) The digit in the tens place is x and the digit in the ones place is y.
Using the information, write down two equations in x and y. [2]

(ii) Solve these two equations to find the original number. [2]

(b) Solve the equation $\frac{x+2}{4} - 1 = \frac{3x-1}{6}$. [3]

---

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

A ball was thrown from the top of a vertical building.
The height, h metres, of the ball above the top of the building t seconds after it is released can be modelled by the equation $h = 10t - t^2$.

Some corresponding values of t and h are given in the following table.

t	0	2	4	6	8	10	12
h	p	16	24	24	16	0	q

(a) Calculate the value of p and of q. [2]

(b) Using a scale of 2 cm to represent 1 second, draw a horizontal t-axis for $0 \leq t \leq 10$.
Using a scale of 2 cm to represent 5 metres, draw a vertical h-axis for $-24 \leq h \leq 24$.
On your axes, plot the points given in the table and join them with a smooth curve. [3]

(c) Use your graph to find the greatest height reached by the ball. [1]

(d) State the equation of the line of symmetry of the graph. [1]

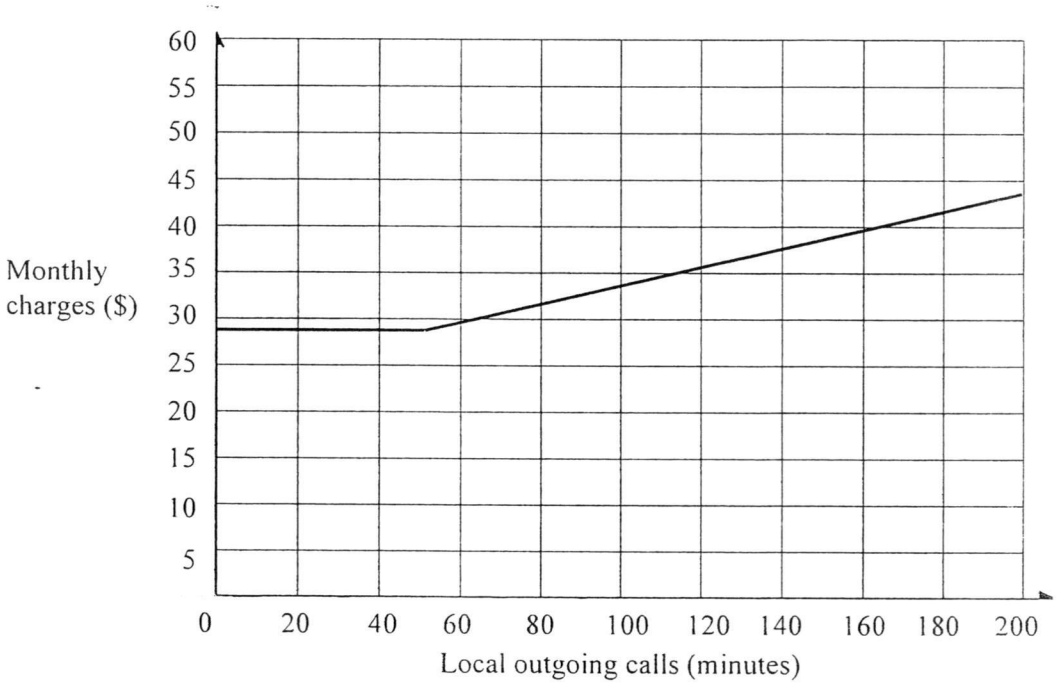
(e) **(i)** On the same axes, draw $h = 2t + 3$ for $0 \leq t \leq 10$. [2]

(ii) Write down the t-coordinate of the point(s) where this line intersects the curve. [1]

Name : .....( ) Class : Sec .....

6 A telecommunication company offers the following two mobile phone plans to its customer with all day free incoming calls.

Plan	SaveSurf	ValueSurf
Monthly subscription	\$28	\$32
Free outgoing call (in minutes)	50	120
Local talk time (exceeding free outgoing call minutes)	10 cents per minute	



(a) The graph above shows the monthly charges for Mr Tan's January phone bill using SaveSurf. Explain why the graph from X to Y is horizontal. [2]

(b) **(i)** Find the monthly charge for making 200 local outgoing calls (in minutes) under the ValueSurf plan. [1]

(ii) Plot the graph for ValueSurf plan on the same axes. [2]

(c) If you make a total of 500 minutes of local calls per month, which is a more expensive plan? Explain how your answer by referring to the two graphs only. [2]

End of Paper 2
Please check your work carefully.

CHIJ St. Theresa's Convent
Mathematics
2 Express SA1 Paper 1

Marking Scheme

1	(a)	9.9938	B1	
	(b)	10	B1	
2		$x^2(x^2-5x+6)$ or $(x^2-3x)(x^2-2x)$ $x^2(x-3)(x-2)$	B1 B1	
3		Solve using elimination or substitution method. $x=-1\frac{1}{3}$, $y=2\frac{2}{7}$	M1 A1	
4	(a)	1 : 40 000	B1	
	(b)	Area scale $=(1\text{ cm})^2:(0.4\text{ km})^2$ $=1\text{ cm}^2:0.16\text{ km}^2$ 154.375 cm^2 or $154\frac{3}{8}$	M1 A1	
5	(a)	$2[4x(3x+2)-y(3x+2)]$ OR $6x(4x-y)+4(4x-y)$ $2(3x+2)(4x-y)$	M1 A1	M1 for factorisation by grouping shown.
	(b)	$\frac{4x-y}{8x(3x+2)(x-y)}$	B1	No marks awarded if part (a) not used.
6	(a)	$14x^2-21x+11x+22x^2-72+16x$ $36x^2+6x-72$	M1 A1	M1 for expansion shown.
	(b)	$6(6x^2+x-12)$ $6(2x+3)(3x-4)$	M1 A1	M1 for factorisation shown.
7		$4x^2+4x-3=4x-2x^2-17x-8$ $6x^2+17x+5=0$ $(3x+1)(2x+5)=0$ $x=-\frac{1}{3}$ or $x=-2\frac{1}{2}$	M1 A1 M1 A1	M1 for expansion. M1 for factorisation.

8	(a)	$x^2 - y^2 = 7$ $(x+y)(x-y) = 7$ $(7)(x-y) = 7$ $x - y = 1$ $x^2 - 2xy + y^2 = 1$ ----- (1) $x^2 + 2xy + y^2 = 49$ ----- (2) (2) – (1): $4xy = 48$ $5xy = 60$	B1 M1 A1	M1 for using simultaneous equations to find $4xy$.
	(b)	$(200+7)^2$ $200^2 + 2(200)(7) + 7^2$ 42 849	M1 A1	
9	(a)	$x = n + 3$ $y = (n+1)^2$ $z = 4(n+2)$ or $z = 4n + 8$	B1 B1 B1	
	(b)	$n = 118$ 14 161	B1 B1	
10	(a)	27 -	B1	
	(b)	$\angle BFD$ $= 180° - 2(27°)$ $= 126°$ 54°	M1 A1	
	(c)	$\angle DBC = 30°$ and $\angle ABF = 18°$ 75°	M1 A1	

11	(a)(i)	$\angle BFD = 180° - 96°$ $= 84°$ 24°	M1 A1	
	(a)(ii)	$\angle FDE = (180° - 96°) \div 2$ $= 42°$ 42°	M1 A1	
	(a)(iii)	$BF = 2\frac{2}{3}$ $6\frac{2}{3}$ or 6.67	B1 DB1	
	(b)	$AB = CD$ (opp side of parallelogram) $AD = CB$ (opp side of parallelogram) $BD = DB$ (same side) OR All **corresponding** sides are equal	B1	
12	(a)	At least 3 points plotted correctly for each graph. Straight line passing through all points.	P1, P1 C1, C1	
	(b)	$x = 2$ $y = 3$	B1	
	(c)(i)	Graph plotted correctly.	P1	
	(c)(ii)	No	B1	
	(c)(iii)	The two lines are parallel, therefore they do not intersect.	B1	

2016 Secondary Two Express SA1 Paper 2

Answer Scheme

S/N	Solution	Marker's Report
1a)	$6x^2+9-(4x-3)^2$ $=6x^2+9-(16x^2-24x+9)$ ---------M1 $=6x^2+9-16x^2+24x-9$ $=-10x^2+24x$ ------B1	Common misconception: $(4x-3)^2=16x^2-9$
1b)i)	$20x^2-5$ $=5(4x^2-1)$ ----------M1 $=5(2x-1)(2x+1)$ ----------A1 1 mark for $(10x-5)(2x+1)$ or $(10x+5)(2x-1)$	Many students did not factorise fully. Students get this wrong when they did not factorise fully in part (i)
1b)ii)	$\frac{20x^2-5}{2x^2-9x+4}$ $=\frac{5(2x-1)(2x+1)}{(2x-1)(x-4)}$ ----------M1 $=\frac{5(2x+1)}{(x-4)}$ ----------A1 Or $=\frac{10x+5}{(x-4)}$	Badly done question.
1c)i)	$s=T\sqrt{\frac{s+1}{x}}$ $15=T\sqrt{\frac{15+1}{\frac{1}{4}}}$ $T=\frac{15}{8}$ accept $1\frac{7}{8}$ or 1.875 -------B1	
1c)ii)	$s=T\sqrt{\frac{s+1}{x}}$ $\frac{s^2}{T^2}=\frac{s+1}{x}$ -------M1 $x=\frac{(s+1)T^2}{s^2}$ -------M1	A few students did not square both sides completely. No mark is awarded if students leave a fraction within a fraction.

2a)	the distance he cycled $= \frac{60(x-1)}{60} \times (2x+5)$ $= (x-1)(2x+5)$ Or $= 2x^2 + 3x - 5$ -------B1	Badly done question where many students did not convert minute to hour. No mark is awarded if student did not simplify the fraction.
2b)	The distance he jogged $= \frac{30}{60} \times x(x+1)$ $= \frac{1}{2}x(x+1)$ Or $= \frac{1}{2}x^2 + \frac{1}{2}x$ ------B1	
2c)	$2x^2 + 3x - 5 + \frac{1}{2}x^2 + \frac{1}{2}x = 75$ --------M1 $4x^2 + 6x - 10 + x^2 + x = 150$ ------M1 $5x^2 + 7x - 160 = 0$-------A1	
2d)	$5x^2 + 7x - 160 = 0$ $(5x - 32)(x - 5) = 0$ ----------M1 $x = -\frac{32}{5}$ or $x = 5$ --------A1 $x = -6\frac{2}{5}$ or $x = -6.4$	Many students went to reject the negative values of x.
2e)	Total time $= = \frac{60(x-1)}{60} + \frac{30}{60}$ $= \frac{60(5-1)}{60} + \frac{30}{60}$ $= 4\frac{1}{2}$ hour Average speed = total distance/total time $= \frac{75}{4.5}$ ----------M1 $= 16\frac{2}{3}$ km/hour ----------A1 Or $= 16.7$ km/hour	

3a)	$\frac{16x^2}{2y^4} \div \frac{2x}{4y^3}$ $= \frac{8x^2}{y^4} \div \frac{x}{2y^3}$ $= \frac{8x^2}{y^4} \times \frac{2y^3}{x}$ or $\frac{16x^2}{2y^4} \times \frac{4y^3}{2x}$ or better -------M1 $= \frac{16x}{y}$ ------B2	Well done question.
3b)	$15t^2 = 6t$ $15t^2 - 6t = 0$ $3t(5t-2) = 0$ ----------M1 $t = 0$ or $t = \frac{2}{5}$ ---------A1 or $t = 0.4$	Many students did not give $t = 0$.
3c)i)	$\frac{7x}{(x+1)^2} + \frac{3x+1}{x+1}$ $= \frac{7x + (3x+1)(x+1)}{(x+1)^2}$ ---------M1 $= \frac{7x + 3x^2 + 3x + x + 1}{(x+1)^2}$ $= \frac{3x^2 + 11x + 1}{(x+1)^2}$ --------A1	Misconception: $\frac{7x}{(x+1)^2} + \frac{(3x+1)^2}{(x+1)^2}$ Or $= \frac{7x + 3x + 1(x+1)}{(x+1)^2}$
3c)ii)	$\frac{3}{7-x} - \frac{2}{3-2x}$ $= \frac{3(3-2x) - 2(7-x)}{(7-x)(3-2x)}$ ----------M1 $= \frac{9 - 6x - 14 + 2x}{(7-x)(3-2x)}$ $= \frac{-4x - 5}{(7-x)(3-2x)}$ ----------A1 or $= \frac{4x+5}{(x-7)(3-2x)}$	1 mark is awarded for: $\frac{9-6x}{(7-x)(3-2x)} - \frac{14-2x}{(7-x)(3-2x)}$ Many students gave $\frac{9-6x-14-2x}{(7-x)(3-2x)}$

4a)i)	Let the first digit be x and the second digit be y. The number will be $(10x + y)$. $x + y = 7$ ----------B1 $(10y + x) - (10x + y) = 9$ ----------B1 Or $9y - 9x = 9$	Badly done question where students could not identify that the original number is $(10x + y)$. Most students could give $x + y = 7$. Misconception: $yx + xy = 9$ Example: $24 = 2 \times 10 - 4$
4a)ii)	Solve using either substitution or elimination method ---------M1 $x = 3, y = 4$ The number is 34. ----------A1	1 mark is given for giving the final 34 using guess-and-check method.
4b)	$\frac{x+2-4}{4} = \frac{3x-1}{6}$ $6x - 12 = 12x - 4$ ---------M1 $-8 = 6x$ ---------M1 $x = -1\frac{1}{3}$ ---------A1 Or $x = -\frac{4}{3}$	Misconception: $4\left(\frac{3x-1}{6}\right) = \frac{12x-4}{24}$
5)a)	$p = 0$ -----B1 $q = -24$ -----B1	Well done graph question.
5b) 5c)	Draw axes and plot all given points [*P2*]. Allow P1 if not more than 3 errors. Draw smooth curve through all plotted points [*C1*].	
5d)	$h = 25(\pm 0.5)$ -----B1 $t = 5$ -----B1	Many students gave answer as $x = 5$.
5e)i)	Draw the correct straight line. $h = 2t + 3$.----B1 *Line ends within* $0 \le t \le 10$ ----B1	Many students did not extend the straight line fully to ends within the required range. $0 \le x \le 10$
5e)ii)	$t = 0.4$ or $t = 7.6$ ----B1	Many students give the coordinate instead of just the t-coordinate.
6a)	No charge for the first 50 minutes as ---------B1	Many students did not give the key

	(or free 50 min which is already paid) it in included in the monthly subscription ------- B1	point in their explanation.
6bi)	$(80 \times 0.10) + 32 = \$40$ -------B1	Well done question.
6bii)	Horizontal line joining (0 , 32) to (120 , 32) -------B1 Line joining (120 , 32) to (200 , 40) -------B1	
6c)	SaveSurf------B1 Explanation for the meaning of point of interaction; Reason why the line is above etc. ------B1 No mark if students do not make reference to the graphs.	Many students use calculation method to obtain the final answer.