14

Name:_____ ( )	Class:_____

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40m

*GREENDALE SECONDARY SCHOOL
Mid-Year Examination 2016

MATHEMATICS **4048/01**

Paper 1 09 May 2016

Secondary Two Express **1 hour**

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 or blue 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** questions.

If working is needed for any question it must be shown with the answer.
Omission of essential working may result in loss of marks.
You are expected to use a scientific calculator to evaluate explicit numerical expressions.
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 required the answer in terms of π.

At the end of the examination, fasten all your work securely together.
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 **40**.

Question	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13
Strand	N	N	N	N	A	A	A	S	S	N	N	A	A
Marks													

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Mathematical Formulae

Compound interest

$$\text{Total amount} = P\left(1 + \frac{r}{100}\right)^n$$

Mensuration

Curve surface area of a cone $= \pi rl$

Surface area of a sphere $= 4\pi r^2$

$$\text{Volume of a cone} = \frac{1}{3}\pi r^2 h$$

$$\text{Volume of a sphere} = \frac{4}{3}\pi r^3$$

$$\text{Area of triangle } ABC = \frac{1}{2}ab\sin C$$

Arc length $= r\theta$, where θ is in radians

$$\text{Sector area} = \frac{1}{2}r^2\theta, \text{ where } \theta \text{ is in radians}$$

Trigonometry

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

Statistics

$$\text{Mean} = \frac{\sum fx}{\sum f}$$

$$\text{Standard deviation} = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f}\right)^2}$$

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Answer **all** questions.

1. Evaluate $\dfrac{\pi + (-0.345)^2}{\frac{7}{11}\sqrt{2\frac{1}{2}}}$, giving your answers to

(a) to 3 decimal places.

Ans: (a) _____ [1]

(b) to 3 significant figures.

Ans: (b) _____ [1]

2. A map is drawn to a scale of 1 cm to 5 km.

Find

(a) the area of the pond on the map in cm^2, if the area of a pond is 50 km^2

Ans: (a) _____ cm^2 [1]

(b) the actual diameter of the pond, in m, if its diameter on the map is 2.6 cm.

Ans: (b) _____ cm [1]

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3. The value of a house increased by 13.2% between 2006 to 2010, and decreased by 15% between 2011 to 2015.
Given that the value of the house in 2006 is \$785 000, find its value in 2015, leaving your answer to the nearest dollar.

Ans: \$_____ [2]

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4. Written as the product of its prime factors, $162 = 2 \times 3^4$.

(a) Express 98 as the product of its prime factors,

Ans: (a) 98 = _____ [1]

(b) **Using the results above**, find

(i) the HCF of 162 and 98,

Ans: (bi) _____ [1]

(ii) $\sqrt{15876}$, giving your answer as the product of its prime factors.

Ans: (bii) _____ [1]

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5. Solve the equations

(a) $\frac{3}{4}x - 6x = 21$.

Ans: (a) $x =$ _____ [1]

(b) $\frac{3}{2x+5} = \frac{4}{1-3x}$.

Ans: (b) $x =$ _____ [2]

6. Simplify the following algebraic expressions.

(a) $\frac{1}{12ab} \div \frac{3}{4a^2}$,

Ans: (a) _____ [1]

(b) $\frac{3x^2 - 12}{x^2 + 2x}$.

Ans: (b) _____ [2]

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7. Given that $z = \dfrac{xt^2}{u - t^2}$, and $t < 0$.

(a) If $x = 2$, $t = -10$, $u = 140$, calculate the value of z.

Ans: (a) $z =$_____ [1]

(b) Make t the subject of the formula.

Ans: (b) $t =$_____ [2]

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8. The stem-and-leaf diagram shows the amount of money that people spent on lunch from a survey.

Stem	Leaf
3	2 5 6 6
4	3 3
5	1 4 8 9
6	0 0 2 2 4 4 8
7	0 1
8	1

Key: 3 | 2 means $3.20

Find

(a) the greatest amount of money spent on lunch,

Ans: (a) $_____ [1]

(b) the number of people surveyed,

Ans: (b) _____people [1]

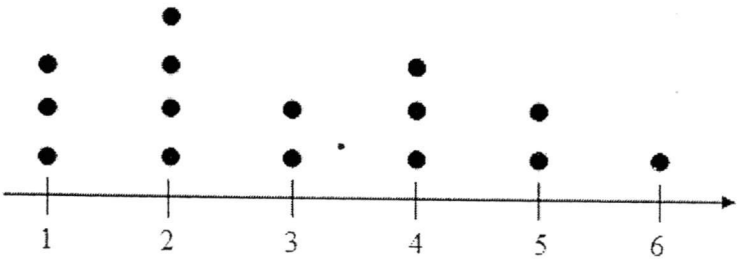
(c) the fraction of the number of people who spent less than $4 on lunch.

Ans: (c) _____ [1]

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9. The dot diagram below represents the number of hours spent on playing computer games by 15 students.



Number of hours

(a) Write down the modal number of hours spent on playing computer games.

Ans: (a) _____ hours [1]

(b) Find the median number of hours spent on playing computer games.

Ans: (b) _____ hours [1]

(c) Another 2 students are surveyed. The median remains unchanged. Given that one of them spends 1 hour on computer games, find the number of hours the other student spends on playing computer games.

Ans: (c) _____ hours [1]

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10. Calculate the speed taken for an insect to walk 450 cm in $1\frac{1}{2}$ minutes, giving your answer in metres per second.

Ans: (b) _____ m/s [3]

11. y is inversely proportional to $\sqrt{x}$ and $y = 5$ when $x = 4$.

(a) Find the equation relating x and y.

Ans: (a) _____ [2]

(b) (i) Find the value of y when $x = 169$.

Ans: (b)(i) $y =$_____ [1]

(ii) Find the value of x when $y = 0.1$.

Ans: (b)(ii) $x =$_____ [1]

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12. When k is a positive integer, $2k+1$ is an odd integer.

Find and simplify an expression for the difference between the squares of $2k+1$ and the next odd integer greater than $2k+1$.

Ans: _____ [4]

13. Factorise completely

(a) $2a^3b-6ab^2$,

Ans: (a) _____ [2]

(b) $\left(b^2-c^2\right)-bc\left(b-c\right)$.

Ans: (b) _____ [3]

End of Paper

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Mark Allocation

1(a)	3.241 (3dp)	B1
1(b)	3.24 (3 sf)	B1
2(a)	*map* : *actual* 1 *cm* : 5 *km* 1 cm^2 : 25 km^2 2 cm^2 : 50km^2 The map area is 2 cm^2.	B1 (2 cm^2)
2(b)	*map* : *actual* 1 *cm* : 5 *km* 2.6 *cm* : 5000 × 2.6 = 13 000 *m* The actual distance is 13 000m.	B1 (13 000 m)
3	Value of house in 2010 = 113.2% × \$785000 = \$888 620 Value of house in 2015 = 85% × \$888 620 = \$755 327	M1 A1
4(a)	$98 = 2 \times 7^2$	B1
4(b)	HCF = 2	B1
4(c)	$\sqrt{15876}$ $= \sqrt{162 \times 98}$ $= \sqrt{(2 \times 3^4) \times (2 \times 7^2)}$ $= 2 \times 3^2 \times 7$	B1
5(a)	$\frac{3}{4}x - 6x = 21$ $-\frac{21}{4}x = 21$ $x = -4$	B1

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5(b)	$\frac{3}{2x+5} = \frac{4}{1-3x}$ $3(1-3x) = 4(2x+5)$ $3-9x = 8x+20$ $-17 = 17x$ $x = -1$	M1 *(for cross-multiplying)* A1
6(a)	$\frac{1}{12ab} \div \frac{3}{4a^2}$ $= \frac{1}{12ab} \times \frac{4a^2}{3}$ $= \frac{a}{9b}$	B1
6(b)	$\frac{3x^2-12}{x^2+2x}$ $= \frac{3(x^2-4)}{x(x+2)}$ $= \frac{3(x-2)}{x}$	M1 (for factorising the numerator & denominator correctly) A1
7(a)	$z = \frac{2(-10)^2}{140-(-10)^2}$ $= \frac{200}{40}$ $= 5$	B1
7(b)	$z(u-t^2) = t^2x$ $uz - zt^2 = xt^2$ $uz = xt^2 + zt^2$ $uz = (x+z)t^2$ $t^2 = \frac{uz}{x+z}$ $t = \pm\sqrt{\frac{uz}{x+z}}$ $\therefore t = -\sqrt{\frac{uz}{x+z}}$	M1 *(for step showing either expansion or factorisation)* A1

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8(a)	\$8.10	B1
8(b)	20 people	B1
8(c)	$\frac{1}{5}$	B1
9 (a)	Mode = 2 hours	B1
9(b)	Median = 3 hours	B1
9(c)	$x \geq 3$	B1
10	$speed = \frac{450\ cm}{1\frac{1}{2}\ \text{min}}$ $= \frac{4.5\ m}{90s}$ $= 0.05\ m/s \quad or \quad \frac{1}{20}\ m/s$	M1 (for 4.5m) M1 (for 90s) A1
11(a)	$y = \frac{k}{\sqrt{x}}$ $5 = \frac{k}{\sqrt{4}}$ $5 = \frac{k}{2}$ $k = 10$ $\therefore y = \frac{10}{\sqrt{x}}$	M1 (for $k = 10$) A1
11(b)	$y = \frac{10}{\sqrt{169}}$ $= \frac{10}{13} \quad or \quad 0.769\ (3sf)$	B1
11(c)	$0.1 = \frac{10}{\sqrt{x}}$ $\sqrt{x} = \frac{10}{0.1}$ $x = 10\ 000$	B1

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12	$(2k+3)^2-(2k+1)^2$ $=4k^2+12k+9-4k^2-4k-1$ $=8k+8$ $=8(k+1)$	B1 (for $2k+3$) M1 (for $4k^2+12k+9$) M1 (for $4k^2+4k+1$ A1 (for $8(k+1)$ / $8k+8$
13(a)	$2a^3b-6ab^2$ $=2ab(a^2-3b)$	B1 (for $2ab$) B1 (for a^2-3b)
13(b)	$(b^2-c^2)-bc(b-c)$ $=(b+c)(b-c)-bc(b-c)$ $=(b-c)(b+c-bc)$	M1 (for $(b+c)(b-c)$ A1 for $b-c$ A1 for $(b+c-bc)$

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GREENDALE SECONDARY SCHOOL
Mid-Year Examination 2016

MATHEMATICS **4048/02**

Paper 2 03 May 2016

Secondary Two Express **1 hour 30 minutes**

Candidates answer on the Writing Paper and graph paper.

READ THESE INSTRUCTIONS FIRST

Write your index number and name on all the work you hand in.
Write in dark or blue 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** questions.

If working is needed for any question it must be shown with the answer.
Omission of essential working may result in loss of marks.
You are expected to use a scientific calculator to evaluate explicit numerical expressions.
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 required the answer in terms of π.

At the end of the examination, fasten all your work securely together.
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 **60**.

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Mathematical Formulae

Compound interest

$$\text{Total amount} = P\left(1 + \frac{r}{100}\right)^n$$

Mensuration

Curve surface area of a cone = πrl

Surface area of a sphere = $4\pi r^2$

$$\text{Volume of a cone} = \frac{1}{3}\pi r^2 h$$

$$\text{Volume of a sphere} = \frac{4}{3}\pi r^3$$

$$\text{Area of triangle } ABC = \frac{1}{2}ab \sin C$$

Arc length = $r\theta$, where θ is in radians

$$\text{Sector area} = \frac{1}{2}r^2\theta, \text{ where } \theta \text{ is in radians}$$

Trigonometry

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

Statistics

$$\text{Mean} = \frac{\sum fx}{\sum f}$$

$$\text{Standard deviation} = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f}\right)^2}$$

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Answer all questions.

1 (a) A cleaning company deployed 14 men to clean a school.
The men took 6 hours to complete the work.
How long would it take 8 men to clean the school, assuming that the men work at the same rate. [2]

(b) y is directly proportional to x^2.
It is known that $y = 5$ for a particular value of x.
Find the value of y when this value of x is halved. [2]

2. Peter works for a book company where he is paid $\$C$ per month.
His pay is made up of a basic pay of \$600 and \$2.80 for each of the x books he sells.
The formula connecting C and x is given by the formula $C = 600 + 2.8x$.

(a) Calculate the amount of money Peter receives in a month when he sells 160 books. [1]

(b) At the end of another month, he receives \$1308.40.
How many books does he sell? [1]

(c) The book company decides to decrease Peter's basic pay by 12.5% but pays \$3.30 for every book that Peter sells.
Write down the new formula connecting C and x. [1]

(d) Find the least number of books that Peter must sell, in order to earn more money using the new formula. [3]

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3 The following table shows the number of books read by a group of students in a class.

Number of books	0	1	2	3	4	5	6
Number of students	5	7	x	8	$2x$	7	4

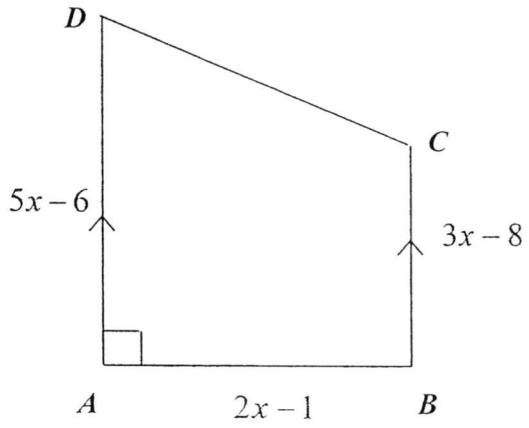
(a) Given that the mode number of books read is 3, list the possible values of x. [1]

(b) If the mean number of books is 3, find x. [3]

(c) Find the median number of books read by students. [1]

(d) If students who read more than 4 books are given a special book prize, find the percentage of students who will be awarded with the special book prize. [2]

4 $ABCD$ is a trapezium which AD is parallel to BC and $\angle ABC = 90^0$.



(a) Write down, in terms of x, an expression for the area of the trapezium. [1]

(b) Given that the area of the trapezium is 33 cm^2, form an equation in x, and show that it reduces to $4x^2 - 9x - 13 = 0$. [3]

(c) Solve $4x^2 - 9x - 13 = 0$. [2]

(d) Hence find the length of AD. [1]

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5 Mei Ling is x years old. Her brother is 10 years older than her. Her father is thrice as old as her brother.

(a) Write down, in terms of x, an expressions, for the ages of

(i) Mei Ling's brother, [1]

(ii) Mei Ling's father. [1]

(b) The sum of the ages of the three family members is 80 years old.

Write down, without simplifying, an equation satisfied by x. [1]

(c) Solve the equation to find the value of x. [2]

(d) Hence, find the father's age when Mei Ling was born. [2]

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

The table shows some values of the function $y = 5 + 4x - x^2$.

x	-2	-1	0	1	3	4	5
y	-7	a	5	8	8	b	0

(a) Find the values of a and b. [2]

(b) Using a scale of 2 cm to 1 unit on the x-axis and 1 cm to 1 unit on the y-axis, draw the graph of $y = 5 + 4x - x^2$ for the values given in the table above. [3]

(c) From the graph, estimate

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

(ii) values of x when $y = 6$. [2]

(d) Draw and label the equation of the line of symmetry on your graph. [2]

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7 **(a)** Factorise completely $2p^2 - 3pq - 5q^2$. [2]

(b) Solve the equation $2x^2 = 7x$. [2]

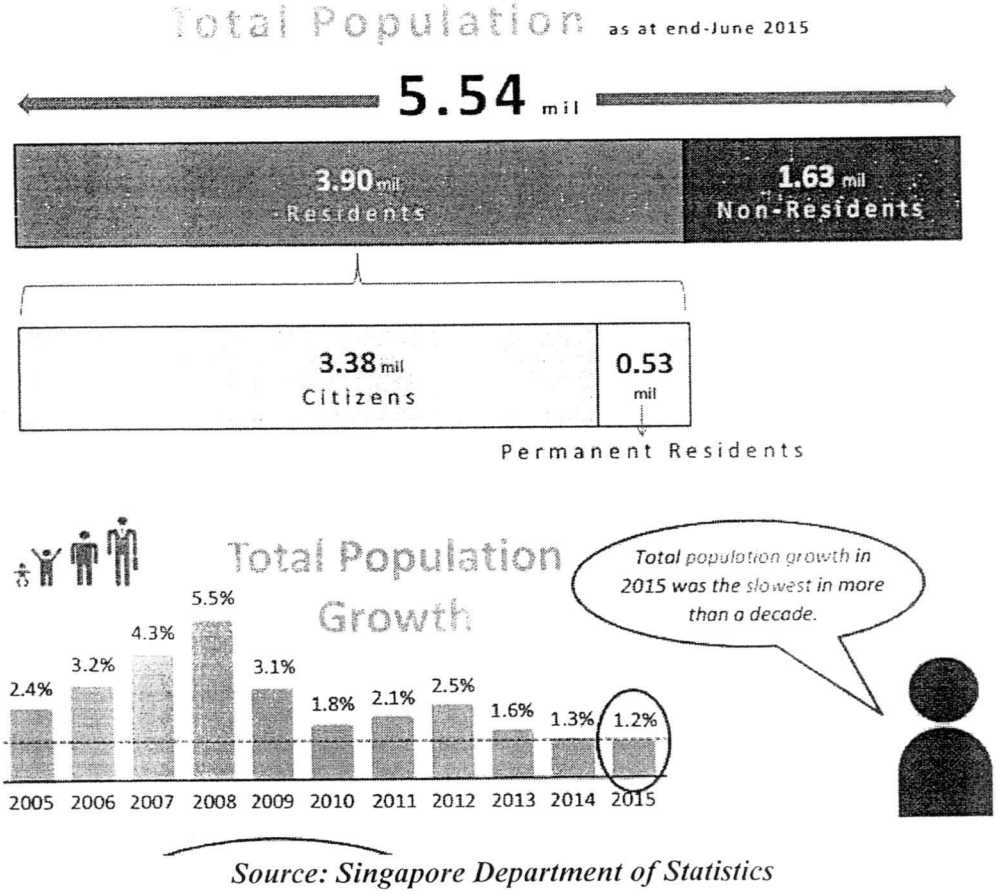
(c) Given that $x + 2y = -3$ and $x - 2y = 3$, calculate the value of $x^2 - 4y^2$. [2]

(d) Given that $\frac{5x}{8} = \frac{3y}{4}$, find the ratio $x : y$. [2]

(e) Express $\frac{x}{a-2} - \frac{1+x}{2-a}$ as a single fraction. [3]

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8 The following information was extracted from the Singapore Department of Statistics on the population profile of Singapore in 2015.



Source: Singapore Department of Statistics

(a) Express the percentage of Permanent Residents to Citizens in 2015. [2]

(b) Given that the population at the start of 2015 is 5.54 million.
What is the population at the end of 2015? [1]

(c) The population density is calculated by the formula

$$Population\ Density = \frac{Total\ Population}{Land\ Size(km^2)}$$

The land size of Singapore is 719 km^2. Calculate the population density of Singapore, giving your answer in people/km^2. (1 million = 1 000 000)
[3]

(d) The targeted total population growth for 2016 is 0.75%.
Find the targeted population at the end of June 2016.
[2]

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Mark Allocation

1(a)	14 men ----- 6 hours 1 man ------- 84 hours 8 men ------ $\frac{84}{8} = 10.5\ hrs$	M1 A1
1(b)	$y = kx^2$ $5 = kx^2$ $y = k\left(\frac{1}{2}x\right)^2$ $y = \frac{1}{4}kx^2$ $y = \frac{1}{4}(5)$ $= 1.25$	M1 A1
2(a)	$C = 600 + 2.8x$ $= 600 + 2.8(160)$ $= \$1048$	 B1
2(b)	$C = 600 + 2.8x$ $1308.40 = 600 + 2.8x$ $x = 253\ books$	 B1
2(c)	$C = 525 + 3.30x$	B1
2(d)	$600 + 2.8x = 525 + 3.3x$ $0.5x = 75$ $x = 150$ He must sell 151 books to earn more under the new formula.	M1 ($600 + 2.8x = 525 + 3.3x$) M1 (for $x = 150$) A1
3(a)	$2x < 8$ $x < 4$ *Possible* $x = 0,1,2,3$	 A1

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3(b)	$mean = 3$ $\frac{(0\times5)+(1\times7)+(2x)+(3\times8)+(8x)+(5\times7)+(6\times4)}{31+3x} = 3$ $\frac{90+10x}{31+3x} = 3$ $90+10x = 3(31+3x)$ $90+10x = 93+9x$ $x = 3$	M1 M1 A1
3(c)	$position = \frac{n+1}{2}$ $= \frac{40+1}{2}$ $= 20.5^{th}\ position$ $\text{median} = \frac{3+3}{2}$ $= 3$ books	B1
3(d)	$\frac{11}{40}\times100\%$ $= 27.5\%$	M1 A1
4(a)	$\frac{1}{2}(2x-1)(5x-6+3x-8)$ $= \frac{1}{2}(2x-1)(8x-14)$	B1 (for either step)
4(b)	$\frac{1}{2}(2x-1)(8x-14) = 33$ $(2x-1)(4x-7) = 33$ $8x^2-14x-4x+7 = 33$ $8x^2-18x-26 = 0$ $4x^2-9x-13 = 0$	M1 M1 (either one of the working steps) A1
4(c)	$(4x-13)(x+1) = 0$ $x = \frac{13}{4}$, $x = -1$	B1 (for either $x = \frac{13}{4}$, $3\frac{1}{4}$, 3.25) B1 (for $x = -1$)
4(d)	$AD = 5x-6$ $= 5(3.25)-6$ $= 10.25\ cm$	B1

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5(a) (i)	Mei Ling's brother = $(x+10)$ years old	B1
(ii)	Mei Ling's father = $3(x+10)$ years old	B1
5(b)	$x+(x+10)+3(x+10)=80$	B1
5(c)	$x+(x+10)+3(x+10)=80$ $5x+40=80$ $5x=40$ $x=8$	M1 A1
5(d)	Mei Ling = 8 years old Mei Ling's father = 3 (18) = 54 years old When Mei Ling was born, Father's age = 54 – 8 = 46 years old	M1 A1
6	Graph	(10m)
7(a)	$2p^2-3pq-5q^2$ $=(2p-5q)(p+q)$	B1 for $(2p-5q)$ B1 for $(p+q)$
7(b)	$2x^2=7x$ $2x^2-7x=0$ $x(2x-7)=0$ $x=0 \quad x=3\frac{1}{2}$	M1 A1
7(c)	x^2-4y^2 $=(x+2y)(x-2y)$ $=(-3)(3)$ $=-9$	M1 A1

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7(d)	$\frac{5x}{8} = \frac{3y}{4}$ $20x = 24y$ $\frac{x}{y} = \frac{24}{20}$ $\frac{x}{y} = \frac{6}{5}$	M1 A1
7(e)	$\frac{x}{a-2} - \frac{1+x}{2-a}$ $= \frac{x}{a-2} + \frac{1+x}{a-2}$ $= \frac{x+1+x}{a-2}$ $= \frac{2x+1}{a-2}$	 M1 (for change of sign to +) M1 A1
8(a)	$\% = \frac{0.53}{3.38} \times 100\%$ $= 15.68047337$ $\approx 15.7\% \ (3sf)$	M1 A1
8(b)	$101.2\% \times 5.54 \ million$ $= 1.012 \times 5.54 \ million$ $= 5.61 \ million$	 B1
8(c)	$\frac{5.53 \times 1\,000\,000}{719}$ $= 7691.23783 \ people / km^2$ $\approx 7690 \ people / km^2 \ (3sf)$ ***Alternatively*** $\frac{5.54 \times 1\,000\,000}{719}$ $= 7705.146036 \ people / km^2$ $\approx 7710 \ people / km^2 \ (3sf)$	M1 (for using the formula) M1 ($5.53 \times 1\,000\,000$) A1

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8(d)	$\frac{0.75}{100} \times 5.61\ million$ $= 0.042075\ million$ $target\ population\ (2016) = 5.61 + 0.042075$ $= 5.652075 million$ $\approx 5.65\ million$ ***Alternative method*** $1.0075 \times 5.61\ million$ $= 5.652075\ million$ $\approx 5.65\ \ million$	M1 A1 *M1.* *A1*

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