NAME:	NO:	CLASS:

ADMIRALTY SECONDARY SCHOOL

MID-YEAR EXAMINATION 2016

SUBJECT	: Mathematics
PAPER	: 1
LEVEL/STREAM	: Secondary 2 Express
DATE	: 6 May 2016
TIME	: 0800h – 0900h
DURATION	: 1 hour

Instructions to candidates:

1. Write your name, class and index number.

2. Answer **ALL** questions.

3. 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.

4. Essential workings must be shown. Omission of essential workings and illegible handwriting will result in loss of marks.

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DO NOT TURN OVER THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

This question paper consists of **9** printed pages including this cover page.

Answer **all** the questions.

1. **(a)** Expand and simplify $(3a-4)(-a+6)$.

(b) Simplify $(-2z^2)(-2z)^2$.

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

(b) ..... [2]

2. Solve each of the following equations. Show your working clearly.

(a) $(x+3)(2x-4)=0$

(b) $(x+8)^2=25$

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

(b) $x=$ ..... [3]

3. Simplify the following.

(a) $\frac{20s}{3q^2} \times \frac{9pq^3}{5r}$

(b) $\frac{20a}{x-y} \div \frac{5}{x^2-y^2}$

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

(b) ..... [3]

4. A map is drawn to a scale of 1 : 75000.

(a) This scale can be expressed as 1 cm represents n km. Find n.

(b) The distance between two towns on the map is 25 cm.
Find the actual distance, in kilometres, between the two towns.

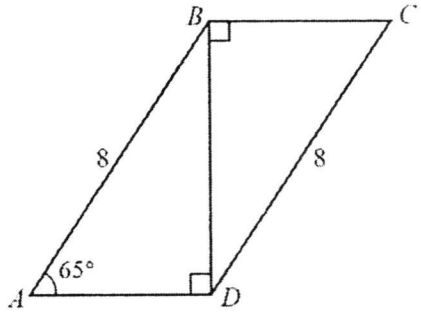
(c) A lake has an actual area of 3.5 km^2.
Find the area, in square centimetres, of the lake on the map.
Give your answer correct to 3 significant figures.

Answer (a) $n =$ ..... [1]

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

(c) ..... cm^2 [2]

5. In the diagram below, it is given that $AB = DC = 8$ cm, $\angle CBD = \angle ADB = 90°$ and $\angle BAD = 65°$. Given that ΔCBD and ΔADB are congruent, find reflex $\angle ADC$.



Answer reflex $\angle ADC =$ ..... ° [3]

6. The volume of a ball, V cm^3, is directly proportional to the cube of its radius, r.
When $r = 7.5$, $V = 562.5\pi$ cm^3.

(a) Find the equation connecting V and r.
Give the value of k, the constant, in terms of π.

(b) Calculate the value of V when $r = 9$, giving your answer in terms of π.

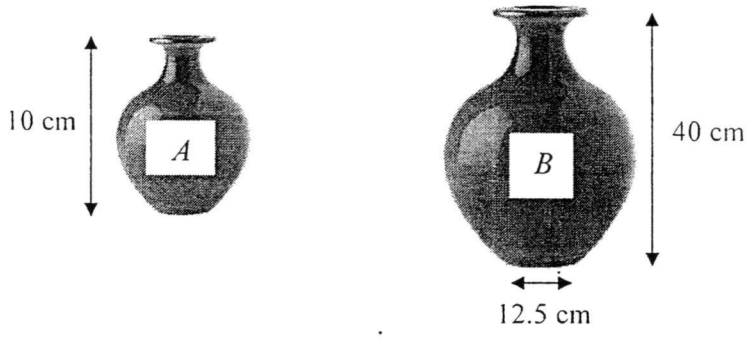
Answer (a) ..... [3]

(b) ..... [2]

7. In the figure below, the two vases A and B are geometrically similar. The heights of vases A and B are 10 cm and 40 cm respectively.

   (a) If the diameter of the base of vase B is 12.5 cm, calculate the diameter of the base of vase A.

   (b) Another vase C has a base of 20 cm and height of 75 cm. Is vase C similar to vase B? Show your working clearly in the space below.



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

(b) Vase C is / is not (circle the right answer) similar to Vase B [3]

8. The volume of a hemisphere is given as $V = \frac{2}{3}\pi r^3$.

(a) Express r as the subject of the formula.

(b) Hence, find the value of r when $V = 1152\pi$ cm^3.

Answer (a) $r =$ ..... [3]

(b) $r =$ ..... cm [2]

9. Factorise the following expressions, showing all your working clearly.

(a) $21ax - 35ab - 9x + 15b$

(b) $2x^2 - 7x - 15$

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

(b) ..... [2]

10. **(a)** Expand $(2x-4z)^2$.

(b) Hence, given that $x^2+4z^2=12$ and $xz=7$, find the value of $(2x-4z)^2$.

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

(b) ..... [3]

11. **(a)** Factorise the expression $-x^2+3x+10$.

(b) Find the value of y when $x=0$ for the equation $y=-x^2+3x+10$.

(c) State the roots of the graph $y=-x^2+3x+10$.

(d) State the y - intercept of the graph $y=-x^2+3x+10$.

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

(b) ..... [1]

(c) The root(s) is/are ..... [2]

(d) y - intercept = ... [1]

NAME:	NO:	CLASS:

ADMIRALTY SECONDARY SCHOOL

MID-YEAR EXAMINATION 2016

SUBJECT	: Mathematics
PAPER	: 2
LEVEL/STREAM	: Secondary 2 Express
DATE	: 12 May 2016
TIME	: 0800h – 0930h
DURATION	: 1 hour 30 minutes

Instructions to candidates:

1. Write your name, class and index number.

2. Answer **ALL** questions.

3. 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.

4. Essential workings must be shown. Omission of essential workings and illegible handwriting will result in loss of marks.

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DO NOT TURN OVER THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

This question paper consists of **8** printed pages including this cover page.

Answer **all** the questions.

1. **(a) (i)** Simplify $(a+2)(a-2)$.

(ii) Hence, evaluate 38×42.

(b) (i) Simplify $(x-2)^2$.

(ii) Hence, evaluate 78^2.

Show your working clearly.

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

(ii) ..... [2]

(b) (i) ..... [1]

(ii) ..... [2]

2. a is directly proportional to b and inversely proportional to the square of c such that $a=\frac{kb}{c^2}$, where k is a constant.

(a) When $a=3$, $b=1$ and $c=2$. Find k.

(b) Find b when $a=4$ and $c=-2$.

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

(b) b = ... [2]

3. Expand and simplify the following.

(a) $(x-2)-3x(5x+3)$

(b) $x(7x+2)+5(-x+5)$

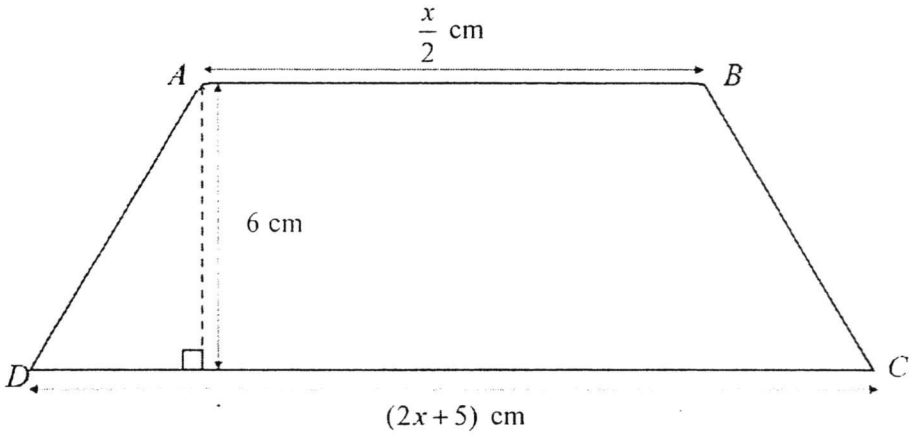
Answer (a) ..... [2]

(b) ..... [2]

4. $ABCD$ is a trapezium with height of 6 cm.

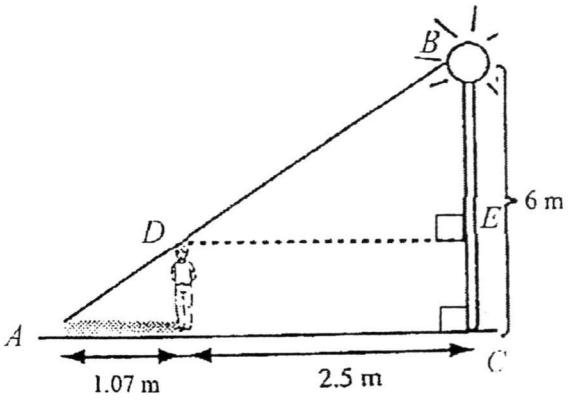
$AB = \frac{x}{2}$ cm and $DC = (2x + 5)$ cm.

Find the area of trapezium $ABCD$ in terms of x.



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

5. A man is standing at a distance of 2.5 m away from a lamp post with a height of 6 m. The length of the man's shadow is 1.07 m. Using the concept of similar triangles, find the man's height, correct to 1 decimal place.



Answer ..... m [3]

6. Three quantities a, b and c are related by the formulae

$$b = \frac{2a+3}{4-a} \text{ and } c = \sqrt[3]{3-\frac{a}{4}}$$

(a) Express a in terms of b.

(b) Express a in terms of c.

(c) Express b in terms of c.

(d) Hence, find the value of b when $c = 2$.

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

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

(c) $b =$ ..... [3]

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

7. A wine barrel contains 240 litres of wine.
A large tap and a small tap are attached to the wine barrel.

(a) The small tap pours out x litres of wine per minute.
Write down an expression, in terms of x, for the number of minutes it takes to empty the barrel using the small tap.

(b) The large tap pours out $(x + 2)$ litres of wine per minute.
Write down an expression, in terms of x, for the number of minutes it takes to empty the barrel using the large tap.

(c) It takes 10 minutes longer to empty the barrel using the small tap than using the large tap.
Write an equation in x, and show that it simplifies to

$$x^2 + 2x - 48 = 0.$$ [3]

(d) Solve the equation $x^2 + 2x - 48 = 0$.

(e) From **(d)**, which answer is rejected? Why?

(f) Find the time taken, in minutes, to empty the barrel using the small tap.

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

(b) ..... [1]

(d) $x =$ ..... [2]

(e) .....

..... [2]

(f) ..... min [1]

8. ***Answer the whole of this question on a piece of graph paper.***

x	-2	0	-1	1	2	3	4
$y=-2x^2+5x+7$	-11	7	0	p	9	q	-5

(a) Find the value of p and q from the table above. [2]

(b) Using a scale of 2 cm to represent 1 unit on the horizontal x - axis and 1 cm to represent 1 unit on the vertical y - axis, draw the graph of $y=-2x^2+5x+7$ for $-2 \le x \le 4$. [3]

(c) Use your graph in **(b)** to estimate the value of x for which the value of y is maximum. [1]

(d) Using the graph in **(b)**, state the two roots of the equation $-2x^2+5x+7=0$. [2]

(e) Without the use of **(b)**, give an alternative method to solve the equation $-2x^2+5x+7=0$. Show all working clearly. [2]

End of Paper

1	a) $(3a-4)(-a+6)$ $=-3a^2+18a+4a-24$ $=-3a^2+22a-24$	 B1 B1
	b) $(-2z^3)(-2z)^2$ $=(-2z^3)(4z^2)$ $=-8z^4$	 B1 B1
2	a) $(x+3)(2x-4)=0$ $x+3=0$ OR $2x-4=0$ $x=-3$ $2x=4$ $x=2$	 B1 each (Final answers)
	b) $(x+8)^2=25$ $x+8=\pm\sqrt{25}$ $x+8=\pm5$ $x+8=5$ $x+8=-5$ $x=5-8$ OR $x=-5-8$ $x=-3$ $x=-13$	 B1 B2 (1 mark for each answer)
3	a) $\frac{20s}{3q^2}\times\frac{9pq^3}{5r}$ $=\frac{4s}{1}\times\frac{3pq}{r}$ $=\frac{12pqs}{r}$	 B1 B1
	b) $\frac{20a}{x-y}\div\frac{5}{x^2-y^2}$ $=\frac{20a}{x-y}\times\frac{x^2-y^2}{5}$ $=\frac{20a}{x-y}\times\frac{(x+y)(x-y)}{5}$ $=\frac{20a(x+y)}{5}$ $=4a(x+y)$ *A lot of students did not simplify answers.*	 M1 (Multiply by reciprocal) M1 (using algebraic rule) A1

4	a) $n = 0.75$	B1
	b) Map : Actual 1 cm : 0.75 km Actual distance between 2 towns $= 25 \times 0.75$ km $= 18.75$ km	 B1
	c) Map : Actual 1 cm : 0.75 km $1\ \text{cm}^2 : 0.5625\ \text{km}^2$ $3.5\ \text{km}^2 \div 0.5625\ \text{km}^2$ $= 6.22\ \text{cm}^2$	 M1 A1
5	$\angle BDC = \angle ABD = 180^\circ - 90^\circ - 65^\circ$ $= 25^\circ$ ($\angle$s of congruent figures) Reflex $\angle ADC = 360^\circ - 90^\circ - 25^\circ$ $= 245^\circ$	B1 M1 A1
6	a) $V = kr^3$ When $r = 7.5$, $V = 562.5\pi$, $562.5\pi = k(7.5)^3$ $k = \dfrac{562.5\pi}{7.5^3}$ $k = \dfrac{4}{3}\pi$ $V = \dfrac{4}{3}\pi r^3$	 B1 (Substitution) B1 (Correct value of k) B1
	b) When $r = 9$, $V = \dfrac{4}{3}\pi(9)^3$ $= \dfrac{4}{3}\pi(729)$ $= 972\pi\ \text{cm}^3$	 M1 (e.c.f. from (a); correct substitution) A1
7	a) $\dfrac{10}{40} = \dfrac{\text{diameter of base of vase } A}{12.5}$ Diameter of base of vase $A = (10 \times 12.5) \div 40$ $= 3.125$ cm	B1 B1
	b) $\dfrac{12.5}{20} = \dfrac{5}{8}$ $\dfrac{40}{75} = \dfrac{8}{15}$ $\dfrac{5}{8} \neq \dfrac{8}{15}$ $\therefore$ Vase C is not similar to vase B.	B1 (accept inverse) B1 B1

8	a) $V = \frac{2}{3}\pi r^3$ $V \div \frac{2}{3}\pi = r^3$ $r^3 = V \times \frac{3}{2\pi}$ $r^3 = \frac{3V}{2\pi}$ $r = \sqrt[3]{\frac{3V}{2\pi}}$	M1 A1
	b) When $V = 1152\pi$. $r = \sqrt[3]{\frac{3(1152\pi)}{2\pi}}$ $= \sqrt[3]{1728}$ $= 12$	B1 B1
9	a) $21ax - 35ab - 9x + 15b$ $= 7a(3x - 5b) + 3(-3x + 5b)$ $= 7a(3x - 5b) - 3(3x - 5b)$ $= (7a - 3)(3x - 5b)$ OR $21ax - 35ab - 9x + 15b$ $= 21ax - 9x - 35ax + 15b$ $= 3x(7a - 3) + 5b(-7a + 3)$ $= 3x(7a - 3) - 5b(7a - 3)$ $= (3x - 5b)(7a - 3)$	M1 (Taking out common factor) A1 M1 (Taking out common factor) A1
	b) $2x^2 - 7x - 15$ $x \times -5 = -10x$ $2x \times 3 = 3x$ $2x^2 \quad -15 \quad -7x$ $= (x - 5)(2x + 3)$	 B1 (Working) B1

10	a) $(2x-4z)^2$ $=(2x)^2-2(2x)(4z)+(4z)^2$ $=4x^2-16xz+16z^2$	 M1 A1
	b) $x^2+4z^2=12$ $4x^2+16z^2$ $=4(x^2+4z^2)$ $=4(12)$ $=48$ $16xz$ $=16\times 7$ $=112$ $(2x-4z)^2$ $=4x^2+16z^2-16xz$ $=48-112$ $=-64$	 B1 B1 B1
11	a) $-x^2+3x+10$ $-x$ 5 $5x$ x 2 $-2x$ $-x^2$ 10 $3x$ $=(-x+5)(x+2)$	 B1
	b) When $x=0$, $y=-0^2+3(0)+10$ $=10$	 B1
	c) The root(s) is/are 5 and -2.	B1 each
	d) y - intercept = 10	B1

1	a) i) $(a+2)(a-2)=a^2-4$ ii) $(40-2)(40+2)$ $=40^2-2^2$ OR 40^2-4 $=1600-4$ $=1596$	 B1 M1 A1
	b) i) $(x-2)^2=x^2-4x+4$ ii) 78^2 $=(80-2)^2$ $=80^2-2(80)(2)+2^2$ OR $80^2-4(80)+4$ $=6400-320+4$ $=6084$	 B1 M1 A1
2	a) When $a=3$, $b=1$ and $c=2$, $3=\frac{k(1)}{2^2}$ $k=3\times4$ $k=12$	 B1 B1
	b) When $a=4$, $c=-2$, $4=\frac{12(b)}{(-2)^2}$ $4\times4=12b$ $b=\frac{16}{12}=\frac{4}{3}$	 M1 A1
3	a) $(x-2)-15x^2-9x$ $=x-2-15x^2-9x$ $=-15x^2-9x+x-2$ $=-15x^2-8x-2$	 B1 (2nd and 3rd step) B1
	b) $x(7x+2)+5(-x+5)$ $=7x^2+2x-5x+25$ $=7x^2-3x+25$	B1 (expansion) B1

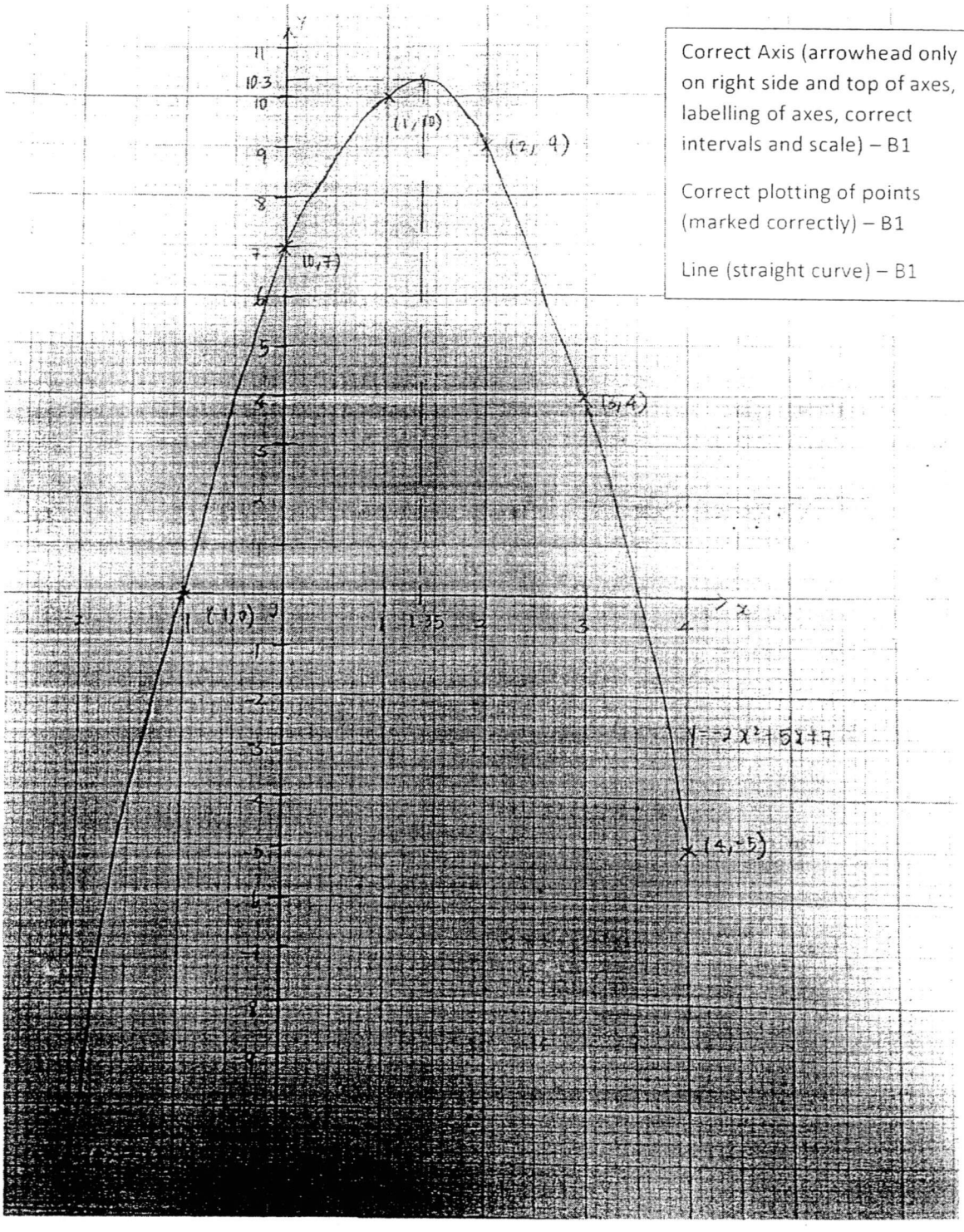
4	Area of trapezium $= \frac{1}{2} \times 6 \times \left[\frac{x}{2} + (2x+5) \right]$ $= 3 \times \left[\frac{x}{2} + (2x+5) \right]$ $= \frac{3x}{2} + 6x + 15$ $= 7.5x + 15$ OR $\frac{15x}{2} + 15$ OR $\frac{15x+30}{2}$	B1 B1
5	Let the height of the man be x. $\frac{2.5}{1.07+2.5} = \frac{6-x}{6}$ $6(2.5) = (6-x)(3.57)$ $21.42 - 3.57x = 15$ $-3.57x = -6.42$ $x = 1.8$ (1 d.p.) The man's height is 1.8 m. OR $\frac{1.07}{2.5+1.07} = \frac{CE}{6}$ $CE = \frac{6(1.07)}{3.57}$ $CE = 1.8$ (1 d.p.) The man's height is 1.8 m. OR $\frac{2.5}{2.5+1.07} = \frac{BE}{6}$ $BE = \frac{2.5}{3.57} \times 6$ $BE = 4.201680672$ $6 - 4.401680672 = 1.798319328 \approx 1.8$ The man's height is 1.8 m.	 B1 (Correct ratio) B1 (Correct manipulation to linear form) B1 (Final answer) B1 (Correct ratio) B1 (Correct numerical manipulation to get CE) B1 (Final answer) B1 (Correct ratio) B1 (Subtracting from 6) B1

6	a) $b=\dfrac{2a+3}{4-a}$ $b(4-a)=2a+3$ $4a-ab=2a+3$ $-ab-2a=3-4b$ $a(-b-2)=3-4b$ $a=\dfrac{3-4b}{-b-2}$	M1 (Multiplying) M1 (Isolating a) A1
	b) $c=\sqrt[3]{3-\dfrac{a}{4}}$ $c^3=3-\dfrac{a}{4}$ $c^3-3=-\dfrac{a}{4}$ $\dfrac{a}{4}=3-c^3$ $a=4(3-c^3)$	M1 (cube) M1 (Moving terms unrelated to a to one side) A1
	c) $b=\dfrac{2\left[4(3-c^3)\right]+3}{4-4(3-c^3)}$ $=\dfrac{8(3-c^3)+3}{4-12+4c^3}$ $=\dfrac{24-8c^3+3}{-8+4c^3}$ $=\dfrac{27-8c^3}{-8+4c^3}$	M1 (e.c.f. Substitution) M1 (Correct BIDMAs) A1
	d) When $c=2$, $b=\dfrac{27-8(2)^3}{-8+4(2)^3}$ $=\dfrac{27-8(8)}{-8+4(8)}$ $=\dfrac{27-64}{-8+32}$ $=\dfrac{-37}{24}$ $=-1\dfrac{13}{24}$	M1 (e.c.f. Substitution) A1

A1 for question 7 means that answer is not totally correct.

7	a) $\frac{240}{x}$ $240 \div x$ and $240 \times \frac{1}{x}$ *Accepted this time round but will be wrong from next assessment onwards.*	B1
	b) $\frac{240}{x+2}$	B1
	c) $\frac{240}{x} - \frac{240}{x+2} = 10$ $\frac{240(x+2)-240x}{x(x+2)} = 10$ $\frac{240x+480-240x}{x^2+2x} = 10$ $480 = 10(x^2+2x)$ $\therefore x^2+2x = 48$ $x^2+2x-48 = 0$	B1 (e.c.f.) B1 (combine fraction) B1
	d) $x^2+2x-48=0$ $x \times 8 = 8x$ $x \times -6 = -6x$ $x^2 \quad -48 \quad 2x$ $(x+8)(x-6)=0$ $x=-8$ or $x=6$	B1 B1
	e) $x=-8$ is rejected. Amount of water cannot be negative.	B1 B1
	f) Time taken (min) to empty barrel $= \frac{240}{6}$ $= 40$	B1
8	a) $p=10$ $q=4$	B1 B1
	c) Value of x when y is maximum $= 1.25 \pm 0.1$	B1
	d) Roots $= 3.5 \pm 0.1$ and -1 ± 0.1	B1 B1
	e) $-2x^2+5x+7=0$ $x \times 1 = -2x$ $-2x \times 7 = 7x$ $-2x^2 \quad 7 \quad 5x$ $(x+1)(-2x+7)=0$ $x=-1$ or $x=3.5$	B1 B1

8 b)



Correct Axis (arrowhead only on right side and top of axes, labelling of axes, correct intervals and scale) – B1

Correct plotting of points (marked correctly) – B1

Line (straight curve) – B1