BEATTY SECONDARY SCHOOL
END-OF-YEAR EXAMINATION 2018

Exp

SUBJECT : Mathematics **LEVEL : Sec 2E**

PAPER : 4048 / 1 **DURATION : 1 hour 15 minutes**

SETTER : Ms Ong Geok Leng **DATE : 8 Oct 2018**

CLASS :	**NAME :**	**REG NO :**

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number in the spaces on the top of this page.
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.

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 **50**.

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 or otherwise stated by the question.

For Examiner's Use
50

Mathematical Formulae

Mensuration

Curved surface area of a cone = πrl

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

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

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

---

1 Given that y is directly proportional to the cube of $(x + 1)$ and that $y = 15$ when $x = 2$.

(a) Express y in terms of x.

Answer ..... [2]

(b) Find the value of x when $y = 120$.

Answer $x =$ ..... [2]

(c) Find the value of y when $x = 11$.

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

2 **(a)** Factorise completely

(i) $15y^2 - y - 6$,

Answer ..... [2]

(ii) $2ac - 6ad + 10bc - 30bd$.

Answer ..... [2]

(b) Expand and simplify $(2x - 1)(2x + 1) - 3(2x + 3)^2$.

Answer ..... [3]

3 **(a)** Make b the subject of the formula $a = \sqrt{\dfrac{2b+1}{b}}$.

Answer ..... [3]

(b) Solve the equation $\dfrac{5}{x-4} = \dfrac{5x-3}{x^2-2}$.

Answer $x =$ ..... [2]

4 Solve the simultaneous equations.

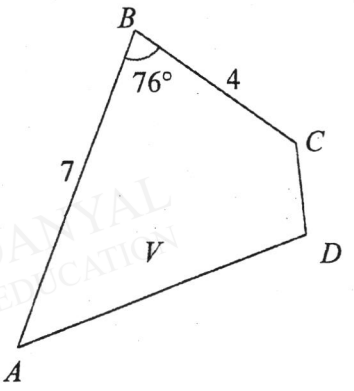
$3x - 2y = 8$

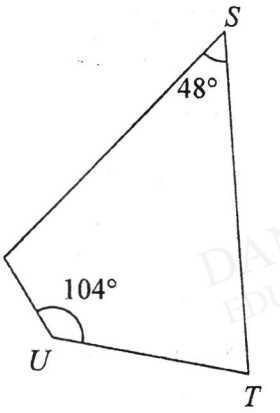
$4x + 3y = 5$

Answer $x =$ ….. , $y =$ ….. [3]

---

5 Quadrilateral $ABCD$ is congruent to quadrilateral $STUV$. $AB = 7$ cm, $BC = 4$ cm, $\angle ABC = 76°$, $\angle TUV = 104°$ and $\angle VST = 48°$.





Find

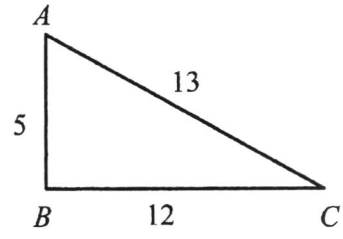
(a) the length of TU,

Answer ..... cm [1]

(b) angle ADC.

Answer ..... [2]

6 A triangle ABC has sides $AB = 5$ cm, $BC = 12$ cm and $AC = 13$ cm.



(a) Prove that triangle ABC is a right-angled triangle.

Answer .....

.....

..... [2]

(b) Hence, find
(i) sin $\angle BAC$,

Answer ..... [1]

(ii) angle ACB.

Answer ..... [1]

7 The stem-and-leaf diagram below represents the scores obtained by 30 boys and girls in a Mathematics test.

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

Key (Boys): 8|4 means 48 marks

Key (Girls): 4|5 means 45 marks

(a) Write down the modal score for the girls.

Answer ..... marks [1]

(b) Find the median score for the boys.

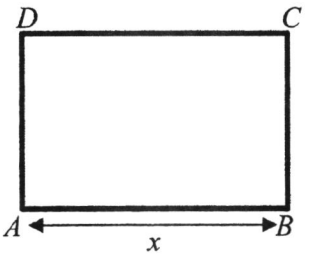
Answer ..... marks [2]

(c) One more boy took the test later and scored 67 marks. Describe how the inclusion of his score will affect the median score for the boys.

Answer .....

..... [1]

8 The perimeter of a rectangle $ABCD$ is 48 cm. Let the length of the rectangle be x cm.



(a) Find an expression, in terms of x, for the width of the rectangle.

Answer ..... cm [1]

(b) The area of the rectangle is 135 cm^2.

(i) Form an equation in terms of x.

Answer ..... [1]

(ii) Solve the equation in (b)(i) and find the length of the rectangle.

Answer ..... cm [2]

9 A river that is 9.6 km long is 2.4 cm long on a map.

(a) Express the scale of the map in the form 1 : n.

Answer ..... [2]

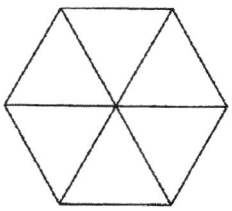
(b) A tunnel has a length of 3.8 cm on the map. Calculate its actual length, in km.

Answer ..... km [1]

(c) A plantation has an area of 24 cm^2 on the map. What is its area, in cm^2, when drawn on another map whose scale is 1 : 80 000 ?

Answer ..... cm^2 [3]

10 A regular hexagonal spinner with sectors of different number is shown below.



The pointer is spun once, find the probability that the pointer will stop at

(a) the number 5,

Answer ..... [1]

(b) a number greater than 2,

Answer ..... [1]

(c) a factor of 12,

Answer ..... [1]

(d) a prime number.

Answer ..... [1]

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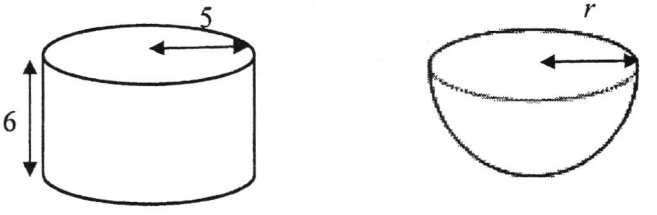
11 A cylinder has radius 5 cm and height 6 cm. A hemisphere has radius r cm. The volumes of the cylinder and hemisphere are equal.



Find

(a) the value of r,

Answer $r =$ ..... cm [3]

(b) the total surface area of the hemisphere.

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

- End of paper -

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Answer for 2E Math Paper 1

1	**(a)**	$y = \frac{5}{9}(x+1)^3$
	(b)	$x = 5$
	(c)	$y = 960$
2	**(a)(i)**	$(5y + 3)(3y - 2)$
	(a)(ii)	$2(a + 5b)(c - 3d)$
	(b)	$-8x^2 - 36x - 28$
3	**(a)**	$b = \frac{1}{a^2 - 2}$
3	**(b)**	$x = \frac{22}{23}$
4		$x = 2$ $y = -1$
5	**(a)**	$TU = 4$ cm
	(b)	132°
6	**(a)**	$AC^2 = 13^2 = 169$ $AB^2 + BC^2 = 5^2 + 12^2 = 169$ Since $AB^2 + BC^2 = AC^2$, by converse of Pythagoras theorem, triangle ABC is a right-angled triangle, $\angle ABC = 90°$.
	(b)(i)	$\sin \angle BAC = \frac{12}{13}$
	(b)(ii)	$\angle ACB = 22.6°$
7	**(a)**	Modal score for the girls = 62 marks
	(b)	Median score for the boys = 70.5 marks
	(c)	Median score will reduce/decrease to 70 marks for the boys.
8	**(a)**	$(24 - x)$ cm
	(b)	$x = 9$ or $x = 15$ Length of the rectangle is 15 cm.
9	**(a)**	1 : 400000
	(b)	3.8 cm : $3.8 \times 4 = 15.2$ km
	(c)	$384/0.64 = 600$ cm^2
10	**(a)**	the number 5 = $\frac{1}{6}$
	(b)	Number greater than 2 = $\frac{4}{6} = \frac{2}{3}$
	(c)	A factor of 12 = $\frac{5}{6}$
	(d)	A prime number = $\frac{3}{6} = \frac{1}{2}$
11	**(a)**	$r \approx 6.08$ cm (to 3 sf)
	(b)	349 cm^2 (to 3sf)

BEATTY SECONDARY SCHOOL
END-OF-YEAR EXAMINATION 2018

SUBJECT : Mathematics **LEVEL : Sec 2 Express**

PAPER : 2 **DURATION : 1 hour 30 minutes**

SETTER : Ms Irene Ng **DATE : 10 October 2018**

CLASS :	NAME :	REG NO :

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number in the spaces on the top of this page.
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.

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 **50**.

Mathematical Formulae

Mensuration

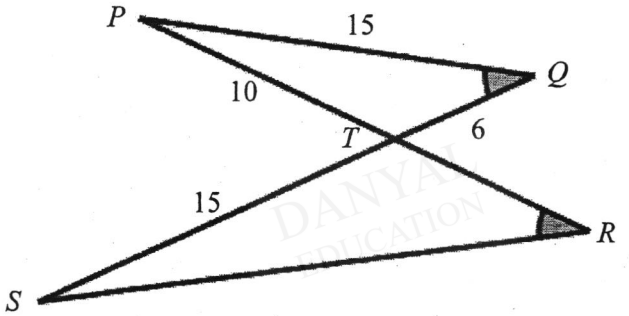
Curved surface area of a cone = πrl

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

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

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

1



In the diagram, triangle PQT is similar to triangle SRT.
Angle PQT = angle SRT.
PQ = 15 cm, PT = 10 cm, QT = 6 cm and ST = 15 cm.

Calculate

(a) SR, [2]

(b) PR. [2]

---

2 **(a)** Factorise fully $18xy + 9y$. [1]

(b) Simplify $\frac{25 - p^2}{2p^2 + 7p - 15}$. [3]

(c) Express as a single fraction in its simplest form $\frac{5x}{(x+2)^2} - \frac{4x}{x+2}$. [2]

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3 **(a)** It takes 3 workers 16 weeks to complete a renovation project. How many extra workers are needed if the project is to be completed in 6 weeks? [2]

(b) y is inversely proportional to x^2. It is given that $y = 28$ for a particular value of x. Find the value of y when x is doubled. [2]

---

4 The table shows the heights of 40 students in class 2G.

Heights (cm)	$150 < x \leq 160$	$160 < x \leq 170$	$170 < x \leq 180$	$180 < x \leq 190$
Number of students	8	13	17	2

(a) Find the percentage of students whose heights are less than or equal to 170 cm. [2]

(b) **(i)** Calculate an estimate of the mean height. [2]

(ii) Explain why the mean in **(b)(i)** is an estimate. [1]

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5 **(a)** **(i)** Simplify $\frac{16p^2}{4q} \div \frac{8p}{3q}$. [2]

(ii) Expand and simplify $3(a - 1)(4a + 5)$. [2]

(b) Given that $x^2 + y^2 = 45$ and $xy = 12$, find the value of $(2x - 2y)^2$. [2]

(c) A cone has radius 8 cm and volume 320π cm^3. Find the height of the cone. [2]

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6 Mr Yan bought 60 litres of apple juice. He poured the fruit juice equally into x bottles.

(a) Write down an expression, in terms of x, for the volume, in litres, of apple juice in each bottle. [1]

(b) Mr Yan bought the same amount of orange juice and poured the orange juice into $(x - 6)$ bottles.
Write down an expression, in terms of x, for the volume, in litres, of orange juice in each bottle. [1]

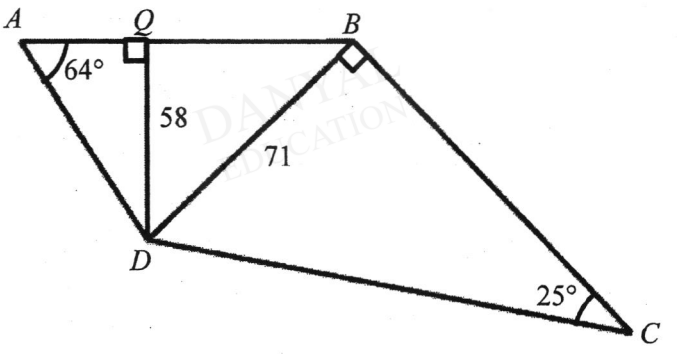
(c) It is given that the volume of orange juice in each bottle is 0.5 litres more than the volume of apple juice in each bottle.

Write down an equation in x and show that it reduces to $x^2 - 6x - 720 = 0$. [3]

(d) Solve the equation $x^2 - 6x - 720 = 0$. [2]

(e) Hence, find the volume, in litres, of apple juice in one bottle. [1]

7



The diagram shows a field $ABCD$.
Q is on AB such that DQ is perpendicular to AB.
$DQ = 58$ m, $DB = 71$ m, angle $DAQ = 64°$, angle $DBC = 90°$ and angle $BCD = 25°$.

Calculate

(a) QB, [2]

(b) AB, [3]

(c) the shortest distance from B to DC. [2]

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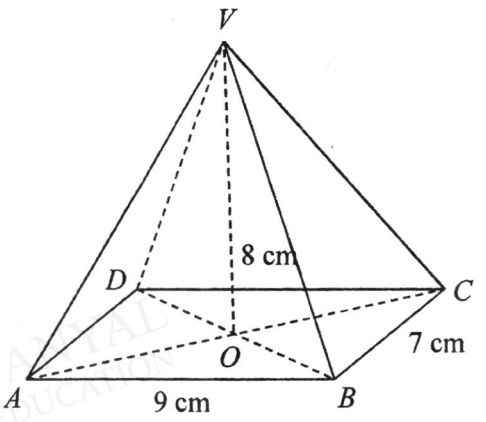
8 A souvenir was designed in the shape of a solid rectangular pyramid as shown below.
$AB = 9$ cm, $BC = 7$ cm and $VO = 8$ cm.



(a) Find the volume of the souvenir. [2]

(b) Find the total surface area of the souvenir. [4]

(c) The souvenir is to be made of wood.
The wooden pyramid must not have a mass greater than 119 grams.

Four types of wood are available.
The table shows these woods and their densities.

Wood	Pine	Birch	Teak	Maple
Density (g/cm^3)	0.65	0.71	0.63	0.75

Which of these woods could be used to make the wooden pyramid?
Justify your answers with workings. [2]

Answer Key:

Qn	Answers
1a	22.5 cm
1b	19 cm
2ai	$(2x + 1)$
2aii	$\frac{5-p}{2p-3}$
2b	$\frac{-4x^2 - 3x}{(x+2)^2}$
3a	5 workers
3b	7
4a	52.5%
4bi	168.25 cm
4bii	It is an estimate as the mid value was used.
5ai	$\frac{3p}{2}$
5aii	$12a^2 + 3a - 15$
5b	84
5c	$h = 15$ cm
6a	$\frac{60}{x}$
6b	$\frac{60}{x-6}$
6d	$x = 30$ or $x = -24$
6e	2litres
7a	41.9m
7b	$AB = 69.2$ m
7c	$h = 64.3$ m
8a	168 cm^3
8b	206 cm^2
8c	Pine and Teak.

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BEATTY SECONDARY SCHOOL
END-OF-YEAR EXAMINATION 2018

MARK SCHEME

SUBJECT : Mathematics **LEVEL : Sec 2E**

PAPER : 4048 / 1 **DURATION : 1 hour 15 mins**

SETTER : Ms Ong Geok Leng **DATE : 8 Oct 2018**

CLASS :	NAME :	REG NO :

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For π, use either your calculator value or 3.142 or otherwise stated by the question.

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1	**(a)**	$y = k(x+1)^3$ $15 = k(2+1)^3$ [M1] $15 = k(27)$ $k = \frac{15}{27} = \frac{5}{9}$ $y = \frac{5}{9}(x+1)^3$ [A1]
	(b)	$y = 120$ $120 = \frac{5}{9}(x+1)^3$ [M1] $216 = (x+1)^3$ $6 = x+1$ $x = 5$ [A1]
	(c)	$x = 11$ $y = \frac{5}{9}(11+1)^3$ $y = \frac{5}{9}(12)^3$ $y = 960$ [B1]
2	**(a)(i)**	$15y^2 - y - 6$ $= (5y + 3)(3y - 2)$ [B2]
	(a)(ii)	$2ac - 6ad + 10bc - 30bd$ $= 2(ac - 3ad + 5bc - 15bd)$ $= 2[a(c - 3d) + 5b(c - 3d)]$ [M1] $= 2(a + 5b)(c - 3d)$ [A1] Mtd 2: $2ac - 6ad + 10bc - 30bd$ $= 2a(c - 3d) + 10b(c - 3d)$ [M1] $= (2a + 10b)(c - 3d)$ $= 2(a + 5b)(c - 3d)$ [A1]
	(b)	$(2x - 1)(2x + 1) - 3(2x + 3)^2$ $= (4x^2 + 2x - 2x - 1) - 3(4x^2 + 6x + 6x + 9)$ $= 4x^2 - 1 - 3(4x^2 + 12x + 9)$ [M2] $= 4x^2 - 1 - 12x^2 - 36x - 27$ $= -8x^2 - 36x - 28$ [A1]
3	**(a)**	$a = \sqrt{\frac{2b+1}{b}}$ $a^2 = \frac{2b+1}{b}$ [M1] $a^2b = 2b + 1$ $a^2b - 2b = 1$ $b(a^2 - 2) = 1$ [M1]

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		$b = \dfrac{1}{a^2 - 2}$ [A1]
3	**(b)**	$\dfrac{5}{x-4} = \dfrac{5x-3}{x^2-2}$ $5(x^2-2) = (x-4)(5x-3)$ $5x^2 - 10 = 5x^2 - 3x - 20x + 12$ [M1] $5x^2 - 5x^2 + 23x = 12 + 10$ $23x = 22$ $x = \dfrac{22}{23}$ [A1]
4		$3x - 2y = 8$ – – – – – (1) $4x + 3y = 5$ – – – – – (2) (1) × 3, $9x - 6y = 24$ ------ (3) (2) × 2, $8x + 6y = 10$ ------ (4) [M1] elimination/substitution (3)+(4), $17x = 34$ $x = 2$ [A1] Subt, $x = 2$ into (2), $4(2) + 3y = 5$ $8 + 3y = 5$ $3y = -3$ $y = -1$ [A1]
5	**(a)**	$TU = 4$ cm [B1]
	(b)	$\angle SVU = 360° - 76° - 48° - 104°$ [M1] $= 132°$ [A1]
6	**(a)**	$AC^2 + 13^2 = 169$ $AB^2 + BC^2 = 5^2 + 12^2 = 169$ } [M1] Since $AB^2 + BC^2 = AC^2$, by converse of Pythagoras theorem, triangle ABC is a right-angled triangle, $\angle ABC = 90°$. [A1]
	(b)(i)	$\sin \angle BAC = \dfrac{12}{13}$ [B1]
	(b)(ii)	$\angle ACB = 22.6°$ [B1]
7	**(a)**	Modal score for the girls = 62 marks [B1]
	(b)	Median score for the boys = $\dfrac{70+71}{2} = 70.5$ marks [B2]
	(c)	Median score <u>will reduce/decrease to 70 marks</u> for the boys. [B1]

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8	**(a)**	Let the length of the rectangle be x. Width = $(48 - 2x) \div 2$ $= (24 - x)$ cm [B1]
	(b)	$x(24 - x) = 135$ [M1] $24x - x^2 = 135$ $x^2 - 24x + 135 = 0$ $(x - 9)(x - 15) = 0$ [M1] $x = 9$ (rejected) or $x = 15$ Length of the rectangle is 15 cm. [A1]
9	**(a)**	Map : Actual 2.4 cm : 9.6 km 1 cm: 4 km [M1] 1 : 400000 [A1]
	(b)	1 cm : 4 km 3.8 cm : 3.8 × 4 = 15.2 km [B1]
	(c)	1 cm : 4 km 1 cm^2 : 16 km^2 [M1] 24 cm^2 : 384 km^2 [M1] 1 cm : 0.8 km 1 cm^2 : 0.64 km^2 _____ cm^2 : 384 km^2 384/0.64 = 600 cm^2 [A1]
10	**(a)**	the number 5 = $\frac{1}{6}$ [B1]
	(b)	Number greater than 2 = $\frac{4}{6} = \frac{2}{3}$ [B1]
	(c)	A factor of 12 = $\frac{5}{6}$ [B1]
	(d)	A prime number = $\frac{3}{6} = \frac{1}{2}$ [B1]
11	**(a)**	$\frac{2}{3}\pi r^3 = \pi(5)^2(6)$ [M1] $\frac{2}{3}r^3 = 150$ [M1] $r^3 = 225$ $r = 6.0822$ $r \approx 6.08$ cm (to 3 sf) [A1]
	(b)	Total surface area of the hemisphere $= 3\pi r^2$ $= 3 \times \pi \times (6.0822)^2$ [M1] $= 349$ cm^2 (to 3sf) [A1]

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Beatty Secondary School
2E EOY Math P2 2018
Marking scheme

Qn	Solutions	Remarks
1a	$\frac{SR}{PQ} = \frac{ST}{PT}$ $\frac{SR}{15} = \frac{15}{10}$ $SR = \frac{15}{10} \times 15$ $SR = 22.5$ cm	M1 A1
1b	$TR = \frac{3}{2} \times 6$ $= 9$ cm $PR = 10 + 9$ $= 19$ cm	M1 A1
2a	$18xy + 9y$ $= 9y(2x + 1)$	B1
2b	$\frac{25-p^2}{2p^2+7p-15}$ $= \frac{(5+p)(5-p)}{(2p-3)(p+5)}$ $= \frac{5-p}{2p-3}$	M1 – factorise numerator M1 – factorise denominator A1
2c	$\frac{5x}{(x+2)^2} - \frac{4x}{(x+2)}$ $= \frac{5x}{(x+2)^2} - \frac{4x(x+2)}{(x+2)^2}$ $= \frac{5x-4x(x+2)}{(x+2)^2}$ $= \frac{5x-4x^2-8x}{(x+2)^2}$ $= \frac{-4x^2-3x}{(x+2)^2}$	M1 A1
3a	3 workers 16 weeks 1 worker 48 weeks 8 workers 6 weeks Answer: 8 – 3 = 5 workers	M1 A1
3b	$28 = \frac{k}{x^2}$ $k = 28x^2$ $new\ y = \frac{k}{(2x)^2}$	M1

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	$=\frac{28x^2}{4x^2}$ $=7$	A1
4a	$\frac{8+13}{40}\times 100\%$ $=52.5\%$	M1 A1
4bi	$mean\ height$ $=\frac{(155\times 8)+(165\times 13)+(175\times 17)+(185\times 2)}{40}$ $=168.25$ cm	M1 A1
4bii	It is an estimate as the mid value was used. The exact height of each student is not known.	B1 Accept any reasonable answers.
5ai	$\frac{16p^2}{4q}\div\frac{8p}{3q}$ $=\frac{16p^2}{4q}\times\frac{3q}{8p}$ $=\frac{3p}{2}$	M1 A1
5aii	$3(a-1)((4a+5)$ $=3(4a^2+5a-4a-5)$ $=3(4a^2+(a-5)$ $=12a^2+3a-15$	M1 A1
5b	$(x+y)^2$ $=x^2-2xy+y^2$ $=x^2+y^2-2xy$ $=45-2(12)$ $=21$ $(2x-2y)^2$ $=[2(x-y)]^2$ $=4(21)$ $=84$	M1 A1
5c	$\frac{1}{3}\pi(8^2)h=320\pi$ $\frac{64}{3}h=320$ $h=\frac{320\times 3}{64}$ $h=15$ cm	M1 A1
6a	$\frac{60}{x}$	B1

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6b	$\frac{60}{x-6}$	B1
6c	$\frac{60}{x-6}-\frac{60}{x}=0.5$ $\frac{60x-60(x-6)}{x(x-6)}=0.5$ $\frac{60x-60x+360}{x^2-6x}=0.5$ $360=0.5(x^2-6x)$ $0.5x^2-3x-360=0$ $x^2-6x-720=0$	M1 M1 A1
6d	$(x-30)(x+24)=0$ $x-30=0$ or $x+24=0$ $x=30$ or $x=-24$	M1 A1
6e	$\frac{60}{30}=2litres$	B1
7a	$QB=\sqrt{71^2-58^2}$ $QB=40.951$ $QB=41.0$ m	M1 A1
7b	$tan64°=\left(\frac{58}{AQ}\right)$ $AQ=\frac{58}{tan64°}$ $AQ=28.288$ $AQ=28.3$ m $AB=28.288+40.951$ $AB=69.239$ $AB=69.2$ m	M1 M1 A1
7c	$\angle BDC=180°-90°-25°$ $=65°$ $\sin 65°=\frac{h}{71}$ $h=71\times\sin 65°$ $h=64.347$ $h=64.3$ m	 M1 A1
8a	Volume $=\frac{1}{3}\times(9\times7)\times8$ $=168$ cm^3	M1 A1
8b	In triangle VAB, ht $=\sqrt{8^2+3.5^2}$ $=\sqrt{76.25}$ In triangle VBC, ht $=\sqrt{8^2+4.5^2}$	M1 (any one)

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	$= \sqrt{84.25}$ Total surface area $= (9 \times 7) + 2\left(\frac{1}{2} \times 9 \times \sqrt{76.25}\right) + 2\left(\frac{1}{2} \times 7 \times \sqrt{84.25}\right)$ $= 205.84$ $= 206\ cm^2$	M1 – area of rectangle M1 – areas of triangular faces A1
8c	Pine: $mass = 0.65 \times 168$ $= 109.2$ grams Birch : mass $= 0.71 \times 168$ $= 119.28$ grams Teak : mass $= 0.63 \times 168$ $= 105.84$ grams Maple : mass $= 0.75 \times 168$ $= 126$ grams Answer: Pine and Teak.	M1 – for workings shown B1 - conclusion
	Alternate method: Density $= \frac{119}{168}$ $= 0.708\ g/cm^3$ Select wood type with density 0.708 or lower. Therefore, select Pine and Teak.	

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