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Class:	Candidate Name:	Candidate Index Number:
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SHUQUN SECONDARY SCHOOL
2017 End-of-Year Examination
Secondary 2 Express

MATHEMATICS

Paper 1

5 October 2017

Candidates answer on the Question Paper

1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, class and class index number in the spaces at the top of this page and all the work you hand in.

Write in 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.

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 requires the answer in terms of π .

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.

This question paper consists of 11 printed pages.

[Turn over]

Answer all questions.

- 1 (a) Calculate $\frac{5.23^3}{\sqrt{123.45 + 2.36}}$.

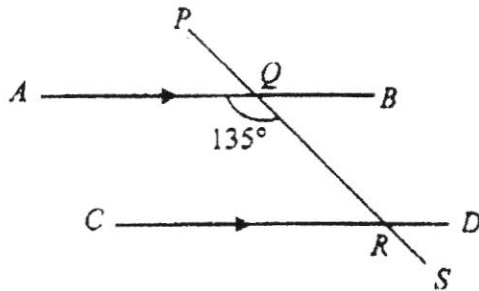
Write down the first five digits on your calculator display.

Answer [1]

- (b) Write your answer to part (a) correct to 2 significant figures.

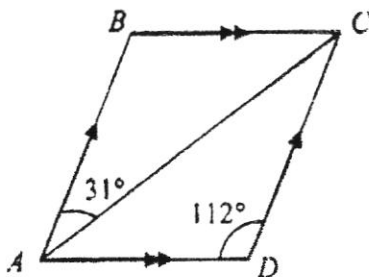
Answer [1]

- 2 In the diagram, AB and CD are parallel lines. PS cuts AB and CD at Q and R respectively. Given that $\angle AQR = 135^\circ$, find $\angle DRS$.



Answer° [2]

- 3 The diagram below shows parallelogram $ABCD$. Given that $\angle BAC = 31^\circ$ and $\angle ADC = 112^\circ$, find $\angle CAD$.



Answer° [2]

3

- 4 (a) Factorise completely $2a(b-c)-(b-c)$.

Answer [1]

- (b) Factorise completely $2m^2 + mn - 6m - 3n$.

Answer [2]

-
- 5 (a) Simplify $\frac{6g^2h^5}{18fg^3h^3}$.

Answer [1]

- (b) Simplify $\frac{x^2 - 2x + 1}{x^2 - 1}$.

Answer [2]

6 It is given that $s = ut + \frac{1}{2}at^2$.

(a) Find s when $u = 10$, $t = 2$ and $a = 9.8$.

Answer [1]

(b) Express a in terms of s , t and u .

Answer [2]

7 Beams from 3 different lighthouses are in continuous operation. The lighthouses operate at the same speed and it takes 18 seconds, 28 seconds and 35 seconds respectively for the beams to complete a round each. The last recorded time when all 3 beams shine simultaneously on a particular point X was 19 50.

(a) Find the next time when all 3 beams shine simultaneously on point X .

Answer [2]

(b) Find the number of complete rounds which the slowest beam would have made from 19 50 to 21 56.

Answer [1]

- 8 A map has a scale of 2 cm to 0.5 km. The distance on the map between Jurong East MRT station and Bukit Batok MRT station is 12.4 cm.
- (a) (i) Express the scale of the map in the form 1 : r .

Answer [1]

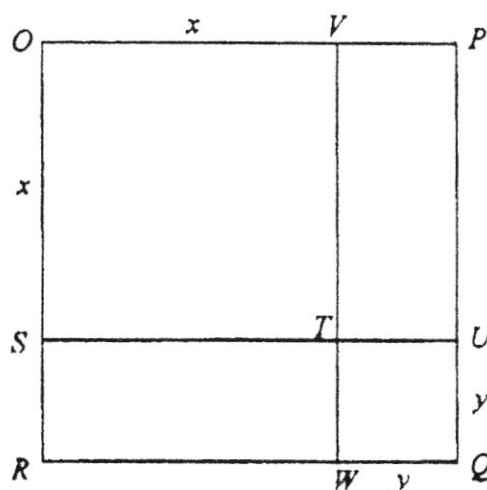
- (ii) Find the actual distance, in km, between Jurong East MRT station and Bukit Batok MRT station.

Answer km [1]

- (b) The actual area of Bukit Batok Nature Park is 0.36 km^2 . Find its area on the map in cm^2 .

Answer cm^2 [2]

- 9 In the diagram, $OPQR$ is a square. $OSTV$ is a smaller square of side x cm and $WTUQ$ is another smaller square of side y cm.



- (a) Express the length OP in terms of x and y .

Answer cm [1]

- (b) Express the area of square $OPQR$ in terms of x and y .

Answer cm^2 [1]

- (c) With reference to the diagram, explain why $(x + y)^2 = x^2 + y^2$.

Answer

.....

.....

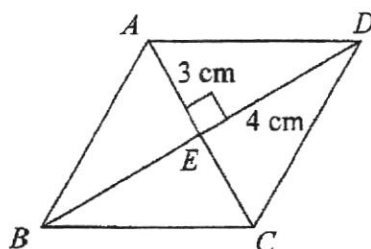
.....

.....

.....

..... [2]

- 10 In the diagram, $ABCD$ is a rhombus with diagonals AC and BD bisecting each other perpendicularly. $AE = 3$ cm, $ED = 4$ cm and triangles AED , AEB , CED and CEB are congruent.



- (a) Name another pair of congruent triangles not stated in the question.

Answer Triangles.....and..... [1]

- (b) Calculate the length of AD .

Answer cm [2]

- (c) Calculate the area of rhombus $ABCD$.

Answer cm^2 [1]

- 11 Two quantities, x^3 and $(y + 1)$ are in direct proportion.
Selected values of x and y are shown in the table below.

x	3	5	n
y	15.2	m	306.2

- (a) Find the equation connecting x^3 and y .

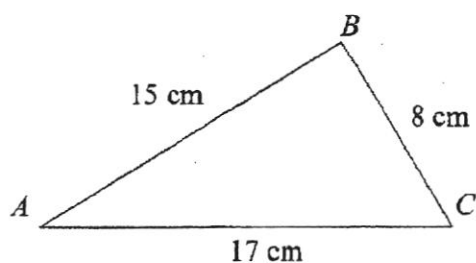
Answer [3]

- (b) Find the values of m and n .

Answer $m =$ [1]

$n =$ [1]

- 12 In triangle ABC , $AB = 15$ cm, $BC = 8$ cm and $AC = 17$ cm.



- (a) Prove that $\angle ABC$ is a right-angle.

Answer

[2]

- (b) State the value of

(i) $\cos \angle BAC$,

Answer [1]

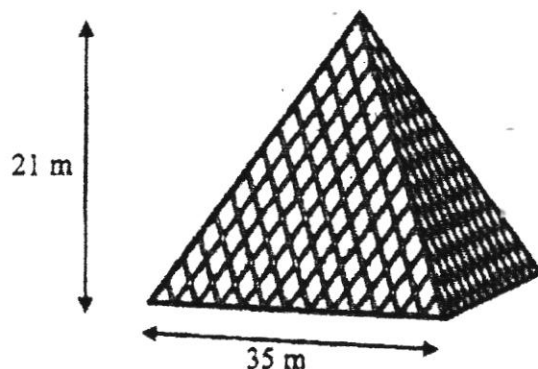
(ii) $\tan \angle ACB$.

Answer [1]

- (c) Calculate $\angle ACB$, correct to one decimal place.

Answer° [1]

- 13 The Louvre Pyramid is a large glass and metal pyramid located at the main entrance of the Louvre Museum in Paris. It has a perpendicular height of 21 m and a square base of side 35 m.



- (a) Calculate the volume of space within the pyramid.

Answer m³ (2)

- (b) A sculptor creates a spherical structure having the same volume as the Louvre Pyramid. Calculate the radius of the spherical structure.

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

Answer m (3)

- 14 The table below shows the number of hours that 16 children spend watching television in a week.

40	49	43	28	50	41	32	32
12	50	23	36	49	49	44	58

- (a) Complete the following stem-and-leaf diagram to represent this set of data.

Number of hours spent watching television in a week

Stem	Leaf
1	
2	
3	
4	
5	

Key: 1 | 2 means 12 hours.

[2]

- (b) State the mode of the distribution.

Answer [1]

- (c) A student is selected at random from this group.

- (i) Find the probability that the student spends less than 40 hours watching television in a week. Express your answer in the simplest form.

Answer [1]

- (ii) Find the probability that the student spends at least 40 hours watching television in a week.

Answer [1]

— END OF PAPER —

Class:	Candidate Name:	Candidate Index Number:
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SHUQUN SECONDARY SCHOOL
2017 End-of-Year Examination
Secondary 2 Express

MATHEMATICS

Paper 2

06 October 2017

Additional Material: Writing Paper

1 hour 30 minutes

Graph Paper (1 sheet)

INSTRUCTIONS TO CANDIDATES

Write your name, class and class index number in the spaces at the top of this page and all the work you hand in.

Write in 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.

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 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.

This question paper consists of 5 printed pages.

[Turn over]

Answer all questions.

- 1 Express $\frac{x-2}{3} + \frac{x}{5}$ as a single fraction in its simplest form. [2]

- 2 Solve the simultaneous equations. [3]

$$x + 2y = 3x - 4y = 5$$

- 3 (a) Without using a calculator, use algebraic rules to evaluate $801^2 - 1602 + 1$. Show your workings clearly. [1]

- (b) Given that $x + 2y = -2$ and $x - 2y = 18$, find the value of $x^2 - 4y^2$. [2]
Show your workings clearly.

- 4 Consider the following number sequence:

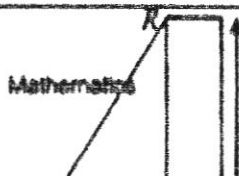
1, 4, 9, 16, ..., 400

- (a) Write down the 5th and 6th terms of the sequence. [1]
(b) Express the n th term of the sequence in terms of n . [1]
(c) How many terms are there in the sequence? [2]

- 5 4 water taps can fill up a fish tank in 20 minutes.

- (a) Find an equation connecting the time, t min, taken to fill up a fish tank and the number of water taps, w , required. [2]
(b) Find the time taken, in minutes, for 10 water taps to fill up 5 identical fish tanks. [2]

- 6 The figure below shows a waterslide, AP , supported by a vertical tower in a water theme park.



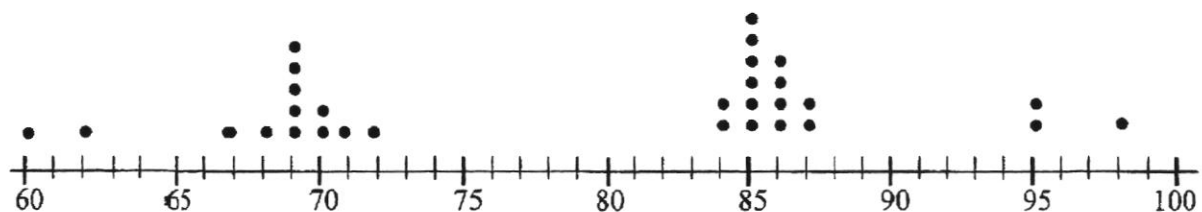
The waterslide AP has a length of 33 m and the angle made with the horizontal ground, $\angle PAQ = 25^\circ$.

The theme park would like to upgrade the slide to a height of 58 m.

It is stated in the safety requirement that the angle of the slide to the ground cannot exceed 60° .

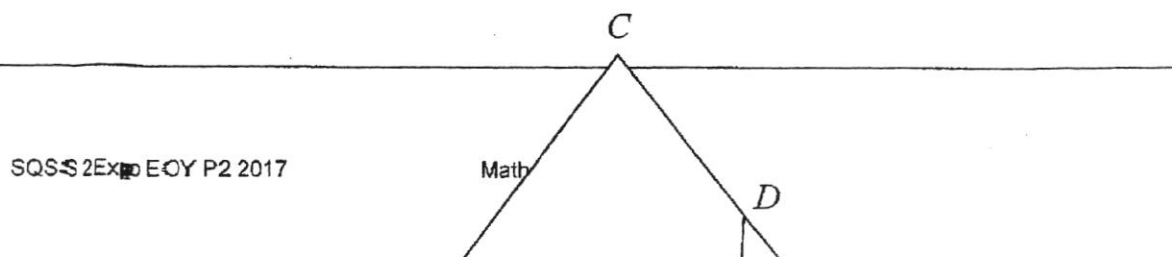
Determine, with calculations, if the new slide AR meets the safety requirement. [4]

- 7 The following dot diagram represents the marks of a class of students in a Mathematics quiz.



- How many students are there in the class? [1]
- State the modal mark. [1]
- Find the median mark obtained by the students. [1]
- Find the percentage of students who obtained 85 marks or more. [1]

- 8 In the figure below, $\triangle ABC$ is similar to $\triangle ADE$.



Given that $AD = 2.1$ cm, $BE = 7$ cm, $EA = 1.4$ cm and $DE = 1.5$ cm, find the length of

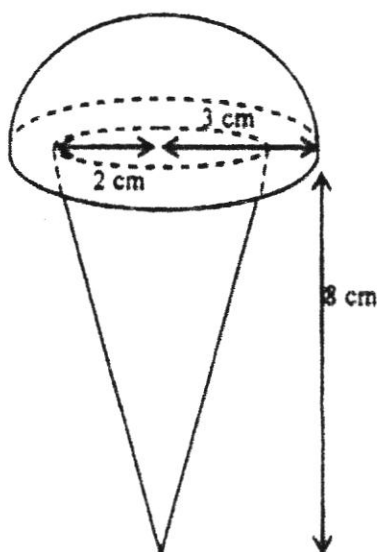
(a) BC , [2]

(b) CD . [3]

- 9 An ice cream cone model is made up of a hemisphere and cone. The hemisphere [5]
has a radius of 3 cm and the cone has a radius of 2 cm and height of 8 cm. Find
the total surface area of the model.

Curved surface area of a cone = πrl

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



- 10 Raphael cycles from his house to school at an average speed of 12 km/h every morning. The school is $(4x + 6)$ km away from his house. He realises that if he

increases the average speed of his bicycle by x km/h, he could save $\frac{1}{6}$ h of his travelling time.

- (a) Write down an expression, in terms of x , for the time taken, in hours, for Raphael to travel to school at 12 km/h. [1]
- (b) Write down an expression, in terms of x , for the time taken, in hours, for Raphael to travel to school if he increases the average speed of his bicycle by x km/h. [1]
- (c) Hence, form an equation in x and show that it reduces to $x^2 + x - 6 = 0$. [2]
- (d) Solve the equation and find the distance between Raphael's house and his school. [2]

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

The variables x and y are connected by the equation $y = \frac{1}{2}(5x - x^2)$.

Some corresponding values of x and y are given in the table below.

x	-1	0	1	2	3	4	5	6
y	a	0	2	b	3	2	0	-3

- (a) Find the values of a and b . [2]
- (b) Taking 2 cm to represent 1 unit on each axis, draw the graph of $y = \frac{1}{2}(5x - x^2)$ for $-1 \leq x \leq 6$. [3]
- (c) From your graph,
- (i) find the coordinates of the maximum point, [1]
 - (ii) state the equation of the line of symmetry, [1]
 - (iii) find the value of y when $x = 4.7$, [1]
 - (iv) find the values of x when $y = 2.5$. [2]

End of Paper

Shuqun Secondary School
End-of-Year Examination 2017
Secondary 2 Express Mathematics P1 Marking Scheme

1	(i)	10.619	B1	
	(ii)	11	B1	
2		$\angle CRS = 135^\circ$ (corr. $\angle$ s) $\angle DRS = 180^\circ - 135^\circ = 45^\circ$ ($\angle$ s on st. line) OR: $\angle CRQ = 180^\circ - 135^\circ = 45^\circ$ (int. $\angle$ s) $\angle DRS = 45^\circ$ (vert. opp. $\angle$ s) OR: $\angle QRD = 135^\circ$ (alt. $\angle$ s) $\angle DRS = 180^\circ - 135^\circ = 45^\circ$ ($\angle$ s on st. line)	M1 A1 M1 A1 M1 A1	
3		$\angle BAD = 180^\circ - 112^\circ = 68^\circ$ (int. $\angle$ s) $\angle CAD = 68^\circ - 31^\circ = 37^\circ$	M1 A1	
4	a	$(2a-1)(b-c)$	B1	
	b	$2m^2 + mn - 6m - 3n$ $= m(2m+n) - 3(2m+n)$ $= (2m+n)(m-3)$	M1 A1	No marks awarded for: $m(2m+n) - 3(2m-n)$
5	a	$\frac{h^2}{3fg}$	B1	
	b	$\frac{x^2 - 2x + 1}{x^2 - 1}$ $= \frac{(x-1)^2}{(x+1)(x-1)}$ $= \frac{x-1}{x+1}$	M1 A1	factorisation of numerator or denominator
6	a	39.6	B1	
	b	$s = ut + \frac{1}{2}at^2$ $\frac{1}{2}at^2 = s - ut$ $a = \frac{2(s-ut)}{t^2}$ OR $a = \frac{2s-2ut}{t^2}$	M1 A1	Isolate term in a

7	a	$18 = 2 \times 3^2$ $28 = 2^2 \times 7$ $35 = 5 \times 7$ $\text{LCM} = 2^2 \times 3^2 \times 5 \times 7$ $= 1260 \text{ s} = 21 \text{ min}$ $\text{Next time} = 20 \text{ 11}$	M1 A1	
	b	$2\text{h } 6 \text{ min} = 126 \text{ min} = 7560 \text{ s}$ $\text{Number of rounds} = 7560 \div 35 = 216$	B1	
8	a(i)	1 : 25000	B1	
	a(ii)	3.1 km	B1	
	b	$1 \text{ cm} : 0.25 \text{ km}$ $1 \text{ cm}^2 : 0.0625 \text{ km}^2$ OR Equivalent $\text{Area on map} = \frac{0.36}{0.0625} = 5.76 \text{ cm}^2$	M1 A1	Correct area scale
9	a	$OP = (x + y) \text{ cm}$	B1	
	b	$(x + y)^2$ OR $x^2 + 2xy + y^2$	B1	
	c	$(x + y)^2$, which represents the area of square $OPQR$, should also include the sum of areas of $RSTW$ and $VTUP$, which is $2xy$.	B1 B1	No marks awarded for explanation without reference to diagram
10	a	ABC and CDA OR ABD and CDB	B1	
	b	$AD^2 = 4^2 + 3^2$ $AD = 5 \text{ cm}$	M1 A1	
	c	$\text{Area of rhombus} = \left(\frac{1}{2} \times 4 \times 3 \right) \times 4 = 24 \text{ cm}^2$	B1	

11	a	$x^3 = k(y+1)$, where k is a constant. Sub $x = 3, y = 15.2$, $3^3 = k(16.2)$ $k = \frac{27}{16.2} = \frac{5}{3}$ $\therefore x^3 = \frac{5}{3}(y+1)$	M1 M1 A1	M1 correct direct proportion application M1 showing substitution of $x = 3, y = 15.2$ A1 correct equation must be seen (not sufficient if just solve for $k = \frac{5}{3}$)
	b	When $x = 5$, $5^3 = \frac{5}{3}(y+1)$ $y = 74 \quad \therefore m = 74$ When $y = 306.2$, $x^3 = \frac{5}{3}(306.2+1)$ $= 512$ $x = \sqrt[3]{512} = 8$ $\therefore n = 8$	B1 B1	
12	a	$AB^2 + BC^2 = 15^2 + 8^2 = 289$ $AC^2 = 17^2 = 289$ Since $AB^2 + BC^2 = AC^2$, by Converse of Pythagoras Theorem, ABC is a right-angled triangle.	M1 A1	
	b(i)	$\cos \angle BAC = \frac{15}{17}$	B1	If B0, award 1m for correct ratios seen for both b(i) and b(ii) – in cases where students go and calculate the angles.
	b(ii)	$\tan \angle ACB = \frac{15}{8}$	B1	
	c	$\tan \angle ACB = \frac{15}{8}$	B1	

		$\angle ACB = \tan^{-1} \frac{15}{8} = 61.9^\circ \text{ (to 1 d.p.)}$														
13	a	Vol. of pyramid $= \frac{1}{3} \times 35^2 \times 21$ $= 8575 \text{ m}^3$	M1 A1													
	b	$\frac{4}{3} \pi r^3 = 8575$ $r^3 = \frac{8575}{\frac{4}{3} \pi}$ $r = 12.7 \text{ m}$	M1 M1 A1	Equate formula for volume of sphere to Ans(a)												
14	a	Number of hours watching television studying in a week <table border="1"> <thead> <tr> <th>Stem</th> <th>Leaf</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>2</td> </tr> <tr> <td>2</td> <td>3 8</td> </tr> <tr> <td>3</td> <td>2 2 6</td> </tr> <tr> <td>4</td> <td>0 1 3 4 9 9 9</td> </tr> <tr> <td>5</td> <td>0 0 8</td> </tr> </tbody> </table>	Stem	Leaf	1	2	2	3 8	3	2 2 6	4	0 1 3 4 9 9 9	5	0 0 8	B2	Minus 1 m for 2 incorrect values / misalignment of leaves 0 m for more than 2 incorrect values / leaves not arranged in ascending order
Stem	Leaf															
1	2															
2	3 8															
3	2 2 6															
4	0 1 3 4 9 9 9															
5	0 0 8															
	b	49 hours	B1													
	c(i)	$P(\text{less than 40 hours}) = \frac{6}{16} = \frac{3}{8}$	B1	Not accepted: $\frac{6}{16}$												
	c(ii)	$P(40 \text{ hours or more}) = 1 - \frac{3}{8} = \frac{5}{8}$	B1													

Secondary 2 Express – 2017 End-of-Year Examinations
(Marking Scheme)

Paper 2

S/N	Solutions/Workings	Marks
1.	$\frac{x-2}{3} + \frac{x}{5}$ $= \frac{5(x-2) + 3x}{15}$ $= \frac{5x - 10 + 3x}{15}$ $= \frac{8x - 10}{15}$	M1 A1
2	By elimination $x + 2y = 5$ $2x + 4y = 10$ $3 + 2y = 5$ $2y = 2$ $y = 1$	M1 A1 A1
	By substitution $x + 2y = 5$ $x = 5 - 2y$ $x = 5 - 2(1)$ *Award only if correct manipulation shown	M1 A1 A1
3a.	$801^2 - 1602 + 1 = (801 - 1)^2$ $= 800^2$ $= 640\,000$	A1
3b.	$x^2 - 4y^2 = x^2 - (2y)^2$	M1

	$= (x+2y)(x-2y)$ $= (-2)(18)$ $= -36$	A1															
4a.	25, 36	B1															
4b.	$T_n = n^2$	B1															
4c.	$n^2 = 400$ $n = \sqrt{400}$ $n = 20$	M1 A1															
5a.	$tw = k$ $k = 20 \times 4$ $k = 80$ $tw = 80$	M1 A1															
5b.	<u>Method 1</u> <table border="1" data-bbox="336 891 1085 1084"> <thead> <tr> <th>Water tap</th><th>Fish tank</th><th>Time</th></tr> </thead> <tbody> <tr> <td>4</td><td>1</td><td>20 min</td></tr> <tr> <td>1</td><td>1</td><td>$20 \times 4 = 80$ min</td></tr> <tr> <td>10</td><td>1</td><td>$\frac{80}{10} = 8$ min</td></tr> <tr> <td>10</td><td>5</td><td>$8 \times 5 = 40$ min</td></tr> </tbody> </table> <u>Method 2</u> $tw = 80$ $t = \frac{80}{10}$ $t = 8$ min $5 \text{ tanks} = 8 \times 5$ $= 40$ min	Water tap	Fish tank	Time	4	1	20 min	1	1	$20 \times 4 = 80$ min	10	1	$\frac{80}{10} = 8$ min	10	5	$8 \times 5 = 40$ min	M1 A1 M1 A1
Water tap	Fish tank	Time															
4	1	20 min															
1	1	$20 \times 4 = 80$ min															
10	1	$\frac{80}{10} = 8$ min															
10	5	$8 \times 5 = 40$ min															
6	$\cos 25^\circ = \frac{AQ}{33}$ $AQ = 29.9081\dots$ $= 29.9 \text{ m (3 s.f.)}$ $\tan \angle RAQ = \frac{58}{29.9081\dots}$ $\angle RAQ = 62.7217\dots^\circ$ $= 62.7^\circ \text{ (1dp)}$ The new height RQ <u>does not meet the safety requirement</u> as $\angle RAQ > 60^\circ$.	M1 M1 A1 B1															
7a.	30 students	B1															

7b.	Modal mark = 85	B1
7c.	Median mark = $\frac{84+85}{2}$ = 84.5	B1
7d.	Percentage of students who obtained 85 marks or more $= \frac{15}{30} \times 100$ = 50%	B1
8a.	$\triangle ABC$ is similar to $\triangle ADE$. $\frac{AD}{AB} = \frac{DE}{BC}$ $\frac{2.1}{7+1.4} = \frac{1.5}{BC}$ $\frac{2.1}{8.4} = \frac{1.5}{BC}$ $BC = \frac{1.5 \times 8.4}{2.1}$ $= 6 \text{ cm}$	M1 A1
8b.	$\triangle ABC$ is similar to $\triangle ADE$. $\frac{AD}{AB} = \frac{AE}{AC}$ $\frac{2.1}{7+1.4} = \frac{1.4}{AC}$ $\frac{2.1}{8.4} = \frac{1.4}{AC}$ $AC = \frac{1.4 \times 8.4}{2.1}$ $= 5.6 \text{ cm}$ $AC = AD + CD$ $5.6 = 2.1 + CD$ $CD = 3.5 \text{ cm}$	M1 M1 A1

9.	Curved SA of hemisphere $= 2\pi r^2$ $= 2\pi(3)^2$ $= 18\pi \text{ cm}^2$ Using Pythagoras' Theorem, $l^2 = 8^2 + 2^2$ $l = \sqrt{8^2 + 2^2}$ $l = \sqrt{68}$ Curved SA of cone $= \pi rl$ $= \pi(2)(\sqrt{68})$ Area between hemisphere and cone $= \pi(3)^2 - \pi(2)^2$ $= 5\pi$ TSA = $18\pi + 2\sqrt{68}\pi + 5\pi$ $= 124 \text{ cm}^2$	M1 M1 M1 M1 A1
10a.	$\frac{4x+6}{12}$ or $\frac{2x+3}{6}$	B1
10b.	$\frac{4x+6}{12+x}$	B1
10c.	$\frac{4x+6}{12} - \frac{1}{6} = \frac{4x+6}{12+x}$ $\frac{4x+6-2}{12} = \frac{4x+6}{12+x}$ $\frac{4x+4}{12} = \frac{4x+6}{12+x}$ $\frac{x+1}{3} = \frac{4x+6}{12+x}$ $(x+1)(12+x) = 3(4x+6)$ $x^2 + 12x + x + 12 = 12x + 18$ $x^2 + x - 6 = 0$	M1 A1*
10d.	$(x-2)(x+3) = 0$ $x = 2$ or $x = -3$ Distance = $4(2) + 6$ $= 14 \text{ km}$	M1 A1

*Award only
if correct
manipulation
shown

11a.	$a = -3, b = 3$	B1, B1
11b.	Refer to page 6	B1 – Correct scale B1 – Correct plotting of values B1 – Smooth curve
11ci.	Maximum point = (2.5, 3.1)	B1
11cii.	$x = 2.5$	B1
11ciii.	When $x = 4.7$, $y = 0.7$ (accept ± 0.1)	B1
11civ.	When $y = 2.5$, $x = 1.4$ (accept ± 0.1) $x = 3.6$ (accept ± 0.1)	B1 B1

