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Name:	Class	Register Number

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DUNEARN SECONDARY SCHOOL
Mid-Year Examination 2016
Mathematics
Secondary 2 Express

Monday **9th May 2016** **0800 - 1030** **2 hours 30 mins**

INSTRUCTIONS TO CANDIDATES

Write your name, class and register number in the spaces at the top of this page.
Write in dark blue or black pen. You may use a soft pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

There are two sections in this paper.
Answer all **Section A** questions in the space provided in this paper.
Answer all **Section B** questions in the writing paper provided.

Omission of essential working will result in loss of marks.

INFORMATION FOR CANDIDATES

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.
At the end of the examination, fasten all your work securely together.
The use of an approved scientific calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.
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 100.

PARENT'S SIGNATURE

FOR EXAMINER'S USE
100

Setter: **Mr Louis Chin**

This question paper consists of 12 printed pages, including this cover page.

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Section A [50 Marks]

1 Solve $2f^2 - 288 = 0$.

Answer $f =$ ..... [2]

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2 Solve the following simultaneous equations.

$$4x + 3y = 10$$
$$y - 3x = -14$$

Answer $x =$ .....

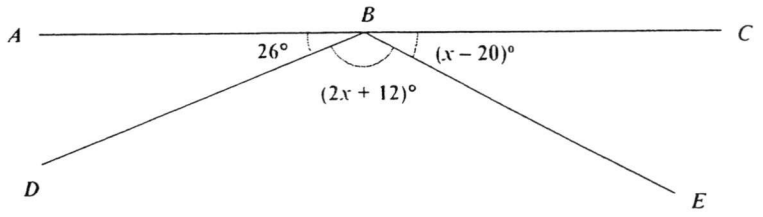
$y =$ ..... [3]

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3 In the given figure below, ABC is a straight line.



(a) Form an equation in x and solve it to find the value of x.

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

(b) Hence, find $\angle DBE$.

Answer (b) $\angle DBE =$ ..... ° [1]

---

4 y is inversely proportional to the square of x. Given that $y = 8$ for a particular value of x, find the value of y when the value of x is doubled.

Answer ..... [3]

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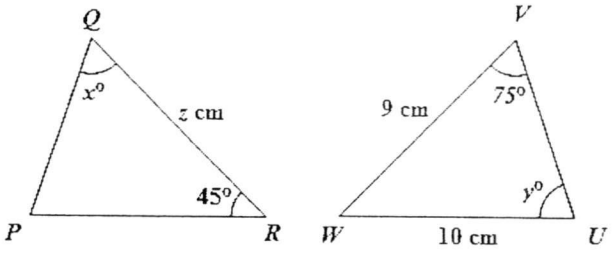
5 In the figure below, ΔPQR is congruent to ΔUVW.

Find the values of

(a) x,

(b) y,

(c) z.



Answer *(a)* $x =$ ..... ° [1]

(b) $y =$ ..... ° [1]

(c) $z =$ ..... cm [1]

---

6 One of the solution of $2x^2 + kx - 15 = 0$ is $x = -3$. Find

(a) the value of k,

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

(b) the other solution of the equation.

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

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7 The values of A and n are shown in the table below.

A	1	2	4	5	q
n	10	p	2.5	2	1

(a) Refer to the known values of A and n. State if A is directly/inversely proportional to n.
Give the reason for your answer,

Answer (a) A is ..... proportional to n because .....

..... [2]

(b) Find the values of p and q.

Answer (b) p = ...

q = ... [2]

---

8 Expand and simplify, where necessary, the following.

(a) $(9x - 1)(x + 2)$

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

(b) $7xy - [6x - 2y(7x - 3)]$

Answer (b) ..... [2]

---

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9 Given that y is directly proportional to $(x + 2)$ and that $y = 9$ when $x = 1$, find

(a) the equation connecting y and x,

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

(b) the value of y when $x = 2$,

Answer (b) $y =$ ..... [1]

(c) the value of x when $y = 15$.

Answer (c) $x =$ ..... [1]

---

10 Factorise the following completely.

(a) $4m^2 + 16mn + 16n^2$

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

(b) $4ac - 2bc + 3bd - 6ad$

Answer (b) ..... [2]

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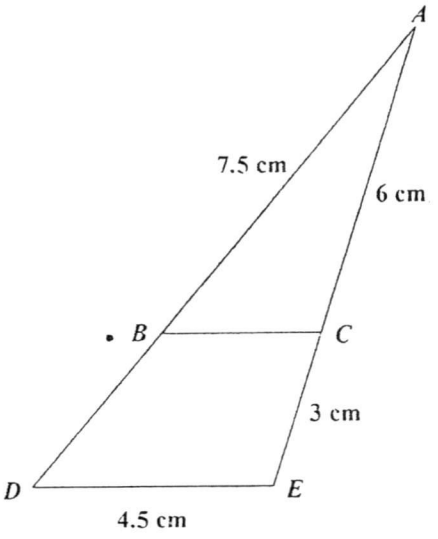
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11 Triangle ABC is similar to triangle ADE.

Find the length of

(a) BC,

(b) BD.



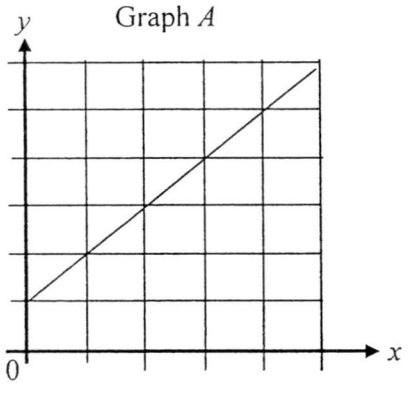
Answer (a) ..... cm [2]

(b) ..... cm [2]

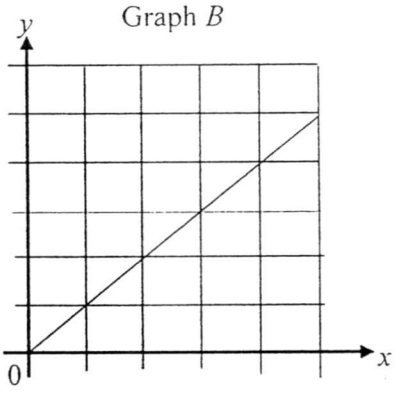
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12 **(a)** Two graphs A and B are shown below. Which graph shows that y and x are in direct proportion? Explain your reason.

Graph A



Graph B



Answer (a) Graph ..... because .....

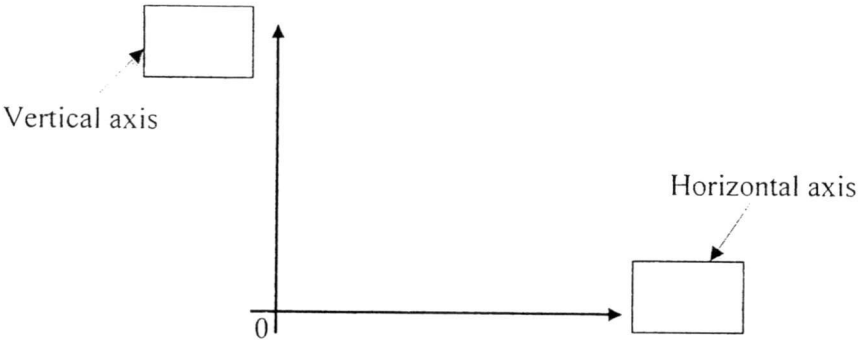
..... [2]

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(b) Sketch a **straight line graph** below to represent y is inversely proportional to x.

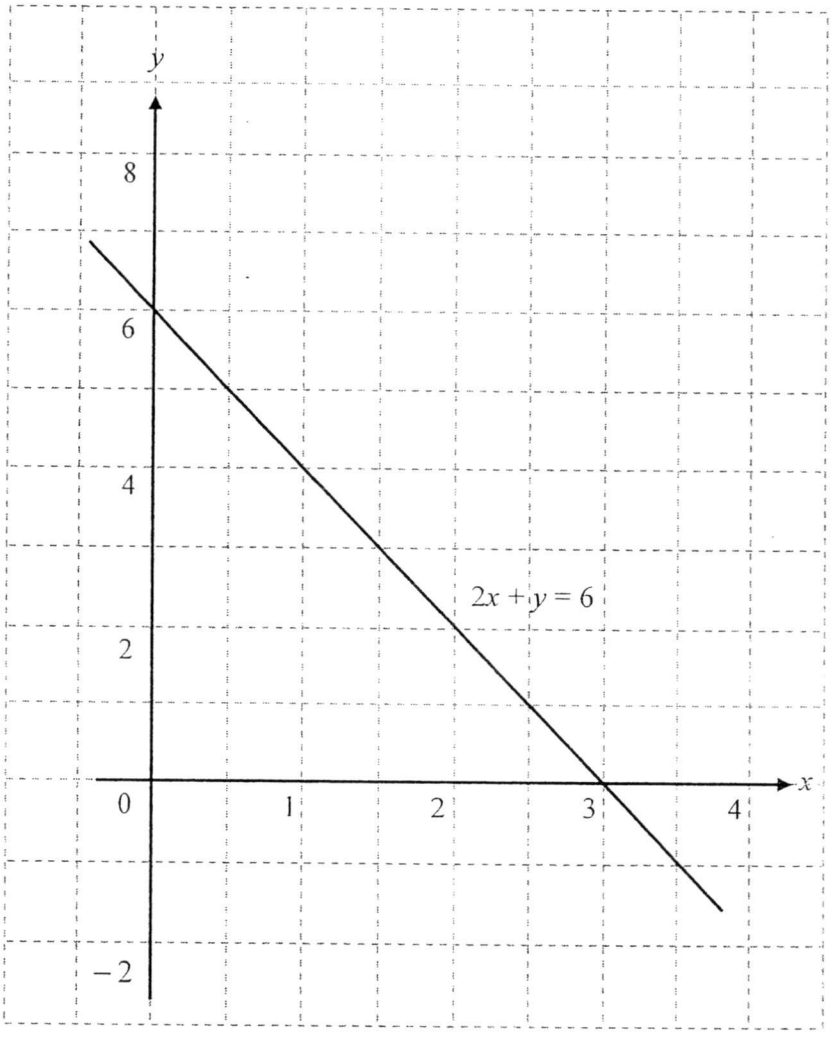
Fill in the correct labels for the vertical and horizontal axes.



[2]

---

13 The diagram shows the graph of $2x + y = 6$.



(a) Complete the table below for $y = 2x - 2$.

x	0	1	4
$y = 2x - 2$	−2	0	

[1]

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(b) On the grid above, draw and label the graph of $y = 2x - 2$. [2]

(c) Using the graph only, solve the following simultaneous equations.

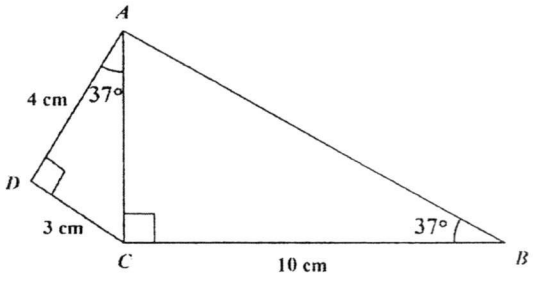
$$2x + y = 6$$
$$2x - y = 2$$

Appropriate lines or markings must be shown on the graph to illustrate your solution.

Answer (c) $x =$ ..... $y =$ ..... [1]

---

14 The diagram below is made up of two right angled triangles ABC and ACD. $\angle ACB = 90°$, $\angle ADC = 90°$, $BC = 10$ cm, $AD = 4$ cm and $DC = 3$ cm.



(a) Show that the two triangles are similar.

Answer (a):

[2]

(b) Complete the statement of similarity below.

Answer (b) Triangle ..... is similar to triangle ..... [1]

(c) What is the scale factor if $\triangle ABC$ is the enlargement of $\triangle CAD$?

Answer (c) Scale factor = ... [1]

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Section B [50 Marks]

15 10 workers need 15 days to build 25 shelters in the park. However, due to a shortage of workers, the company has only 6 workers to build the shelters. It is assumed that all the workers work at the same rate.

(a) How many **more** days would be needed to complete the job? [2]

(b) How many shelters can the 6 workers build in 15 days? [2]

---

16 On a public holiday, Aaron worked part time at a rate of $\$x$ per hour for 2 hours while Betty worked part time at a rate of $\$y$ per hour for one hour.

(a) If the total amount Aaron and Betty earned that day is \$55, write down an equation connecting x and y. [1]

(b) If the rate that Aaron earned per hour is \$5 more than Betty, write down an equation connecting x and y. [1]

(c) Solve the two equations from **(a)** and **(b)** to find the hourly rate earned by Aaron and by Betty. [3]

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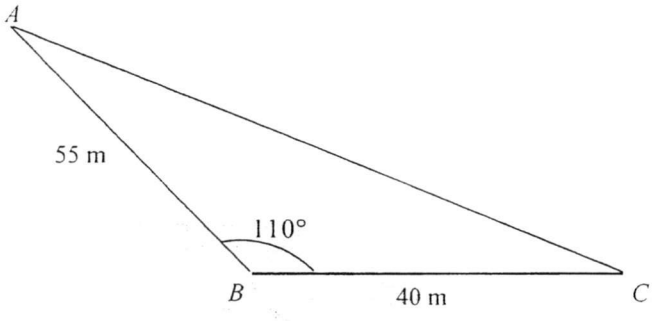
17 **(a)** **(i)** Factorise $a^2 - b^2$. [1]

(ii) **Hence**, evaluate $111^2 - 11^2$ without using a calculator. Show your working clearly. [2]

(b) If $(x - y)^2 = 64$ and $xy = 12$, find the value of $x^2 + y^2$. [2]

---

18 The diagram below shows a garden ABC.



(a) Make an accurate scale drawing of the garden using a scale of 1 cm to 5 m. [3]

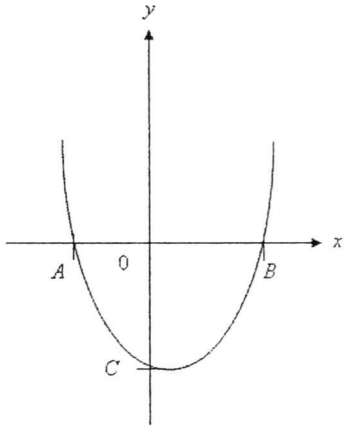
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(b) A flag pole needs to be located equidistant from points A, B and C. By constructing perpendicular bisectors, find the location of the flag pole and label it clearly as F. [2]

(c) Measure and write down the distance of the flag pole, F, from point B in metres. [1]

---

19 The curve $y = (x - 5)(x + 3)$ cuts the x-axis at A and B, and the y-axis at C.



(a) Write down the coordinates of A and B. [2]

(b) Find the y-intercept. [2]

(c) Find the coordinates of the minimum point. [2]

---

20 A map is drawn to a scale of 1 : 250000.

(a) The length measured between Town A and Town B on the map is 3.5 cm. What is the actual distance between the towns in kilometres? [2]

(b) Town B is 15 km away from Town C. What is the length on the map, in cm, between the two towns? [1]

(c) A lake on the map has an area of 2.4 cm^2. What is the actual area of the map in km^2? [2]

(d) Next to the lake is a park whose area is 13.75 km^2. What is the area of the park represented on the map, in cm^2? [1]

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21 Answer the whole of this question on a graph paper.

A stone is thrown from the ground. The height h, in metres, of the stone above the ground after t seconds is given by the equation

$$h = -2t^2 + 10t.$$

A table showing the values of h and t is given below.

t	0	0.5	1	1.5	2	2.5	3	3.5	4
$h = -2t^2 + 10t$	0	p	8	10.5	12	12.5	12	10.5	8

(a) Find the value of p. [1]

(b) Using a scale of 2 cm to represent 0.5 seconds, draw a horizontal t axis for $0 \leq t \leq 4$.

Using a scale of 1 cm to represent 1 metre, draw a vertical h axis for $0 \leq h \leq 13$.

On your axes, plot the points given in the table and join them with a smooth curve. [3]

(c) From the graph, find

(i) the height of the stone above the ground when $t = 2.25$ seconds. [1]

(ii) the values of t for which the height of the stone above the ground is 10 m. [2]

(d) Write down the equation of the line of symmetry. [1]

---

22 The rectangular field in Dunearn Secondary School has a breadth of x metres and a length that is 40 metres more than the breadth.

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

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

(c) Last year, the cost of engaging a contractor to maintain the field is \$15 per m^2. If the total cost of maintaining the field is \$18 000, form an equation in x and show that it reduces to $x^2 + 40x - 1200 = 0$. [3]

(d) Hence, solve the equation $x^2 + 40x - 1200 = 0$ to find the length and breadth of the field. [3]

(e) The budget for maintaining the school field has been cut to \$15 000. What is the maximum cost per m^2 that a contractor should propose in order to have a chance to win the job to maintain the field? [2]

End of Paper

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2016 2Exp MYE Marking Scheme

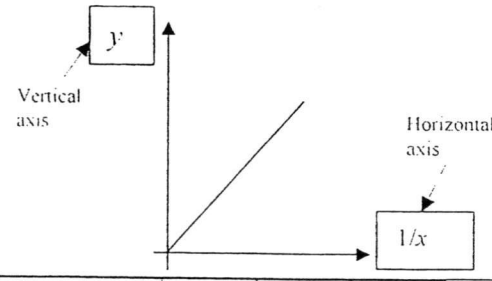
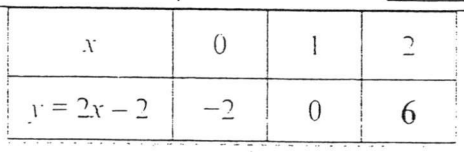
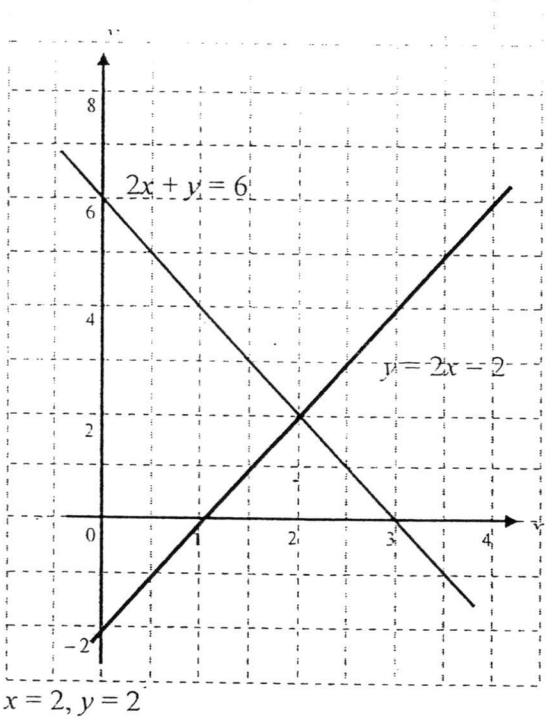
Note: −1 mark from overall for no or wrong units

Question	Solutions	Mark Scheme	Remarks
1	$f^2 = 144$ $f = \pm 12$	M1 A1	
2	Correct use of elimination or substitution method $x = 4, y = -2$	M1 A1,A1	
3 (a)	$(x - 20) + (2x - 12) - 26 = 180$ $x = 54$	M1 A1	
(b)	120°	B1	
4	$8 = \frac{k}{x^2}$ New $y = \frac{8x^2}{(2x)^2}$ 2	M1 M1 A1	
5 (a)	$x = 75$	B1	
(b)	$y = 60$	B1	
(c)	$z = 9$	B1	
6 (a)	$2(-3)^2 + k(-3) - 15 = 0$ $k = 1$	M1 A1	
(b)	$(2x - 5)(x + 3) = 0$ 2.5	M1 A1	ecf
7 (a)	inverse, because $A \times n = 10$, a constant	B1,B1	
(b)	$p = 5, q = 10$	B1,B1	
8 (a)	$9x(x + 2) - (x + 2)$ $9x^2 + 17x - 2$	M1 A1	
(b)	$7xy - (6x - 14xy + 6y)$ $21xy - 6x - 6y$	M1 A1	
9 (a)	$9 = k(1 + 2)$ $y = 3(x + 2)$	M1 A1	
(b)	12	B1	
(c)	3	B1	
10 (a)	$4(m^2 + 4mn + 4n^2)$ $4(m + 2n)^2$	M1 A1	1 mark only if not fully factorized e.g $(2m + 4n)^2$
(b)	$2c(2a - b) + 3d(b - 2a)$ $(2a - b)(2c - 3d)$	M1 A1	
11 (a)	$\frac{BC}{4.5} = \frac{6}{9}$ 3 cm	M1 A1	
(b)	$AD = 1.5 \times 7.5 = 11.25$ $BD = 11.25 - 7.5 = 3.75$ cm	M1 A1	
12 (a)	Graph ***B*** because for direct proportion, the graph needs to **pass through the origin**	B1 B1	

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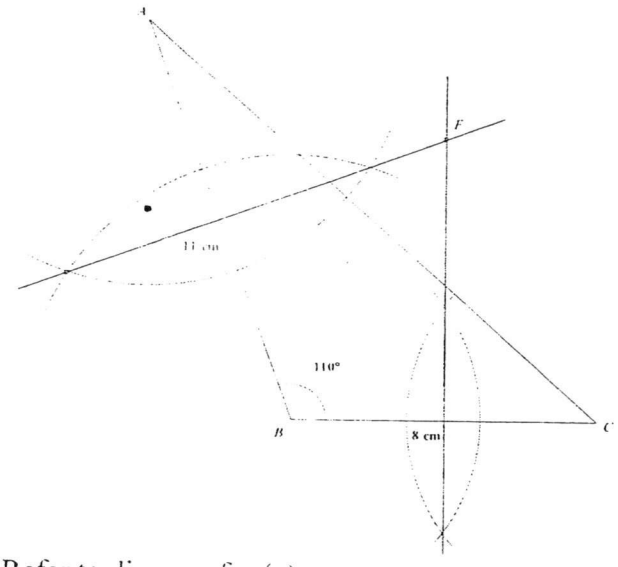
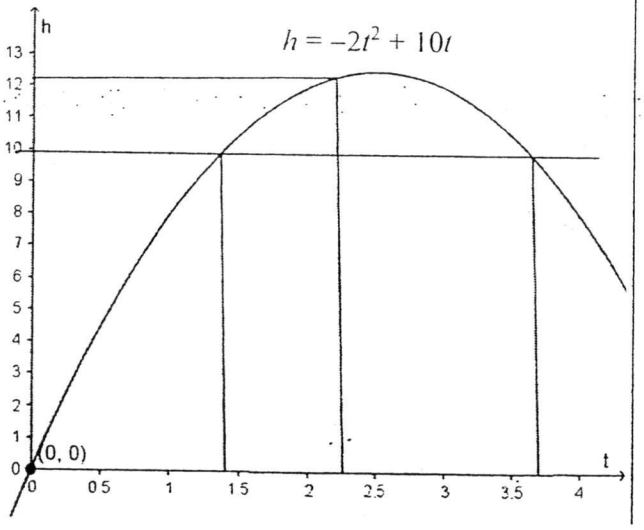
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	(b)		B1 B1	y for vertical axis 1/x for horizontal axis Any line passing through origin
13	(a)		B1	
	(b)		P1 B1	Correct points plotted Line with label
	(c)	$x = 2, y = 2$	B1	
14	(a)	$\angle ABC = \angle CAD = 37°$ $\angle ACB = \angle CDA = 90°$ $\angle BAC = \angle ACD = 180 - 90 - 37 = 53°$ Similar because all corresponding angles are equal	M1 A1	
	(b)	ΔADC is similar to ΔBCA	B1	
	(c)	2.5	B1	
15	(a)	6 workers → 25 days 10 more days	M1 A1	
	(b)	$\frac{25 \times 15}{25}$ or $\frac{25 \times 6}{10}$ 15 shelters	M1 A1	
16	(a)	$2x + y = 55$	B1	
	(b)	$x - y = 5$	B1	
	(c)	Any method to solve simultaneous equations $x = 20, y = 15$	M1 A1,A1	ecf
17	(a)(i)	$(a - b)(a + b)$	B1	

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	(ii)	$(111 + 11)(111 - 11)$ 12 200	M1 A1	
	(b)	$x^2 - 2(12) + y^2 = 64$ 88	M1 A1	
18	(a)		B1 B1 B1	Correct scale Correct lengths Correct angle
	(b)	Refer to diagram for (a)	B1 B1	⊥ bisector of AB & BC Label F
	(c)	41.5 m (± 0.5 m)	B1	
19	(a)	$A(-3, 0)$ and $B(5, 0)$	B1,B1	
	(b)	$y = (0 - 5)(0 + 3)$ -15	M1 A1	
	(c)	$y = (1 - 5)(1 + 3)$ since $x = 1$ at min. pt. $(1, -16)$	M1 A1	
20	(a)	1 cm : 2.5 km 8.75 km	M1 A1	
	(b)	6 cm	B1	
	(c)	1 cm^2 : 6.25 km^2 15 km^2	M1 A1	
	(d)	2.2 cm^2	B1	
21	(a)	4.5	B1	
	(b)		B1 P1 C1	Correct scales Correct points plotted Smooth curve

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	(c)	(i)12.4 (± 0.2) (ii) 3.6 or 1.4 (± 0.05)	B1 B1.B1	
	(d)	$t = 2.5$	B1	
22	(a)	$4x + 80$	B1	
	(b)	$x(x + 40)$	B1	
	(c)	$15x(x + 40) = 18\ 000$ $15x^2 + 600x - 18\ 000 = 0$ $x^2 + 40x - 1200 = 0$	M1 M1 A1	ecf ecf
	(d)	$(x - 20)(x + 60) = 0$ $x = 20$ or -60 (reject) Length = 60 m, Breadth = 20 m	M1 M1 A1	ecf ecf
	(e)	Area = $60 \times 20 = 1200\ m^2$ Max cost = $15000 \div 1200 = \$12.50$ per m^2	M1 A1	ecf

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