Surname	Centre Number	Candidate Number
Other Names		0

WJEC CBAC

GCSE

4370/06

SOLUTIONS

MATHEMATICS – LINEAR
PAPER 2
HIGHER TIER

A.M. MONDAY, 17 June 2013

2 hours

ADDITIONAL MATERIALS

A calculator will be required for this paper.

A ruler, a protractor and a pair of compasses may be required.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use gel pen or correction fluid.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** the questions in the spaces provided.

If you run out of space, use the continuation page at the back of the booklet, taking care to number the question(s) correctly.

Take π as 3·14 or use the π button on your calculator.

INFORMATION FOR CANDIDATES

You should give details of your method of solution when appropriate.

Unless stated, diagrams are not drawn to scale.

Scale drawing solutions will not be acceptable where you are asked to calculate.

The number of marks is given in brackets at the end of each question or part-question.

You are reminded that assessment will take into account the quality of written communication (including mathematical communication) used in your answer to question 3*(b)*(ii).

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1	3	
2	2	
3	14	
4	8	
5	7	
6	3	
7	4	
8	7	
9	3	
10	5	
11	5	
12	4	
13	7	
14	5	
15	6	
16	1	
17	6	
18	2	
19	8	
TOTAL MARK		

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Examiner only

1. The table below shows the shoe sizes of 20 people.

Shoe size	Number of people
38	3
39	9
40	5
41	3

Calculate the mean shoe size.

$$\text{Mean} = \frac{(3 \times 38) + (9 \times 39) + (5 \times 40) + (3 \times 41)}{20}$$

$$= \frac{114 + 351 + 200 + 123}{20}$$

$$= \frac{788}{20}$$

$$= 39.4$$

[3]

2. A fair coin and a fair six-sided dice are thrown together.
Calculate the probability of obtaining a head and a two.

$$P(\text{H and 2})$$

$$= \frac{1}{2} \times \frac{1}{6}$$

[2]

$$= \frac{1}{12}$$

Examine only

3. Miriam is planning a holiday in Pakistan.

(a) Miriam went to an exchange bureau to get some Pakistan rupees for her holiday.

She exchanged £540 for 85 000 Pakistan rupees.
Complete the statement below, giving your answer correct to two decimal places.

$\frac{85000}{540} = \frac{8500}{54} =$

'Exchange rate: £1 buys 157.41 Pakistan rupees' [3]

(b) Miriam knows that when it is 1p.m. in London it is 6p.m. local time in Karachi, Pakistan. (+5 hours)
Miriam is booked onto a flight leaving London on Tuesday at 13:50.
The flight time is 7 hours 51 minutes.

(i) On which day and at what local time should Miriam land in Karachi?

13·50 + 5 hrs + 7hrs 51 min

= 13·50
5·00
+ 7·51
26·41

so 2hrs 41 min into next day

Day Wed Landing time 02·41 [4]

(ii) *You will be assessed on the quality of your written communication in this part of the question.*

Miriam's flight actually arrived 7 hours 45 minutes after departure.
The aeroplane flying speed between London and Karachi was 434 knots.
Given that 1 knot is 1·85 km/h, calculate the flying distance between London and Karachi.
Give your answer in kilometres.

45 hr
60

Time taken = 7hrs 45 min = 7·75 hours

Speed = 434 knots

$S = \frac{D}{T}$ ×T

$S \times T = D$

1 knot = 1·85 km/h

434 knots = 434 × 1·85

= 802·9 km/h

802·9 × 7·75 = D

6222·48 KM = D

[7]

Examiner only

4. Across the world, temperatures are measured using different units.
All the unit scales are uniform.

Approximate conversions are often used to give a reading in more than one unit in scientific reports.

Use the information given below to complete the tables.

(a)

degrees Celsius	degrees Fahrenheit
20	68
30	86
40	104
50	122
60	140
70	158

+10 +10 +10 +10 +10 +18 +18 +18 +18 +18

.....

.....

[1]

(b)

kelvin	degrees Celsius
0	−273·15°
100	−173·15°
200	−73·15
300	26·85
400	126·85
500	226·85

+100 +100 +100 +100 +100 −100 −100 −100 −100 −100

.....

.....

[2]

Examiner only

(c)

kelvin	degrees Celsius	degrees Fahrenheit
340	66·85	152·33

Ok + 340 = 340k

−273·15°C + 340 = 66·85°C

Recall 60°C = 140°F

70°C = 158°F

10°C increase = 18°F increase

1°C increase = 1·8°F increase

6·85° increase = 6·85 × 1·8 = 12·33°F increase

∴ 66·85°C = 140 + 12·33

= 152·33°F

[5]

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Examiner only

5. *(a)* Solve $8x - 11 = 3x + 29$.

$8x - 3x = 29 + 11$

$5x = 40$

$x = \frac{40}{5}$

$x = 8$

[3]

(b) Factorise $7x + 49$.

$= 7(x + 7)$

[1]

(c) Factorise $x^2 - 10x$.

$= x(x - 10)$

[1]

(d) Expand $2x(x + 6)$.

$= 2x^2 + 12x$

[2]

Examiner only

6. The diagram shows a rectangle $ABCD$.

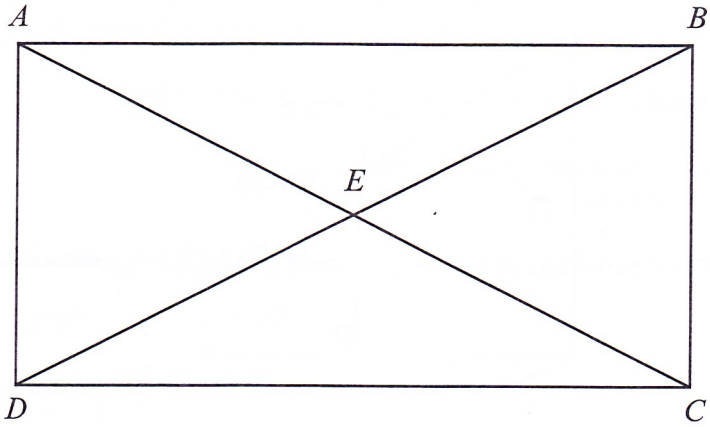

Diagram not drawn to scale

Select 3 **different** pairs of congruent triangles shown in the diagram above and then complete the sentences below for your 3 selections.

Triangle ABE is congruent to triangle EDC

Triangle AED is congruent to triangle BEC

Triangle ACD is congruent to triangle BCD

[3]

means exactly the same as

Examiner only

7.

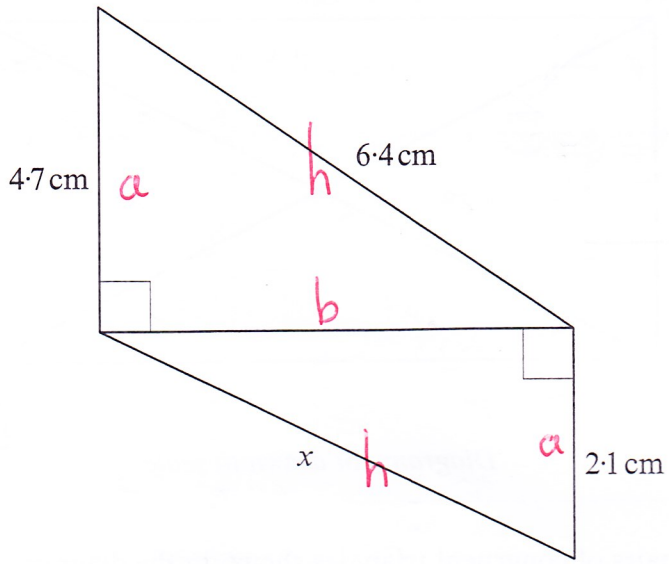

Diagram not drawn to scale

Calculate the length of the side marked x.

Top triangle $h^2 = a^2 + b^2$

$6.4^2 = 4.7^2 + b^2$

$40.96 - 22.09 = b^2$

$18.87 = b^2$

Bottom triangle $h^2 = a^2 + b^2$

$x^2 = 2.1^2 + 18.87$

$x^2 = 23.28$

$x = 4.82$ cm.

[4]

Examiner only

8. A factory production line packs buttons into bags.
There are exactly 80 buttons packed into each bag.
There is a mixture of different coloured buttons in each bag.
A total of 600 bags of buttons were packed in a day.

The first 100 bags were checked and it was found that a total of 1200 red buttons had been used.
In the 600 bags of buttons, it was found that the relative frequency of red buttons packed was 40%.

Calculate the relative frequency of red buttons packed in the final 500 bags.

$80 \times 600 = 48\,000$ buttons in a day were packed.

For first 100 bags: Total buttons $= 80 \times 100 = 8000$

$\therefore$ % red $= \frac{1200}{8000} \times 100 = 15\%$

TOTAL Number of Red in 600 bags $= 40\%$ of $48\,000$
$= 19200$

This means than in last 500 bags
there are $19200 - 8000 = 11\,200$ red beads.

Total buttons in 500 bags $= 500 \times 80 = 40\,000$

$\therefore$ Rel. freq. of red in last 500
$= \frac{11\,200}{40\,000} \times 100\%$
$= 28\%$

[7]

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Examiner only

9. On the squared paper provided, draw the region which satisfies all of the following inequalities.

$$y \leqslant 8$$
$$x + y \geqslant 2$$
$$y \geqslant 2x - 4$$

Make sure that you clearly indicate the region that represents your answer.

below boundary (solid)

Above Boundary (solid)

Above Boundary (solid)

$x + y \geqslant 2$

$y \geqslant 2 - x$

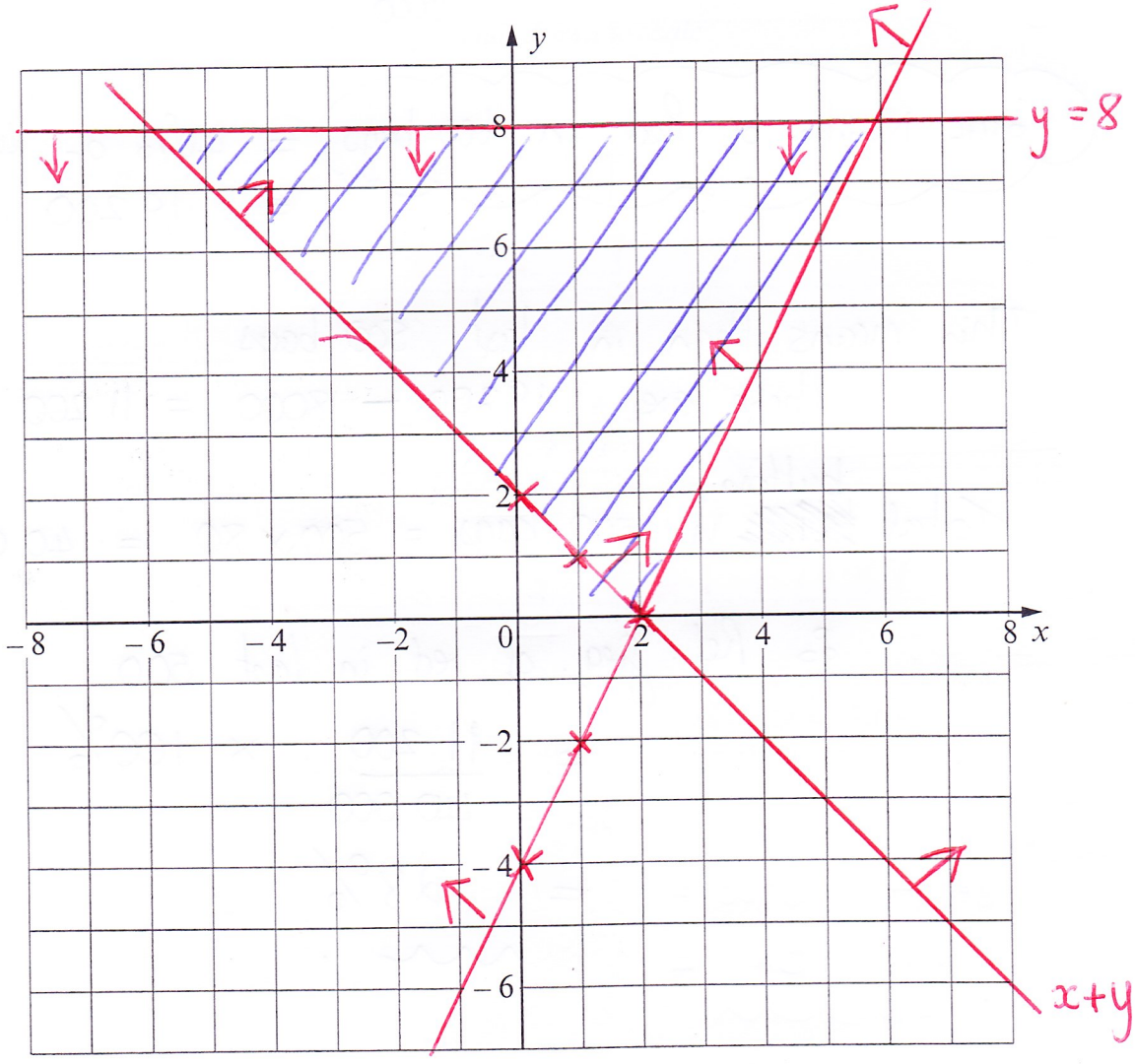
Boundary $y = 2 - x$

x	0	1	2
y	2	1	0

$y \geqslant 2x - 4$

Boundary $y = 2x - 4$

x	0	1	2
y	-4	-2	0

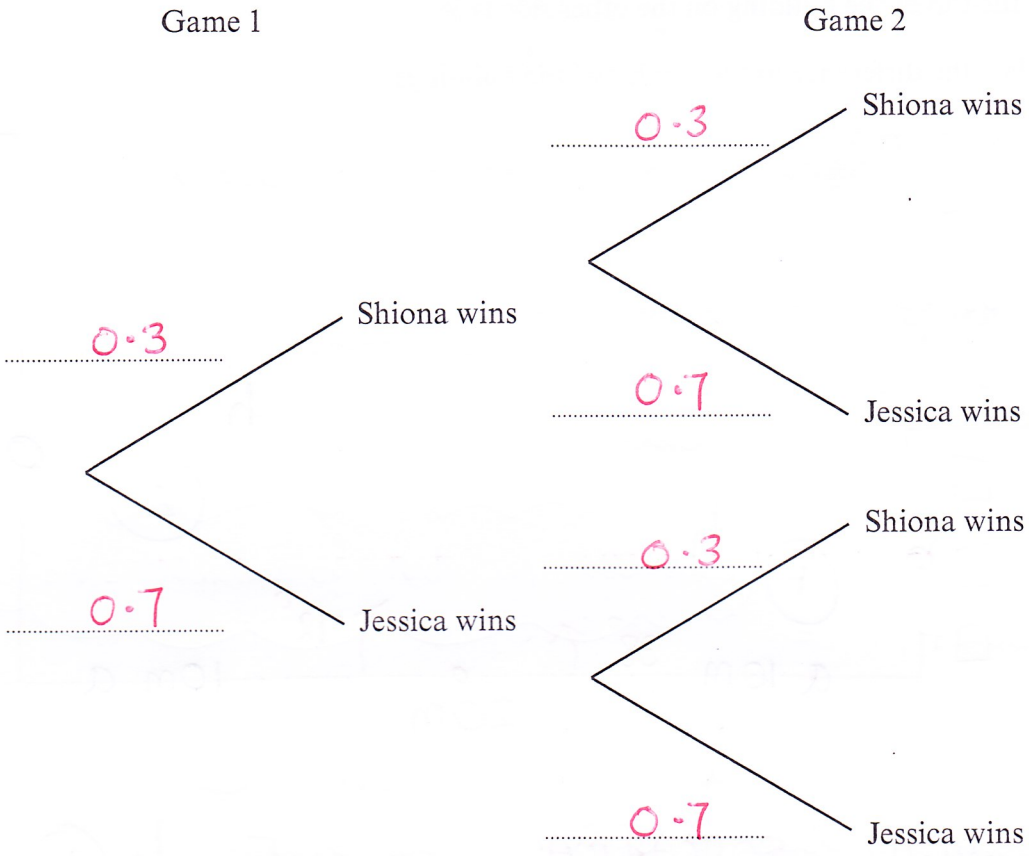


[3]

Examiner only

10. Whenever Shiona and Jessica play a game of 'Jewels' the probability that Shiona wins is 0·3.

(a) Complete the following tree diagram to show the probabilities of what can happen when Shiona and Jessica play two games of 'Jewels'.



[2]

(b) Calculate the probability that Shiona wins exactly one game.

P(Siona wins and Jess wins OR Jess wins and Siona wins)

$= (0.3 \times 0.7) + (0.7 \times 0.3)$

$= 0.21 + 0.21$

$= 0.42$

[3]

Examiner only

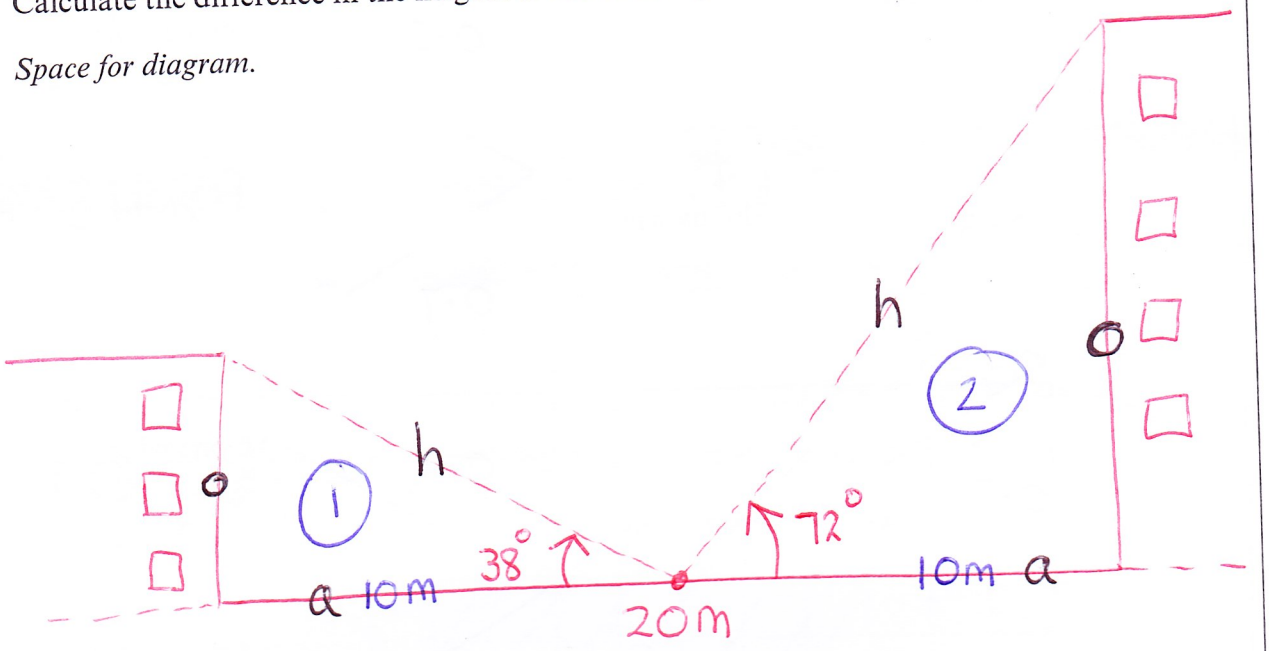
11. City planners need to know the difference in height between a building on one side of a road and a building on the other side of the road.
The buildings are vertical and directly opposite each other.

The horizontal road is 20 m wide.
From the centre of the road between the buildings, the angle of elevation of

- the top of the building on one side is 72°,
- the top of the building on the other side is 38°.

Calculate the difference in the heights of the buildings.

Space for diagram.



Triangle (1) SOHCAHTOA

$\tan x = \frac{O}{a}$

$\tan 38^\circ = \frac{O}{10}$

$10 \tan 38^\circ = O$

$7.81\text{ m} = ht$

Triangle (2)

$\tan x = \frac{O}{a}$

$\tan 72^\circ = \frac{O}{10}$

$10 \tan 72^\circ = O$

$30.8\text{ m} = ht$

∴ difference in height $= 30.8 - 7.8$

$= 23$ M

[5]

Examiner only

12. Show that $(4x - 1)(6x + 5) - (8x - 1)(3x + 5)$ is identical to $-23x$.

$= 24x^2 + 20x - 6x - 5 - (24x^2 + 40x - 3x - 5)$

Expand the bracket

$= 24x^2 + 20x - 6x - 5 - 24x^2 - 40x + 3x + 5$

$= 0x^2 - 23x + 0$

All combine to give $-23x$

[4]

Examiner only

13. Dewi's company is planning a new logo.
The diagram shows two similar versions of the planned logo.

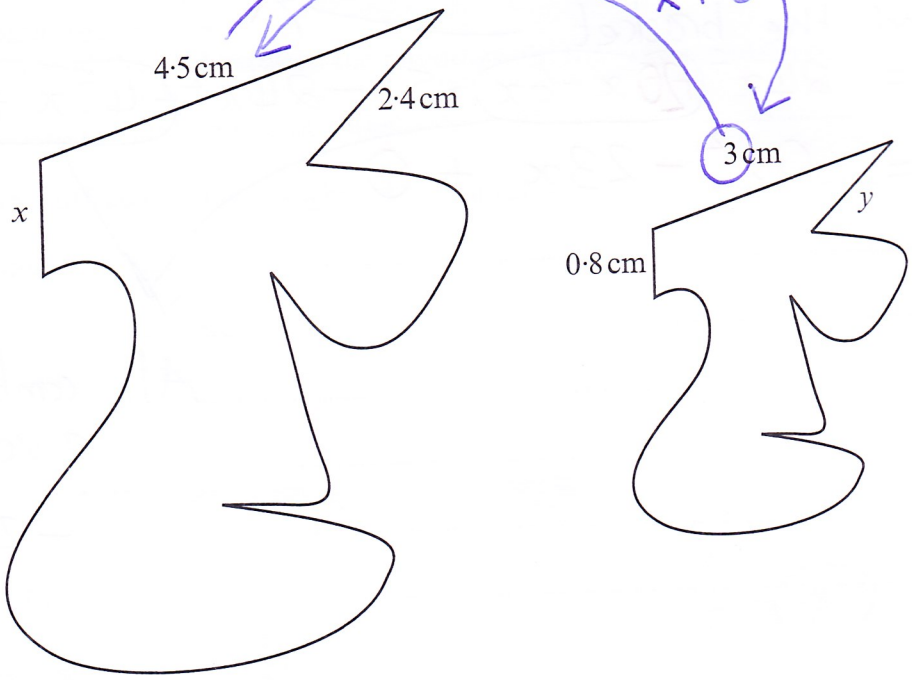


Diagram not drawn to scale

(a) Calculate the lengths of the sides marked x and y.

SFactor $= \frac{4 \cdot 5}{3} = 1 \cdot 5$

$y = 2 \cdot 4 \div 1 \cdot 5$

$y = 1 \cdot 6$ cm.

$x = 0 \cdot 8 \times 1 \cdot 5$

$x = 1 \cdot 2$ cm

$x =$ 1·2 cm

$y =$ 1·6 cm

[4]

Examiner only

(b) The smaller of the two versions of the logo costs £3.40 to paint with metallic gold paint. Calculate the cost of painting the larger version of the logo with the same metallic gold paint.

Area of small costs £3.40

Area of large one to paint costs = £3.40 × 1.5^2

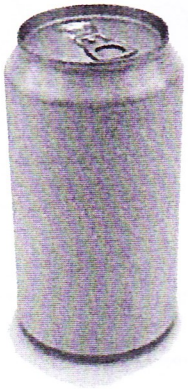
= £7.65

area gets multiplied by scale factor squared!!

[3]

Examiner only

14.



In the UK, some soft drinks are sold in cans.
75% of all these cans are made of aluminium.
In 2008, 5 billion aluminium cans were sold.

Given that 1 billion is 1000 million, calculate how many of the cans that were sold in 2008 were **not** made of aluminium.
Give your answer in standard form correct to two significant figures.

AL : 75% of cans = 5 000 000 000

75% ÷ 3 = 25%

NOT AL : 25% = 5 000 000 000 ÷ 3

$= 1.6\dot{6} \times 10^9$

$\approx 1.7 \times 10^9$ to 2 sig figs.

1st sig fig

2nd sig fig

[5]

Examiner only

15. *(a)* By factorising, solve the following quadratic equation.

$$8x^2 + 18x - 5 = 0$$

By inspection $(4x - 1)(2x + 5) = 0$

either

$4x - 1 = 0$ or $2x + 5 = 0$

$4x = 1$ $\quad 2x = -5$

$x = \frac{1}{4}$ $\quad x = \frac{-5}{2}$

[3]

(b) Use the quadratic formula to solve the following quadratic equation, giving your answers correct to 2 decimal places.

$$3x^2 - 5x - 7 = 0$$

$a = 3 \quad b = -5 \quad c = -7$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-(-5) \pm \sqrt{(-5)^2 - 4(3)(-7)}}{2(3)}$$

$$x = \frac{5 \pm \sqrt{25 + 84}}{6}$$

$$x = \frac{5 \pm \sqrt{109}}{6}$$

[3]

Either

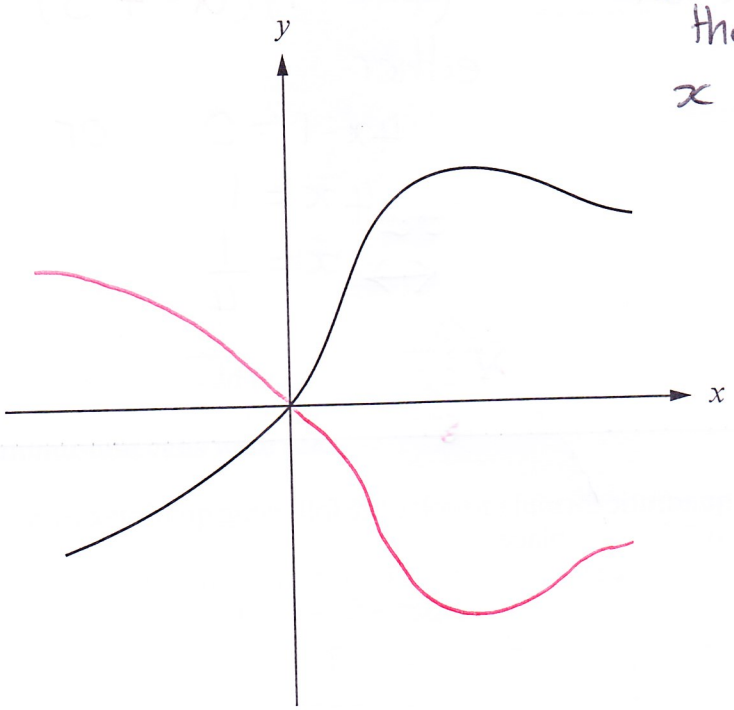
$x = \frac{5 + \sqrt{109}}{6}$ or $x = \frac{5 - \sqrt{109}}{6}$

$x = 2.57$ $\quad x = -0.91$

Examiner only

16. The diagram shows a sketch of $y = f(x)$.
On the same diagram, sketch the curve $y = -f(x)$.

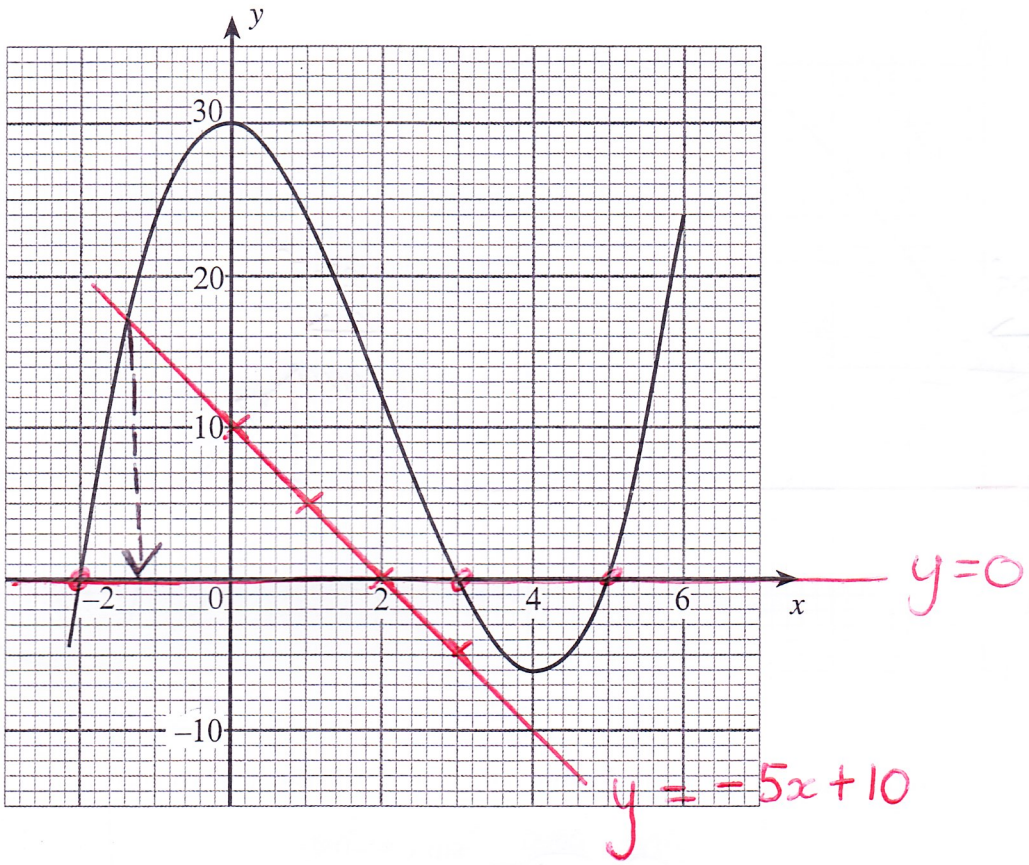
Reflect in the x axis !!



[1]

Examiner only

17. The graph of the equation $y = x^3 - 6x^2 - x + 30$ is shown on the graph paper below.



Use the graph above to answer the following questions.

(a) Solve $x^3 - 6x^2 - x + 30 = 0$.

Plot curve given and $y=0$ (x axis)

Intersect at $x = -2$ $x = 3$ $x = 5$ [2]

(b) By drawing a suitable straight line, solve the equation $x^3 - 6x^2 - x + 30 = -5x + 10$.

Need to draw $y = -5x + 10$ curve given $y = -5x + 10$

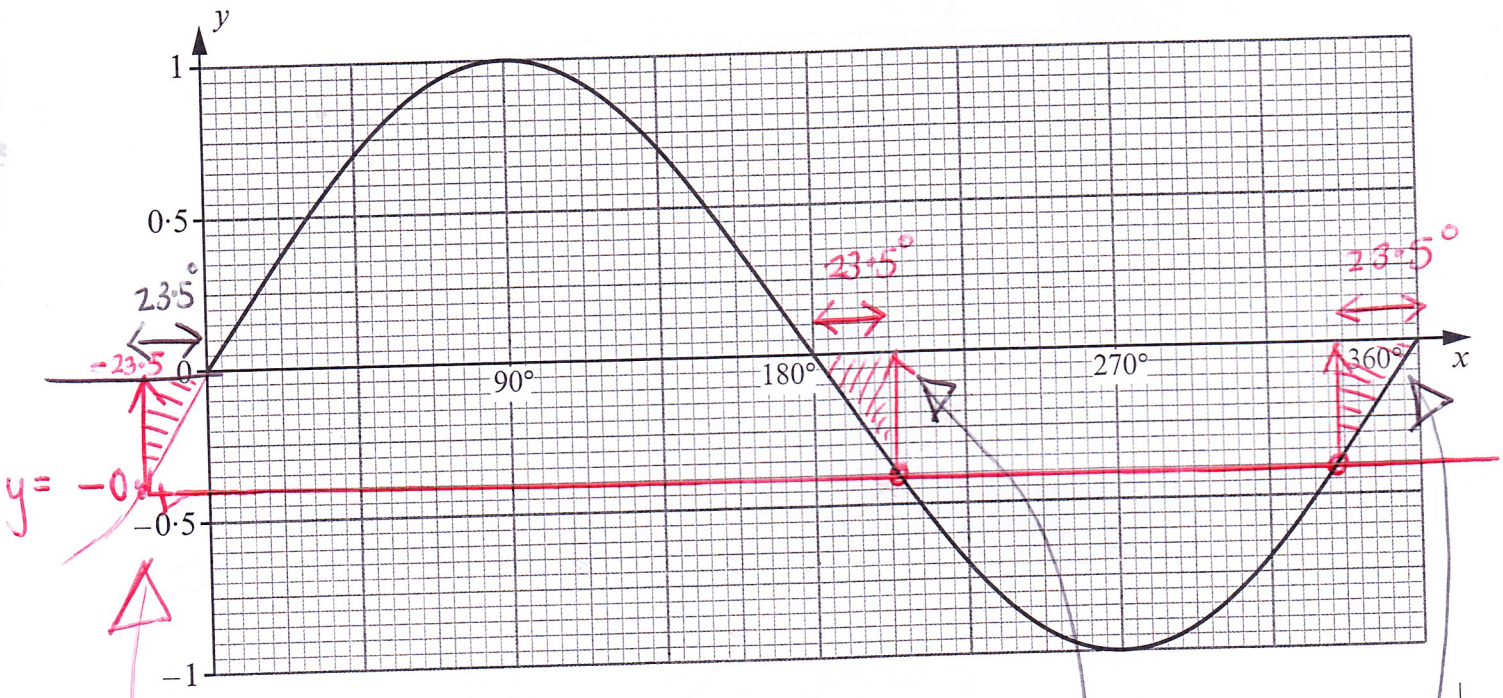
x	0	1	2	3
y	10	5	0	−5

One intersection point

$x = -1.4$ [4]

Examiner only

18. The diagram below shows the graph of $y = \sin x$ for values of x from 0° to 360°.



Find all solutions of the following equation in the range 0° to 360°.

$$\sin x = -0{\cdot}4$$

Need to plot y = Sinx and y = −0·4 (This is given)

↑ horizontal line

No from calculator

[Shift] [Sin] [−] [0] [·] [4] [=]

[2]

Ans = −23·5°

So from diagram extending graph gives 23·5° shown

From symmetry we have 23·5° here and here too

$x = 180 + 23{\cdot}5$ and $x = 360 - 23{\cdot}5$

$x = 203{\cdot}5°$ $x = 336{\cdot}5°$

Examiner only

19. A triangular flowerbed in a park is being prepared for planting bulbs.
The gardener is going to lay compost over all the flowerbed to a depth of 12 cm.

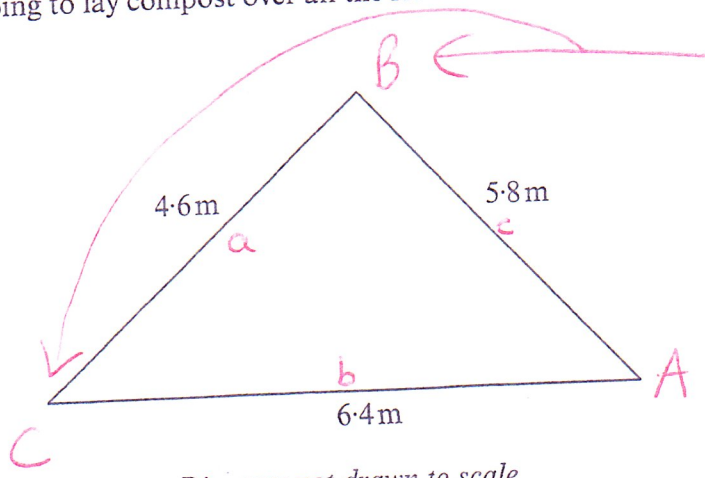


Diagram not drawn to scale

Calculate the volume of compost required.

STEP ONE : Calculate an angle
TWO : Calculate area
THREE : Calculate volume

Find angle A (You could find any angle to use)

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

$4{\cdot}6^2 = 6{\cdot}4^2 + 5{\cdot}8^2 - 2(6{\cdot}4)(5{\cdot}8)\cos A$

$21{\cdot}16 = 40{\cdot}96 + 33{\cdot}64 - 74{\cdot}24\cos A$

$74{\cdot}24\cos A = 40{\cdot}96 + 33{\cdot}64 - 21{\cdot}16$

$74{\cdot}24\cos A = 53{\cdot}44$

$\cos A = 0{\cdot}7198$

$A = 44{\cdot}0^\circ$

Use this version of formula because we know $\hat{A}$.

Find area of triangle

$A = \frac{1}{2}bc\sin A$

$A = \frac{1}{2}(6{\cdot}4)(5{\cdot}8)\sin 44{\cdot}0$

$A = 12{\cdot}89\ m^2$

12 cm = 0·12 m

$\therefore$ Volume = CSA × d

$V = 12{\cdot}89 \times 0{\cdot}12$

$V = 1{\cdot}55\ m^3$

[8]

Question number	Additional page, if required. Write the question numbers in the left-hand margin.

Examiner only