| Surname | Centre Number | Candidate Number |
|---|---|---|
| Other Names | | 0 |

WJEC CBAC

# GCSE

4370/06

SOLUTIONS

# MATHEMATICS – LINEAR
## PAPER 2
## HIGHER TIER

A.M. WEDNESDAY, 13 June 2012

2 hours

| For Examiner's use only | | |
|---|---|---|
| Question | Maximum Mark | Mark Awarded |
| 1 | 7 | |
| 2 | 13 | |
| 3 | 5 | |
| 4 | 13 | |
| 5 | 9 | |
| 6 | 3 | |
| 7 | 5 | |
| 8 | 4 | |
| 9 | 3 | |
| 10 | 11 | |
| 11 | 5 | |
| 12 | 5 | |
| 13 | 4 | |
| 14 | 6 | |
| 15 | 7 | |
| TOTAL MARK | | |

### ADDITIONAL MATERIALS

A calculator will be required for this paper.

### 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 $\pi$ as 3·14 or use the $\pi$ 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 **2***(a)*.







4370 060001

Examiner only

**1.** *(a)* A bag contains 10 beads, of which 2 are red, 3 are blue and 5 are yellow.
One bead is selected at random from the bag.
Find the probability that the bead is

(i) white,

0 or $\frac{0}{10}$

[1]

(ii) either red or yellow.

$\frac{7}{10}$

[1]

*(b)* A fair dice is thrown.
What is the probability that the top face shows a square number?

$\frac{2}{6} = \frac{1}{3}$

[2]

*(c)* There are marbles of 6 different colours in a bag.
The table shows the probabilities of selecting the different coloured marbles from the bag.

| Colour | Red | Orange | Yellow | Green | Blue | Purple |
|---|---|---|---|---|---|---|
| Probability | 0·23 | 0·12 | 0·13 | | 0·22 | 0·21 |

(i) Complete the entry for Green in the table.

$1 - 0{\cdot}23 - 0{\cdot}12 - 0{\cdot}13 - 0{\cdot}22 - 0{\cdot}21$

$= 0{\cdot}09$

[2]

(ii) Which colour of marble is the mode?

RED

[1]

4370 060003

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

Valley Water Company measures the water used by a household in cubic metres.
There is a quarterly standing charge of £7.45.
The first 25 cubic metres of water used are charged at a rate of 93 pence per cubic metre.
All further water used is charged at the rate of 132 pence per cubic metre.

Calculate the quarterly water bill for a household using 46 cubic metres of water.

Quarterly bill = £7·45 + (25 × 0·93) + (21 × 1·32)

= 7·45 + 23·25 + 27·72

= £58·42

[6]

*(b)* A different water company, Trevi Water, has a different scale of charges.

> Trevi Water:
> - Quarterly standing charge £4
> - First 10 cubic metres per quarter at £1.50 per cubic metre
> - All further water charged at £2 per cubic metre

Write down, in its simplest form, an expression for the quarterly bill in pounds for a Trevi Water customer who uses $x$ cubic metres of water, where $x > 10$.

Quarterly bill = $4 + (10 \times 1{\cdot}50) + [(x-10) \times 2]$

= $4 + 15 + 2(x-10)$

= £$19 + 2(x-10)$

[4]

Examiner only

*(c)* Mr and Mrs Alston recycle the water from their bath and washing machine to use in their garden.
Their meter reading, in cubic metres, on 1st April was 1678 and on 30th June it was 1702.
They recycled 8 cubic metres of the water used between 1st April and 30th June.
Find the percentage of the water that they recycled in the quarter.

Units used on meter = 1702 − 1678 = 24

% recycled = $\frac{8}{24} \times 100\ \%$

= 33 %.

[3]

**3.** *(a)* Solve $5(2x - 7) = 75$.

$10x - 35 = 75$

$10x = 75 + 35$

$10x = 110$

$x = \frac{110}{10}$ $\quad x = 11$

[3]

*(b)* Simplify $7x - 3(4x - 1)$.

$= 7x - 12x + 3$

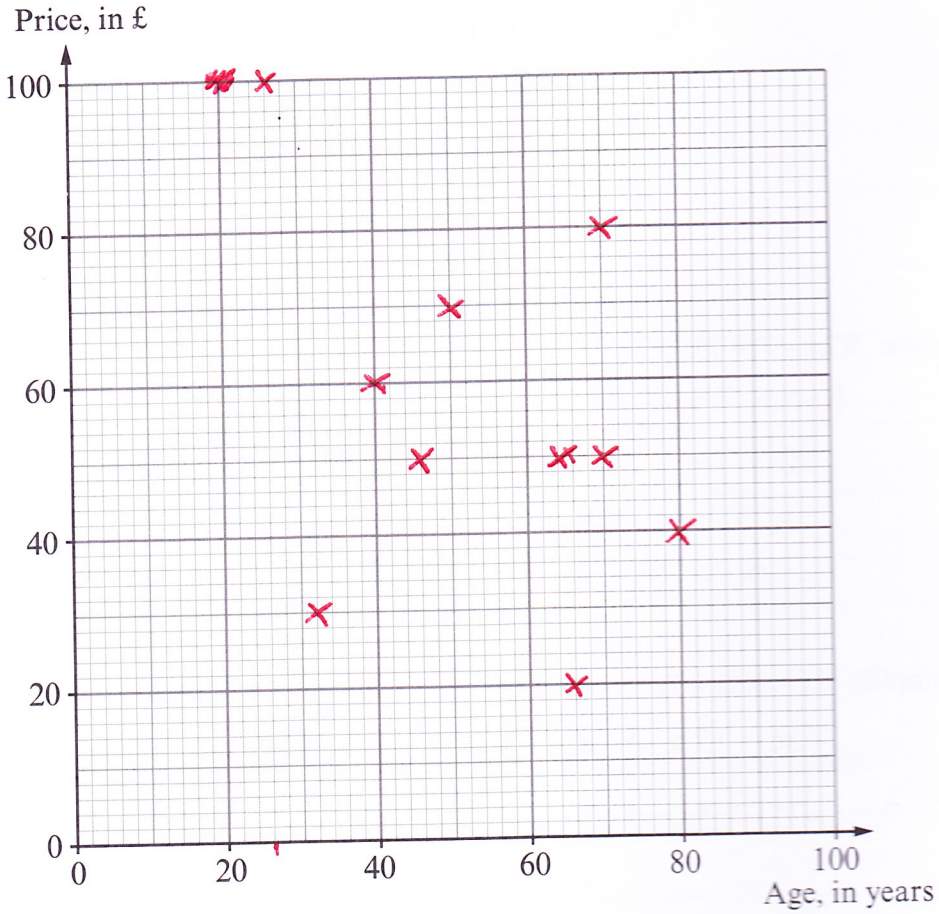
$= 3 - 5x$

[2]

**4.** *(a)* The age and price of each of 10 chairs in an antique shop are recorded in the table.

| Age, in years | 26 | 40 | 70 | 50 | 46 | 80 | 66 | 64 | 70 | 32 |
|---|---|---|---|---|---|---|---|---|---|---|
| Price, in £ | 100 | 60 | 80 | 70 | 50 | 40 | 20 | 50 | 50 | 30 |

(i) Draw a scatter diagram to display these ages and prices. [2]




(ii) Write down the age and price of the oldest chair.

Age ..... 80 ..... years

Price £ ..... 40 .....

[2]

(iii) Does the scatter diagram indicate that there is a correlation between the age and price of the chairs? You must give a reason for your answer.

No correlation : no trend

or

.....

.....

[1]

*(b)* The same antique shop has a number of tables for sale.

| Price, £$x$ | Number of tables | Mid Point |
|---|---|---|
| $50 \leqslant x < 100$ | 6 | 75 |
| $100 \leqslant x < 150$ | 10 | 125 |
| $150 \leqslant x < 200$ | 4 | 175 |

Calculate an estimate for the mean price of a table.

$$= \frac{(6 \times 75) + (10 \times 125) + (4 \times 175)}{20}$$

$$= \frac{450 + 1250 + 700}{20}$$

$$= \frac{2400}{20} = £120$$

[4]

*(c)* A leather sofa costs £2400.
Each year, the value of furniture depreciates by 18% of its value at the start of the year.
At the end of two years, by how much has the value of the leather sofa depreciated?

$$2400 \times 0{\cdot}82^2$$

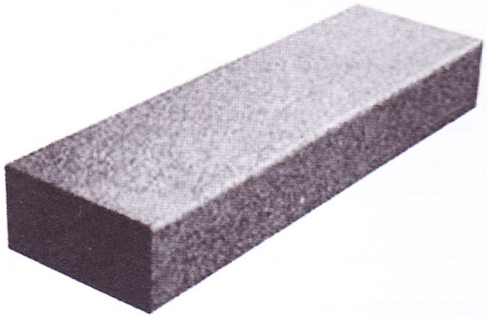
Final value $= £1613{\cdot}76$

$\therefore$ Depreciated by $-1613{\cdot}76 + 2400$

$= £786{\cdot}24$

[4]

**5.** *(a)* Kerbstones are made in the shape of a cuboid.



The dimensions of the kerbstones are 50 cm by 20 cm by 10 cm.
**All measurements are given correct to the nearest centimetre.**
Calculate the greatest possible length of 200 of these kerbstones laid along a straight road.
Give your answer in metres.
Explain any assumption you have made in working out your answer.

MAx Length = 50·5cm (Assume length is longest side)

∴ MAx length of 200 = 200 x 50·5
= 10,100 cm
= 101 m

[5]

Examine only

*(b)* Concrete blocks in the shape of cuboids are made using cement, sharp sand, gravel and water. A builder's yard offers customers use of their Concrete Quantity Calculator.

Customers enter the length, width and depth of the block of concrete they want to make. The calculator then works out the quantities of cement, sharp sand, gravel and water needed.

One customer enters her measurements, length 0·5 m, width 0·2 m and depth 0·3 m for the concrete she wants to make. This is what the Concrete Quantity Calculator shows:

| Concrete Quantity Calculator | | | |
|---|---|---|---|
| Block dimensions | Length 0·5 metres | Width 0·2 metres | Depth 0·3 metres |
| | Cement | **10** kg | |
| | Sharp sand | **18** kg | |
| | Gravel | **36** kg | |
| | Water | **5** litres | |

×1·6

Complete the Concrete Quantity Calculator for another customer who wants to make a block of the same type of concrete, measuring 0·6 m by 0·4 m by 0·2 m.

| Concrete Quantity Calculator | | | |
|---|---|---|---|
| Block dimensions | Length 0·6 metres | Width 0·4 metres | Depth 0·2 metres |
| | Cement | **16** kg | |
| | Sharp sand | 28·8 kg | |
| | Gravel | 57·6 kg | |
| | Water | 8 litres | |

$0{\cdot}5 \times 0{\cdot}2 \times 0{\cdot}3 = 0{\cdot}03 \text{ m}^3$

$0{\cdot}6 \times 0{\cdot}4 \times 0{\cdot}2 = 0{\cdot}048 \text{ m}^3$

$\therefore \frac{0{\cdot}048}{0{\cdot}03} = \frac{48}{30} = \frac{8}{5} = 1{\cdot}6$

[4]

**6.**

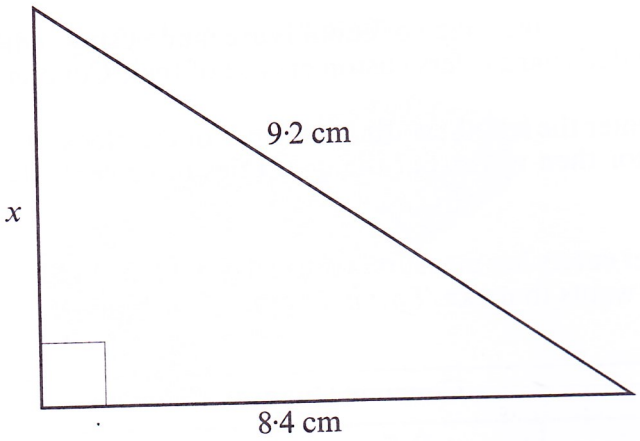



*Diagram not drawn to scale*

Calculate the length of the side marked $x$.

$x^2 = 9.2^2 - 8.4^2$

$x^2 = 84.64 - 70.56$

$x^2 = 14.08$

$x = 3.75\text{cm}$

[3]

**7.** *(a)* Write the number twenty million in standard form.

$20\,000\,000 = 2 \times 10^7$

[1]

*(b)* Calculate, giving your answers in standard form correct to 2 significant figures.

(i) $(4{\cdot}6 \times 10^{-7}) \times (7{\cdot}2 \times 10^{14})$

$3.3 \times 10^8$

[2]

(ii) $\dfrac{4{\cdot}56 \times 10^3}{9{\cdot}24 \times 10^{14}}$

$= 4.9 \times 10^{-12}$

[2]

Examiner only

**8.**

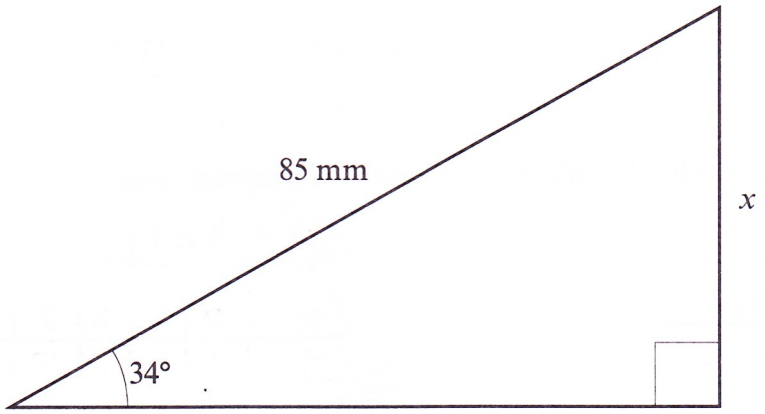



*Diagram not drawn to scale*

Calculate the length $x$ to an appropriate degree of accuracy.

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

$\tan 34^\circ = \frac{x}{85}$

$85 \tan 34^\circ = x$

$57.3 \text{ mm} = x$

[4]

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

$$x + y \leqslant 6 \qquad y \leq 6 - x$$
$$y \leqslant 3x + 1$$
$$y \geqslant 2$$

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

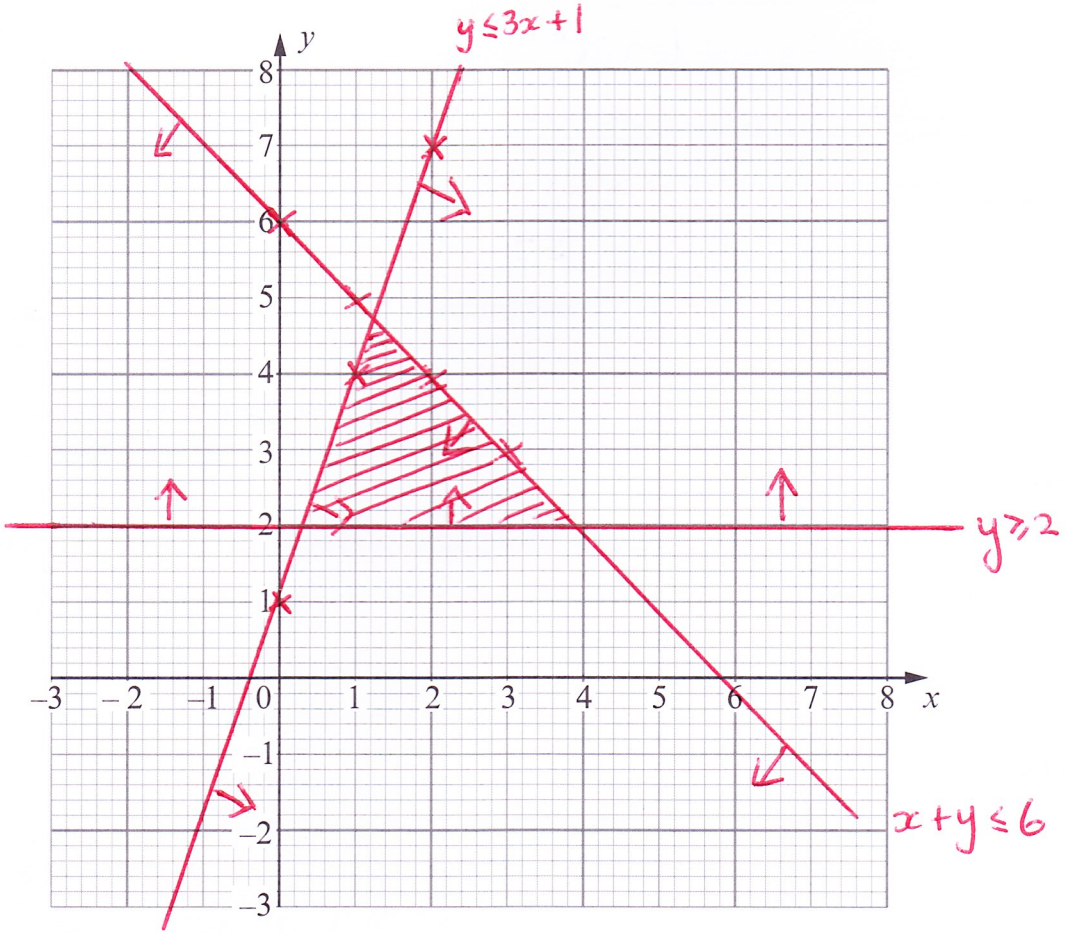
$y = 6 - x$

| $x$ | 0 | 1 | 2 | 3 |
|---|---|---|---|---|
| $y$ | 6 | 5 | 4 | 3 |

$y = 3x + 1$

| $x$ | 0 | 1 | 2 | 3 |
|---|---|---|---|---|
| $y$ | 1 | 4 | 7 | 10 |

[3]



Examiner only

**10.** *(a)* Make $g$ the subject of the formula.

$$3(g - 2f) = ag + 5h$$

$3g - 6f = ag + 5h$

$3g - ag = 5h + 6f$

$g(3-a) = 5h + 6f$

$g = \dfrac{(5h + 6f)}{(3-a)}$

[4]

*(b)* Factorise $4x^2 - 169$.

$= (2x - 13)(2x + 13)$

[2]

*(c)* Solve $3 - 2n > 4n - 9$.

$3 + 9 > 4n + 2n$

$12 > 6n$

$2 > n$

$n < 2$

[2]

*(d)* Solve $3x^2 + 4x - 18 = 0$, giving your answers correct to two decimal places.

$a = 3 \quad b = 4 \quad c = -18$

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

$x = \dfrac{-4 \pm \sqrt{4^2 - 4(3)(-18)}}{2(3)}$

$x = \dfrac{-4 \pm \sqrt{16 + 216}}{6}$

$x = \dfrac{-4 \pm \sqrt{232}}{6}$

either

$x = \dfrac{-4 + 15.232}{6}$

$x = 1.87$

OR

$x = \dfrac{-4 - 15.232}{6}$

$x = \dfrac{-19.232}{6}$

$x = -3.21$

[3]

Examiner only

**11.**

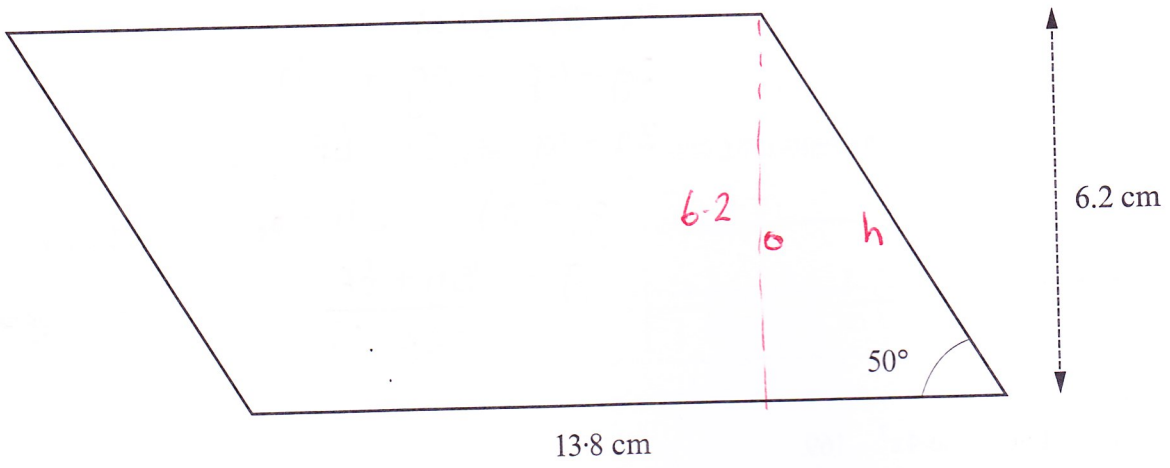



*Diagram not drawn to scale*

The diagram shows a parallelogram with a base of length 13·8 cm, a perpendicular height of 6·2 cm and one interior angle of 50°. Calculate the perimeter of the parallelogram.

$\sin 50^\circ = \frac{6.2}{h}$

$h = \frac{6.2}{\sin 50} = 8.09 \text{ cm}$

$\therefore P = 13.8 + 13.8 + 8.09 + 8.09$

$P = 43.8 \text{ cm}$.

[5]

Examiner only

**12.** Given that $y$ is inversely proportional to $x^2$, and that $y = 8$ when $x = 0{\cdot}5$,

*(a)* find an expression for $y$ in terms of $x$,

$y \propto \frac{1}{x^2}$

$y = \frac{k}{x^2}$

$8 = \frac{k}{0{\cdot}5^2}$

$8 = \frac{k}{0{\cdot}25}$ $\quad \therefore \quad y = \frac{2}{x^2}$

$2 = k$

[3]

*(b)* use the expression you found in *(a)* to complete the following table.

| $x$ | $\frac{1}{20} = 0{\cdot}05$ | 0·2 | 0·5 |
|---|---|---|---|
| $y$ | 800 | 50 | 8 |

$y = \frac{2}{0{\cdot}2^2} = \frac{2}{0{\cdot}04} = \frac{200}{4} = 50$

$800 = \frac{2}{x^2}$

$x^2 = \frac{2}{800} = \frac{1}{400}$

$\therefore \quad x = \frac{1}{20}$

[2]

Examiner only

**13.** A company manufactures two different sized boxes.
Both boxes are cuboids and are similar in shape.
The total surface area of the smaller box is 132 cm$^2$ and the length of its longest edge is 12 cm.
The total surface area of the larger box is 297 cm$^2$.
Calculate the length of the longest edge of the larger box.

Small area = 132 cm$^2$ L = 12 cm

Larger area = 297 cm$^2$ L = ?

Ratio areas = $\frac{297}{132}$ = 2·25

∴ Ratio sides = $\sqrt{2·25}$ = 1·5

∴ larger box L = 12 × 1·5

= 18 cm

[4]

Examiner only

**14.** The diagram below shows a sketch of a company logo.
The company needs to paint the triangle *ACD* blue.

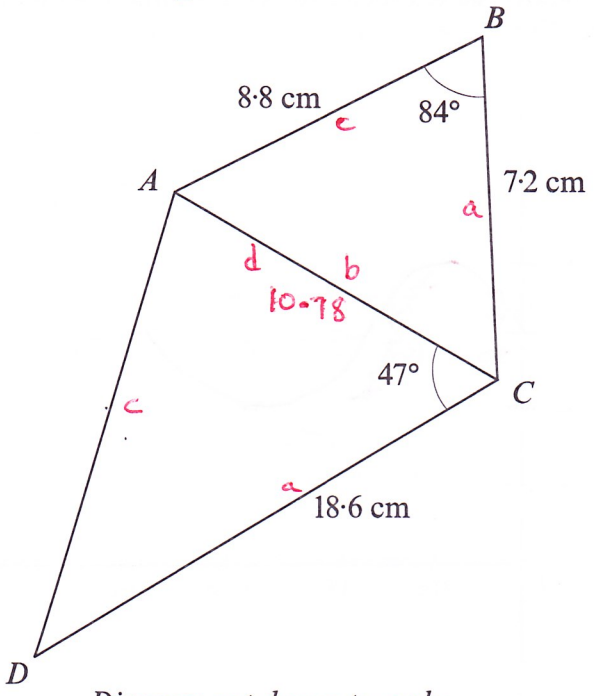



*Diagram not drawn to scale*

Calculate the area of the triangle *ACD*.

Find AC

$b^2 = a^2 + c^2 - 2ac\cos B$

$b^2 = 7.2^2 + 8.8^2 - 2(7.2)(8.8)\cos 84°$

$b^2 = 51.84 + 77.44 - 126.72\cos 84°$

$b^2 = 129.28 - 13.246$

$b^2 = 116.034$

$b = 10.78$ cm

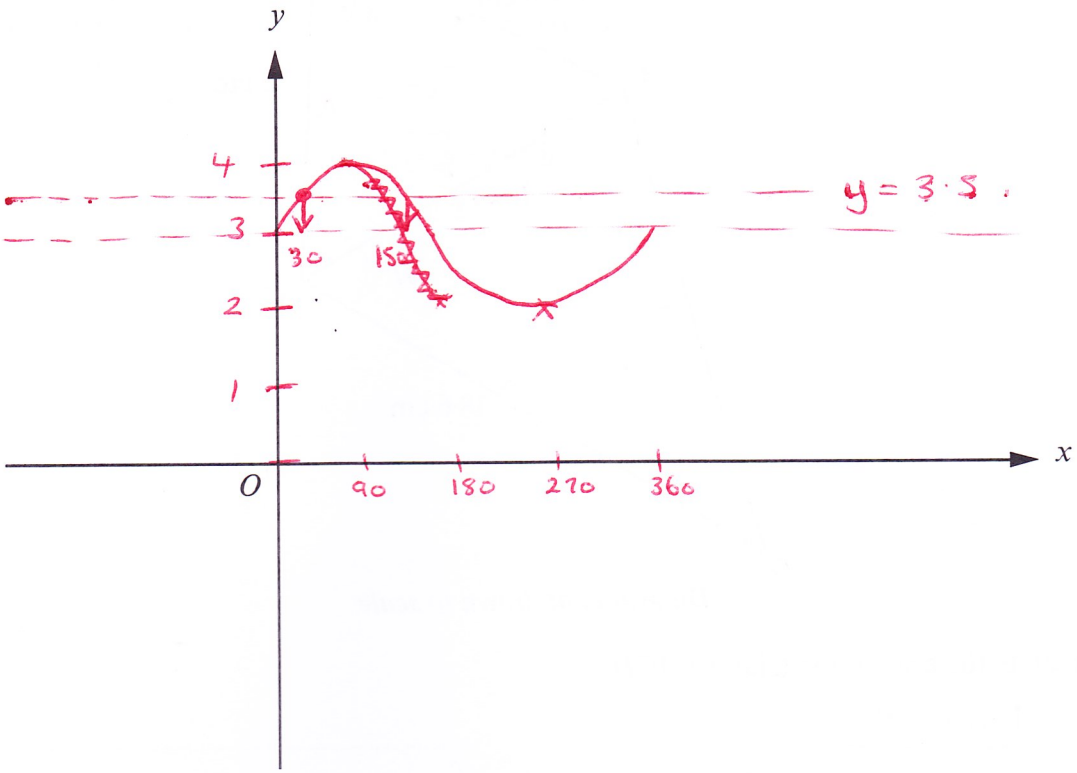
Area $= \frac{1}{2}ad\sin C$

$= \frac{1}{2}(18.6)(10.78)\sin 47°$

$= 73.3\ cm^2$

[6]

**15.** *(a)* Using the axes below, **sketch** the graph of $y = \sin x + 3$ for values of $x$ from 0° to 360°. [2]




*(b)* Solve the simultaneous equations $y = 3{\cdot}5$ and $y = \sin x + 3$ for values of $x$ from 0° to 360°.

~~Calculator~~ ⇒

$3{\cdot}5 = \sin x + 3$

$0{\cdot}5 = \sin x$

$30° = x$ from calculator.

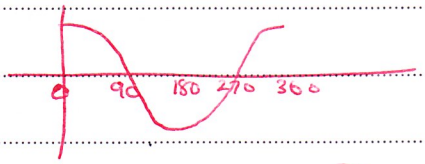
Graph ⇒ $30°, 150° = x$ [3]

Examiner only

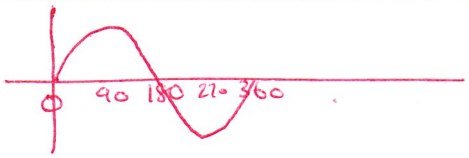
(c) Denia says that "the graph of $\sin x$ is the same as the graph of $\cos(x - 90°)$". Explain the transformation from $y = \cos x$ to $y = \cos(x - 90°)$ and hence decide if Denia is correct.

$\cos(x-90°)$ is a 90° shift to the right of basic $\cos x$ curve.

ie




$y = \cos x$




$y = \cos(x-90°)$ is 90° →

[2]

This is same as $y = \sin x$.

∴ Denia correct

$y = \cos(x-90°)$ is same as $y = \sin x$.