

Centre No.						Paper Reference						Surname	Initial(s)	
Candidate No.						1	3	8	0	/	3	H	Signature	

Paper Reference(s)

**1380/3H**

# Edexcel GCSE

**Mathematics (Linear) – 1380**

Paper 3 (Non-Calculator)

# Higher Tier

Wednesday 9 November 2011 – Afternoon

Time: 1 hour 45 minutes

Examiner's use only

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Team Leader's use only

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**Materials required for examination**

Ruler graduated in centimetres and millimetres, protractor, compasses, pen, HB pencil, eraser.  
Tracing paper may be used.

**Items included with question papers**

Nil

### Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, initials and signature.

Check that you have the correct question paper.

Answer ALL the questions. Write your answers in the spaces provided in this question paper.

**You must NOT write on the formulae page.**

**Anything you write on the formulae page will gain NO credit.**

If you need more space to complete your answer to any question, use additional answer sheets.

### Information for Candidates

The marks for individual questions and the parts of questions are shown in round brackets: e.g. (2).

There are 22 questions in this question paper. The total mark for this paper is 100.

There are 24 pages in this question paper. Any blank pages are indicated.

**Calculators must not be used.**

### Advice to Candidates

Show all stages in any calculations.

Work steadily through the paper. Do not spend too long on one question.

If you cannot answer a question, leave it and attempt the next one.

Return at the end to those you have left out.

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*Turn over*

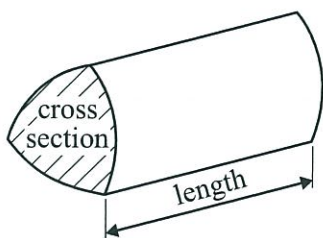
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## GCSE Mathematics (Linear) 1380

### Formulae: Higher Tier

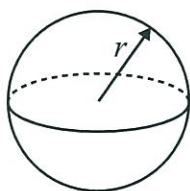
**You must not write on this formulae page.**  
**Anything you write on this formulae page will gain NO credit.**

**Volume of a prism** = area of cross section  $\times$  length



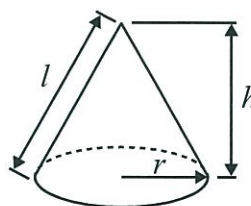
**Volume of sphere** =  $\frac{4}{3} \pi r^3$

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

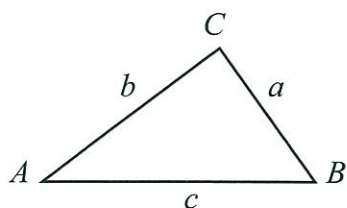


**Volume of cone** =  $\frac{1}{3} \pi r^2 h$

**Curved surface area of cone** =  $\pi r l$



**In any triangle ABC**



**The Quadratic Equation**

The solutions of  $ax^2 + bx + c = 0$

where  $a \neq 0$ , are given by

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

**Sine Rule**  $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

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

**Area of triangle** =  $\frac{1}{2} ab \sin C$



Answer ALL TWENTY TWO questions.

Write your answers in the spaces provided.

You must write down all stages in your working.

You must NOT use a calculator.

1. Theo earns £20 one weekend.  
He gives £4 to his brother.

- (a) Express £4 as a fraction of £20  
Give your answer in its simplest form.

$$\frac{4}{20} = \frac{1}{5}$$

$$\frac{1}{5}$$

.....

(2)

Theo gives £6 to his mother.

- (b) Express £6 as a percentage of £20

$$\frac{6}{20} \times 100 = \frac{3}{10} \times 100 = 30\%$$

$$30$$

..... %

(2)

Theo spent the remaining £10 on bus fares and food.  
He spent £1.50 more on bus fares than on food.

- (c) How much did he spend on bus fares?

Let  $x$  = amount spent on food.

Then amount spent on bus fares =  $x + 1.5$

and  $x + x + 1.5 = 10$

$$\Rightarrow 2x + 1.5 = 10$$

$$\Rightarrow x = \frac{10 - 1.5}{2} = \frac{8.5}{2} = 4.25 \quad \text{£ } 5.75$$

.....

(2)

$\therefore$  Amount spent on bus fares =  $4.25 + 1.5 = 5.75$  (Total 6 marks)

Q1



2. Here is a number pattern.

Line Number			
1	$1^2 + 3^2$	$2 \times 2^2 + 2$	10
2	$2^2 + 4^2$	$2 \times 3^2 + 2$	20
3	$3^2 + 5^2$	$2 \times 4^2 + 2$	34
4	$4^2 + 6^2$	$2 \times 5^2 + 2$	52
10	$10^2 + 12^2$	$2 \times 11^2 + 2$	244

(a) Complete Line Number 4 of the pattern. (1)

(b) Complete Line Number 10 of the pattern. (2)

(c) Use the number pattern to find the answer to  $999^2 + 1001^2$

$$\begin{aligned}
 999^2 + 1001^2 &= 2 \times 1000^2 + 2 \\
 &= 2 \times 1000000 + 2 \\
 &= 2,000,002
 \end{aligned}$$

$$\underline{\underline{2,000,002}}$$

(2)

Q2

(Total 5 marks)



3.

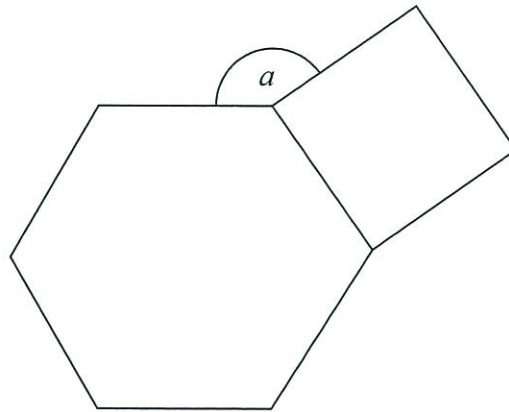
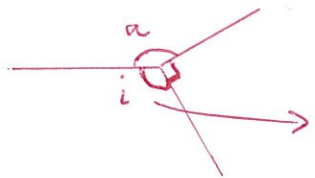


Diagram NOT accurately drawn

The diagram shows a regular hexagon and a square.

Calculate the size of the angle  $a$ .

Interior angle,  $i$ , of a regular  $n$ -sided polygon =  $\frac{180(n-2)}{n}$



$$i = \frac{180(6-2)}{6} = \frac{180(4)}{6} = \frac{720}{6} = \frac{360}{3} = 120^\circ$$

$$\therefore a = 360 - (120 + 90) = 360 - 210 = 150^\circ$$

..... 150 °

(Total 4 marks)

Q3



4. Jim did a survey on the lengths of caterpillars he found on a field trip.

Information about the lengths is given in the stem and leaf diagram.

1	3 5 7 7
2	0 6 8 8 8 9
3	1 5 5 5 5 6 8 9
4	1 5
5	2

Key: 5|2 means 5.2 cm

Work out the median.

Sample size is 21.  
 Median is 11<sup>th</sup> value along given by  
 $\frac{21+1}{2} = 11$

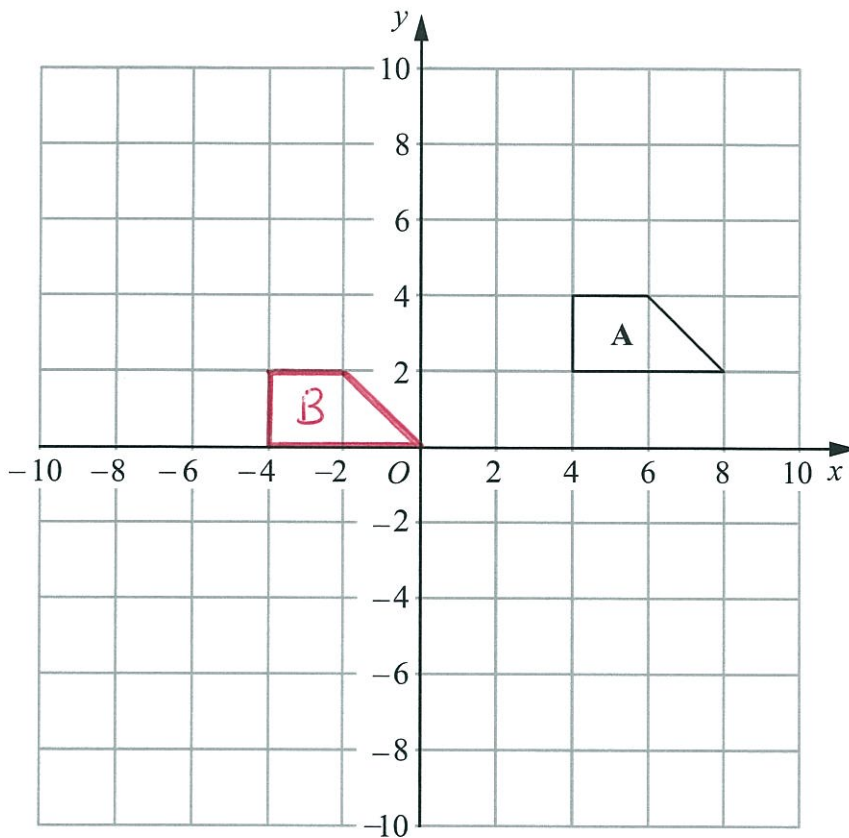
∴ Median = 3.1 cm

..... 3.1 ..... cm

(Total 2 marks)

Q4

5.

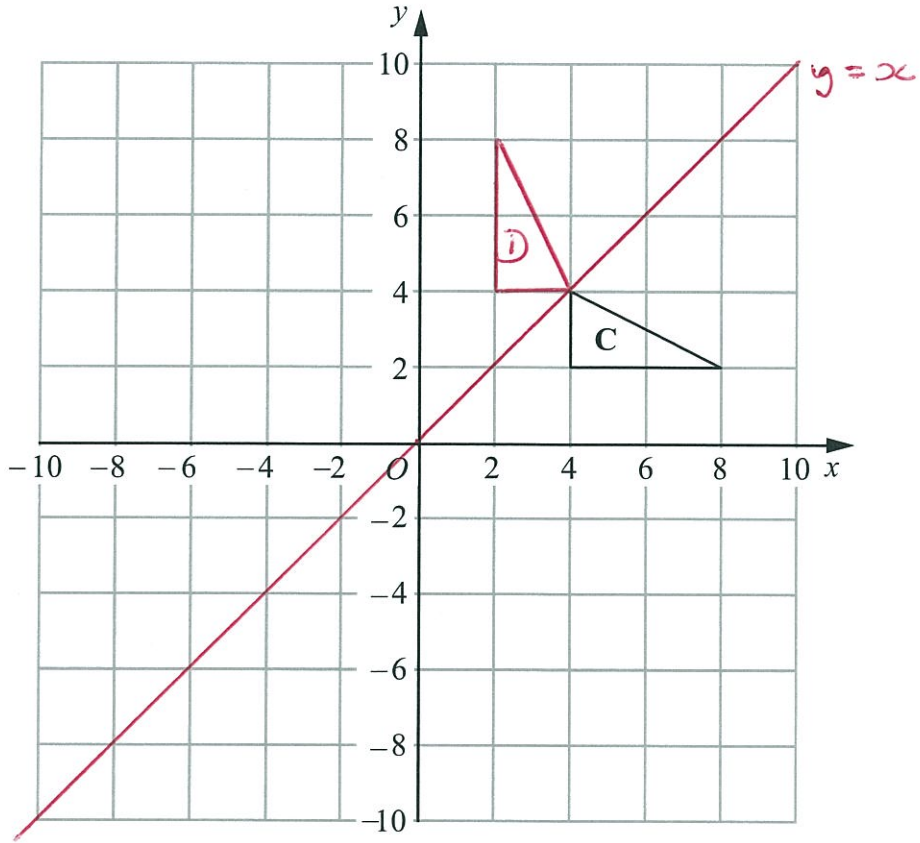


(a) Translate shape A by  $\begin{pmatrix} -8 \\ -2 \end{pmatrix}$

Label the new shape B.

(2)





(b) Reflect shape **C** in the line  $y = x$ .  
Label the new shape **D**.

(2)

Q5

(Total 4 marks)



6.

<b>Reading</b>				
22	<b>Slough</b>			
28	40	<b>Guildford</b>		
30	22	47	<b>Oxford</b>	
45	28	66	25	<b>Buckingham</b>

The table gives distances in miles by road between some towns.

Izzy lives in Oxford.

She has to drive to a meeting in Buckingham and then from Buckingham to Reading to pick up a friend.

After she picks up her friend she will drive back to Oxford.

She plans to drive at a speed of 50 miles per hour.

The meeting will last 3 hours, including lunch.

She leaves Oxford at 9 am.

Work out the time at which she should get back to Oxford.

Total distance to travel = 25 + 45 + 30 = 100 miles

Time taken to travel 100 miles at 50 m.p.h =  $\frac{d}{s} = \frac{100}{50}$   
= 2 hours.

Total time taken for meeting and travel = 2 + 3 = 5 hrs.

∴ Arrival time back at Oxford will be ..... 2 pm.  
2 pm.

(Total 4 marks)

Q6





7. (a) Solve

$$3(2t - 4) = 2t + 12$$

$$6t - 12 = 2t + 12$$

$$4t - 12 = 12$$

$$\Rightarrow t = \frac{12 + 12}{4} = \frac{24}{4} = 6$$

$$t = \underline{6} \quad (3)$$

(b) Expand and simplify

$$2(x - y) - 3(x - 2y)$$

$$2x - 2y - 3x + 6y$$

$$= -x + 4y$$

$$\text{or } 4y - x$$

$$\underline{4y - x} \quad (2)$$

(c) Expand and simplify

$$(x - 5)(x + 7)$$

$$x^2 + 7x - 5x - 35$$

$$= x^2 + 2x - 35$$

$$\underline{x^2 + 2x - 35} \quad (2)$$

(Total 7 marks)

Q7

8. Work out an estimate for the value of

$$(0.49 \times 0.61)^2$$

$$\approx (0.5 \times 0.6)^2$$

$$(0.5 \times 0.6)^2 = 0.3^2 = 0.09$$

$$\underline{0.09} \quad (2)$$

(Total 2 marks)

Q8



9. Two shops both sell the same type of suit.  
In both shops the price of the suit was £180

One shop increases the price of the suit by  $17\frac{1}{2}\%$ .

The other shop increases the price of the suit by  $22\frac{1}{2}\%$ .

Calculate the difference between the new prices of the suits in the two shops.

N.B:  $17\frac{1}{2}\% = 7 \times 2.5\%$  and  $22\frac{1}{2}\% = 9 \times 2.5\%$

$2.5\%$  of 180 =  $\frac{1}{4}$  of 10% of 180 =  $\frac{18}{4} = 4.5$

$\therefore 17\frac{1}{2}\%$  of 180 =  $7 \times 4.5 = 31.5$

and  $22\frac{1}{2}\%$  of 180 =  $9 \times 4.5 = 40.5$

$\Rightarrow$  Difference between prices is given by

$$\begin{array}{r} 40.5 \\ - 31.5 \\ \hline 09.0 \end{array}$$

£ 9.00.....

(Total 3 marks)

Q9



10.

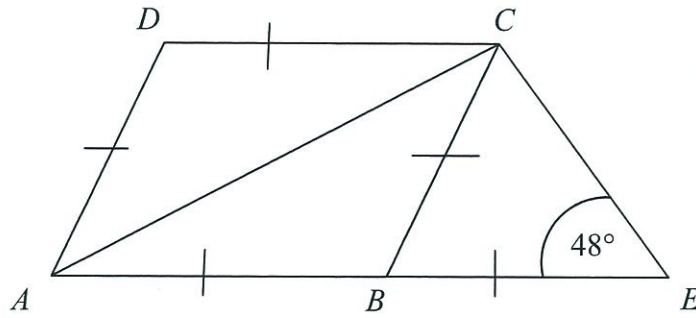
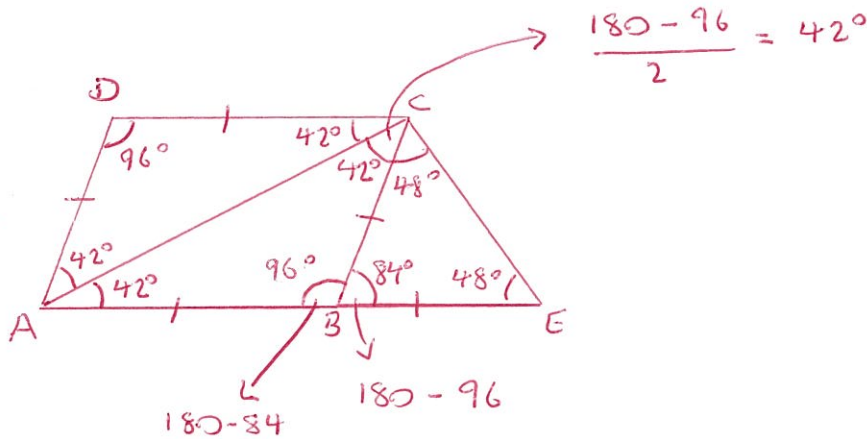


Diagram NOT accurately drawn

$ABCD$  is a rhombus.  
 $BCE$  is an isosceles triangle.  
 $ABE$  is a straight line.

Work out the size of angle  $DCA$ .



N.B:  $ACD$  and  $ABC$  are congruent triangles with matching angles.

$$\hat{DCA} = 42^\circ$$

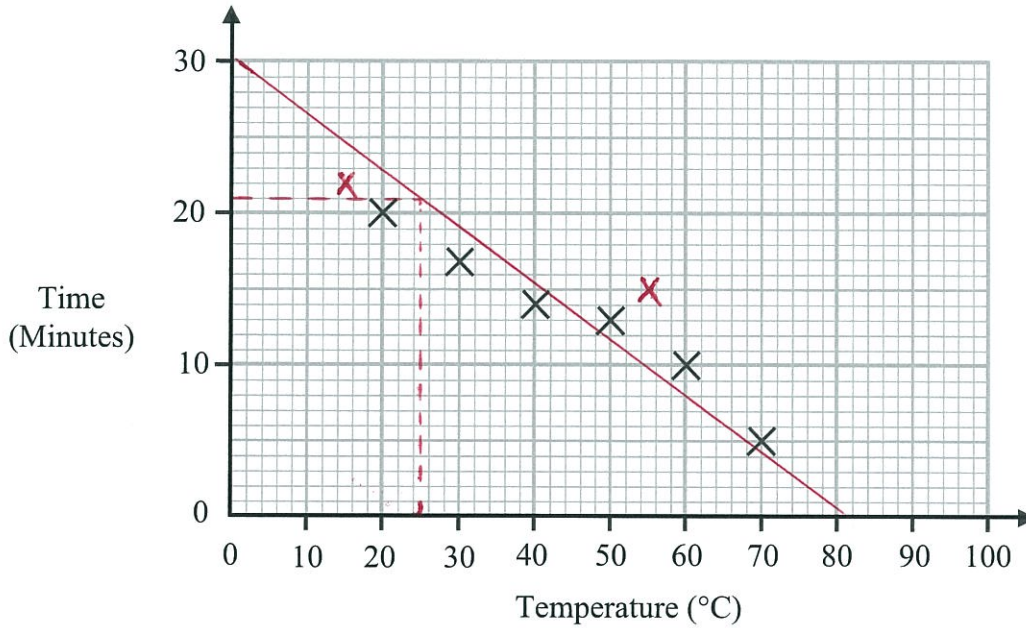
42 °

(Total 3 marks)

Q10



11. Suzy did an experiment to study the times, in minutes, it took 1 cm ice cubes to melt at different temperatures.  
Some information about her results is given in the scatter graph.



The table shows information from two more experiments.

Temperature (°C)	15	55
Time (Minutes)	22	15

- (a) On the scatter graph, plot the information from the table. (1)

- (b) Describe the relationship between the temperature and the time it takes a 1 cm ice cube to melt.

*Negative correlation* ..... (1)

- (c) Find an estimate for the time it takes a 1 cm ice cube to melt when the temperature is 25 °C.

..... *21* ..... minutes (2)

Suzy's data cannot be used to predict how long it will take a 1 cm ice cube to melt when the temperature is 100 °C.

- (d) Explain why.

*At extremes such as the freezing and boiling points for water, the straight line (linear) relationship will break down and the melting time at 100°C will be too brief to measure in minutes.* (1)

**(Total 5 marks)**

Q11



12. Solve the simultaneous equations

$$\begin{aligned} 3x + 4y &= 200 && \dots \dots \dots \textcircled{1} \\ 2x + 3y &= 144 && \dots \dots \dots \textcircled{2} \end{aligned}$$

$$\textcircled{1} \times 2 : 6x + 8y = 400 \dots \dots \dots \textcircled{3}$$

$$\textcircled{2} \times 3 : 6x + 9y = 432 \dots \dots \dots \textcircled{4}$$

$$\textcircled{4} - \textcircled{3} : y = 32$$

$$\text{In } \textcircled{2} : 2x + 3(32) = 144$$

$$\Rightarrow x = \frac{144 - 96}{2} = \frac{48}{2} = 24$$

$$x = \underline{24} \dots \dots \dots$$

$$y = \underline{32} \dots \dots \dots$$

(Total 4 marks)

Q12



13. (a) Work out the value of  $(6 \times 10^8) \times (4 \times 10^7)$

Give your answer in standard form.

$$\begin{aligned}
 &6 \times 4 \times 10^8 \times 10^7 \\
 &= 24 \times 10^{(8+7)} \\
 &= 24 \times 10^{15}, \text{ which in standard form} \\
 &\text{is given by } 2.4 \times 10^{16}
 \end{aligned}$$

$$\begin{array}{r}
 2.4 \times 10^{16} \\
 \hline
 \end{array}
 \quad (2)$$

(b) Work out the value of  $(6 \times 10^8) + (4 \times 10^7)$

Give your answer in standard form.

$$6.4 \times 10^8$$

CHECK:

$$\begin{array}{r}
 600,000,000 \\
 + 40,000,000 \\
 \hline
 640,000,000
 \end{array}$$

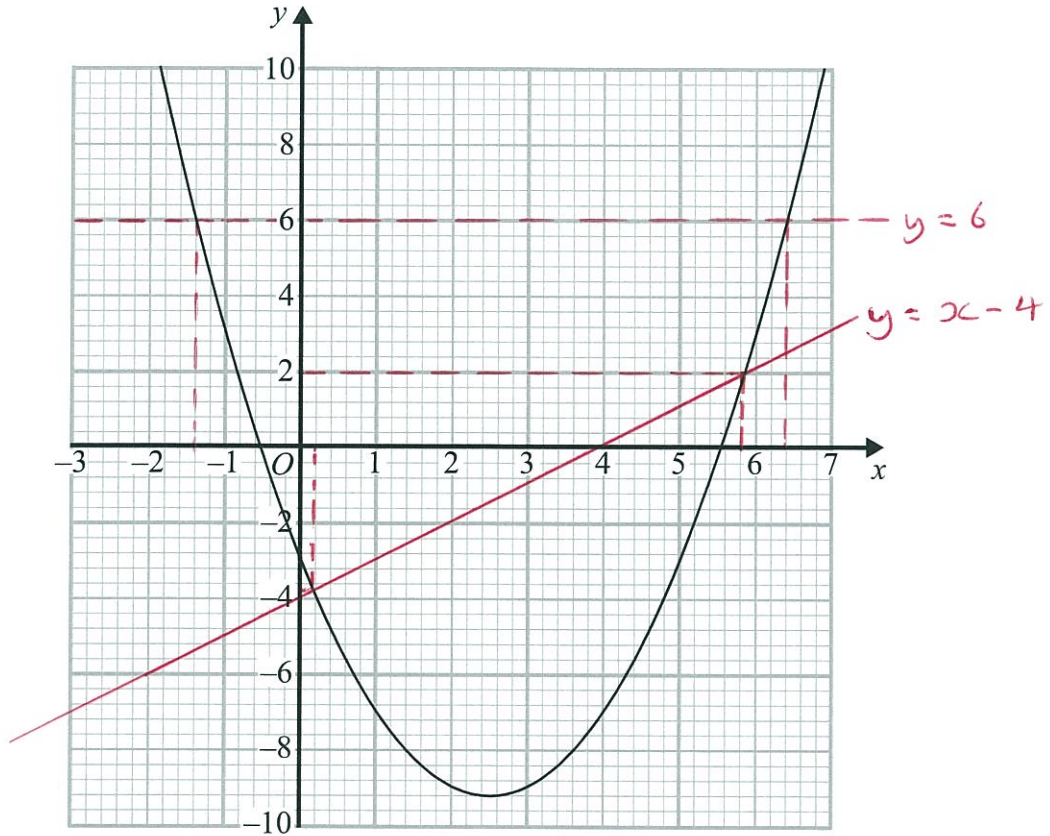
$$\begin{array}{r}
 6.4 \times 10^8 \\
 \hline
 \end{array}
 \quad (2)$$

(Total 4 marks)

Q13



14. The diagram shows the graph of  $y = x^2 - 5x - 3$



(a) Use the graph to find estimates for the solutions of

(i)  $x^2 - 5x - 3 = 0$

$x = -0.5$  or  $5.5$

(ii)  $x^2 - 5x - 3 = 6$

$x = -1.4$  or  $6.4$

(3)

(b) Use the graph to find estimates for the solutions of the simultaneous equations

$$y = x^2 - 5x - 3$$

$$y = x - 4$$

$(x, y) = (0.2, -3.8)$  or  $(5.8, 2)$

(3)

Q14

(Total 6 marks)



15. A garage keeps records of the costs of repairs to customers' cars.

The table gives information about these costs for one month.

Cost (£C)	Frequency
$0 < C \leq 200$	7
$200 < C \leq 400$	11
$400 < C \leq 600$	9
$600 < C \leq 800$	10
$800 < C \leq 1000$	8
$1000 < C \leq 1200$	5

(a) Write down the modal class interval.

$200 < C \leq 400$   
(1)

(b) Complete the cumulative frequency table.

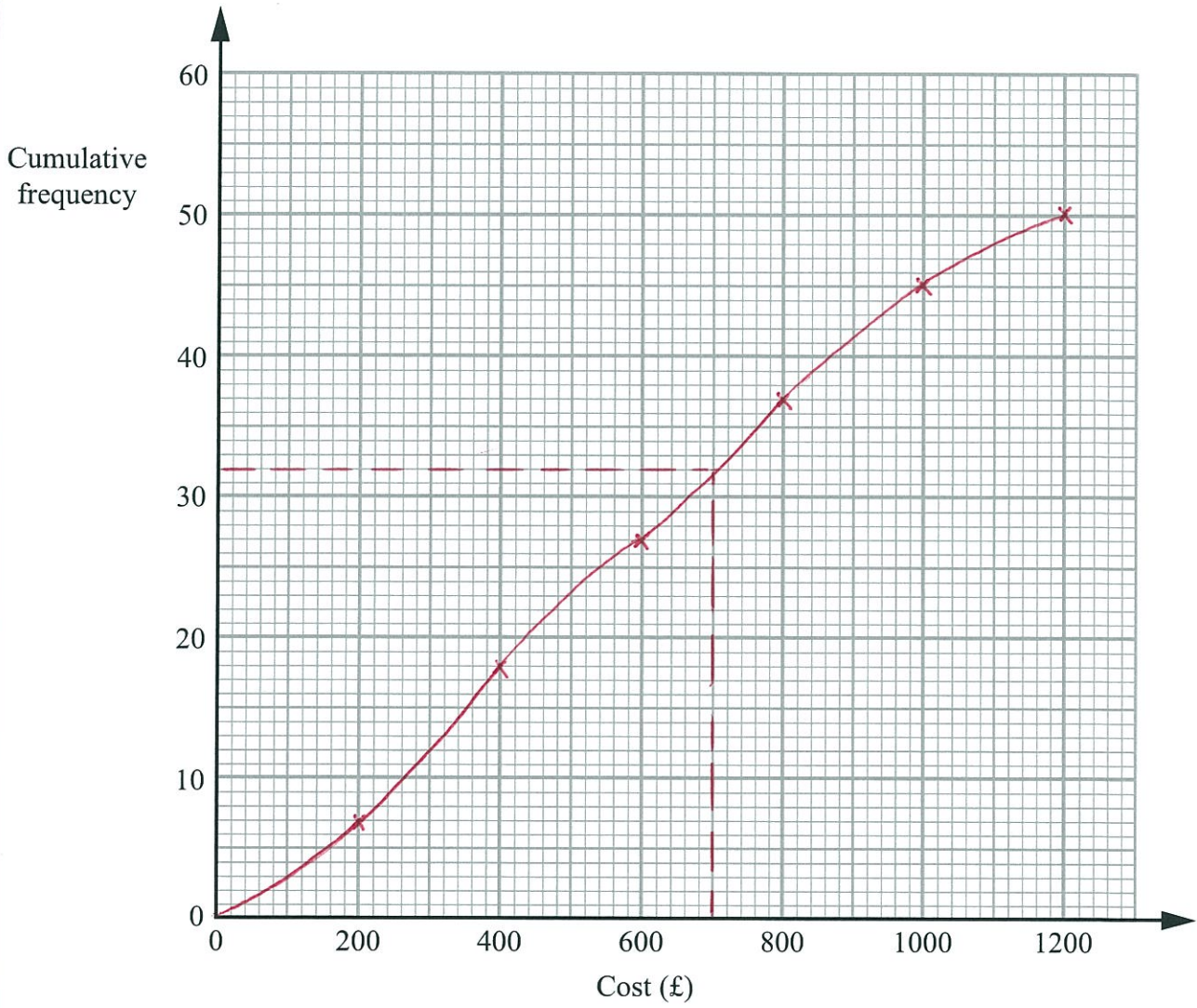
Cost (£C)	Cumulative Frequency
$0 < C \leq 200$	7
$0 < C \leq 400$	18
$0 < C \leq 600$	27
$0 < C \leq 800$	37
$0 < C \leq 1000$	45
$0 < C \leq 1200$	50

(1)

(c) On the grid, draw a cumulative frequency diagram for your table.







(2)

(d) Use the graph to find an estimate for the number of repairs which cost more than £700

$$50 - 32 = 18$$

18

(2)

(Total 6 marks)

Q15



16.

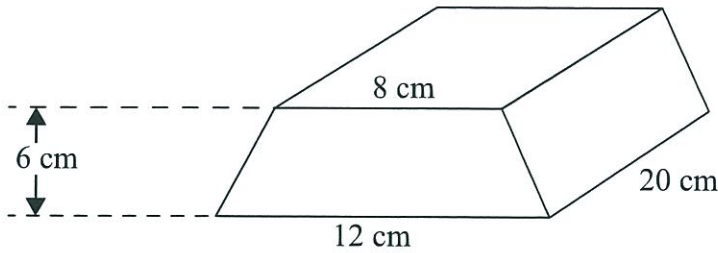


Diagram NOT accurately drawn

The diagram shows a solid prism made from metal.  
The cross-section of the prism is a trapezium.

The parallel sides of the trapezium are 8 cm and 12 cm.  
The height of the trapezium is 6 cm.  
The length of the prism is 20 cm.

The density of the metal is 5 g/cm<sup>3</sup>.

Calculate the mass of the prism.  
Give your answer in kilograms.

$$\text{Density} = \frac{\text{Mass of trapezium}}{\text{Volume of trapezium}}$$

$$\begin{aligned} \text{Volume of trapezium} &= \text{Cross-sectional surface area} \times \text{length} \\ &= \frac{1}{2}(12+8)(6) \times 20 = 60 \times 20 = 1200 \text{ cm}^3 \end{aligned}$$

$$\Rightarrow 5 = \frac{\text{Mass}}{1200}$$

$$\Rightarrow \text{Mass} = 5(1200) = 6000 \text{ g or } 6 \text{ kg}$$

..... 6 ..... kg

(Total 5 marks)

Q16



$$17. y = p - 2qx^2$$

$$p = -10$$

$$q = 3$$

$$x = -5$$

(a) Work out the value of  $y$ .

$$\begin{aligned} y &= -10 - 2(3)(-5)^2 \\ &= -10 - 6(25) \\ &= -10 - 150 = -160 \end{aligned}$$

$$\underline{-160}$$

(2)

(b) Rearrange  $y = p - 2qx^2$

to make  $x$  the subject of the formula.

$$\begin{aligned} y + 2qx^2 &= p \\ \Rightarrow 2qx^2 &= p - y \\ \Rightarrow x^2 &= \frac{p - y}{2q} \\ \Rightarrow x &= \pm \sqrt{\frac{p - y}{2q}} \end{aligned}$$

$$\underline{x = \pm \sqrt{\frac{p - y}{2q}}}$$

(3)

Q17

(Total 5 marks)



18. (a) Write down the value of  $2^0$

N.B.:  $a^0 = 1, a \neq 0$

$$2^0 = 1$$

$$\frac{1}{\dots\dots\dots} \quad (1)$$

$$2^y = \frac{1}{4}$$

(b) Write down the value of  $y$ .

Take logs on both side (or natural logs,  $\ln$ ).

$$\begin{aligned} \ln 2^y &= \ln\left(\frac{1}{4}\right) \\ \Rightarrow y(\ln 2) &= \ln\left(\frac{1}{4}\right) \\ \Rightarrow y &= \frac{\ln(1/4)}{\ln 2} = -2 \end{aligned}$$

Alternatively, and without using calculator, note by inspection (or trial & error) that  $2^{-2} = \frac{1}{2^2} = \frac{1}{4}$

$$\therefore y = -2$$

$$y = \frac{-2}{\dots\dots\dots} \quad (1)$$

(c) Work out the value of  $9^{-\frac{3}{2}}$

$$9^{-\frac{3}{2}} = \frac{1}{9^{3/2}} = \frac{1}{(\sqrt{9})^3} = \frac{1}{3^3} = \frac{1}{27}$$

$$\frac{1}{27} \quad (2)$$

(Total 4 marks)

Q18



19.

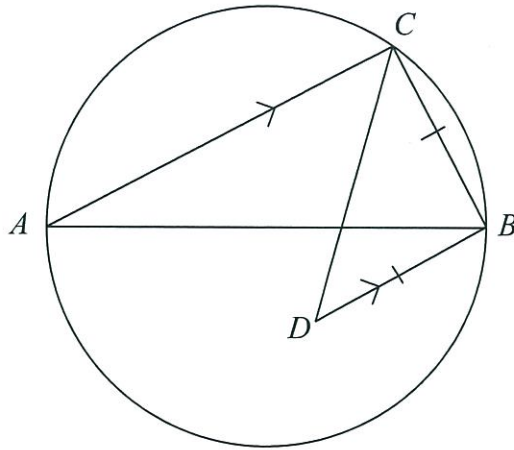


Diagram NOT accurately drawn

$AB$  is a diameter of a circle.  
 $C$  is a point on the circle.  
 $D$  is the point inside the circle such that  $BD = BC$  and  $BD$  is parallel to  $CA$ .  
 Find the size of angle  $CDB$ .  
 You must give reasons for your answer.

Let's call  $\hat{CDB} = x$  for short and try and solve for  $x$ .

$\hat{CDB} = \hat{CAD} = x \dots$  Alternate ( $Z$ -configured) angles between parallel lines are equal.

$\hat{BCD} = 90 - x \dots$  Angle  $\hat{ACB} = 90^\circ$  since a triangle drawn from two ends of a diameter will always make an angle of  $90^\circ$  at the circumference

$\hat{CDB} = \hat{BCD} = 90 - x \dots$  Triangle  $BCD$  is an isosceles.

$\Rightarrow x = 90 - x$   
 $\Rightarrow 2x = 90$

.....  $45^\circ$   
 (Total 4 marks)

Q19

$\therefore x = \frac{90}{2} = 45^\circ$



20. (a) Factorise

$2x^2 - 9x + 4$

$$(2x - 1)(x - 4)$$

$$\frac{(2x - 1)(x - 4)}{(2)} \quad (2)$$

Hence, or otherwise,

(b) solve

$2x^2 - 9x + 4 = (2x - 1)^2$

$$(2x - 1)(x - 4) = (2x - 1)(2x - 1)$$

$$\Rightarrow x - 4 = 2x - 1$$

$$\Rightarrow x = -3$$

Be careful here as we lose one of our solutions for  $x$  when we divide by the factor  $(2x - 1)$ .

$2x - 1 = 0$  is also a solution since  $x = \frac{1}{2}$  makes both LHS and RHS equal to zero.  $x = \frac{1}{2}$  or  $-3$

$$\therefore x = \frac{1}{2} \text{ or } x = -3 \quad (4)$$

Q20

(Total 6 marks)



21.

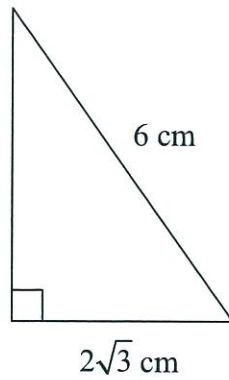


Diagram NOT accurately drawn

The diagram shows a right-angled triangle.

The length of the base of the triangle is  $2\sqrt{3}$  cm.

The length of the hypotenuse of the triangle is 6 cm.

The area of the triangle is  $A$  cm<sup>2</sup>.

Show that  $A = k\sqrt{2}$  giving the value of  $k$ .

$$A = \frac{\text{Base} \times \text{Height}}{2} \quad \text{Height} = \sqrt{6^2 - (2\sqrt{3})^2}$$

$$= \sqrt{36 - 4(3)}$$

$$= \sqrt{36 - 12} = \sqrt{24}$$

$$A = \frac{2\sqrt{3} \cdot \sqrt{24}}{2} = \sqrt{3} \times \sqrt{24}$$

$$= \sqrt{72} = \sqrt{2 \times 36}$$

$$= \sqrt{36} \times \sqrt{2} = 6\sqrt{2}$$

$$\therefore k = 6$$

$$A = 6\sqrt{2} \text{ with } k = 6$$

Q21

(Total 5 marks)



22. Jan has two boxes.

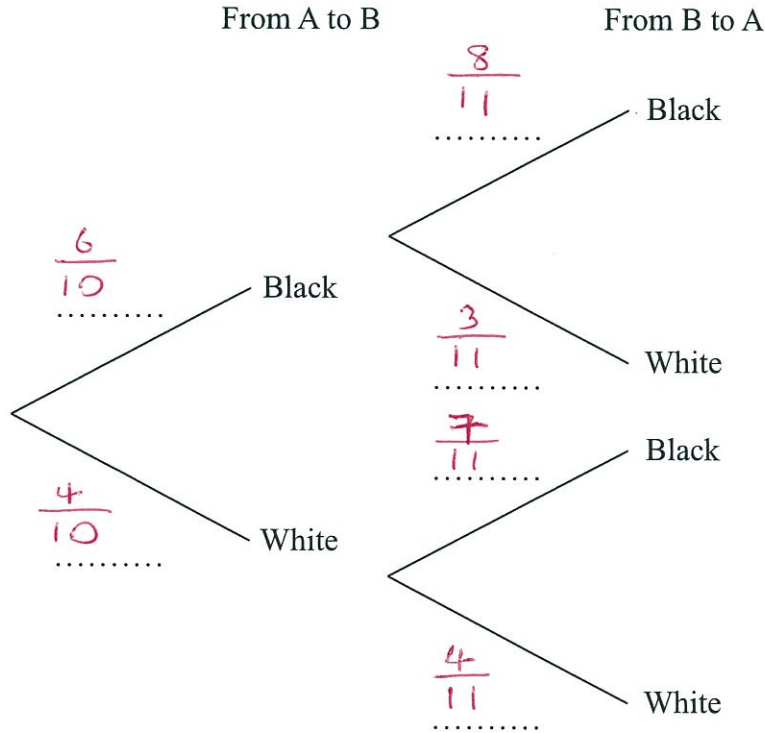
There are 6 black and 4 white counters in box A.

There are 7 black and 3 white counters in box B.

Jan takes at random a counter from box A and puts it in box B.

She then takes at random a counter from box B and puts it in box A.

(a) Complete the probability tree diagram.



(2)

(b) Find the probability that after Jan has put the counter from box B into box A there will still be 6 black counters and 4 white counters in box A.

$$\begin{aligned}
 & P(\text{still 6 black and 4 white in box A after both selections}) \\
 &= P(\text{BB OR WW}) \\
 &= \frac{6}{10} \left( \frac{8}{11} \right) + \frac{4}{10} \left( \frac{4}{11} \right) \\
 &= \frac{48}{110} + \frac{16}{110} = \frac{64}{110} = \frac{32}{55}
 \end{aligned}$$

(4)

(Total 6 marks)

Q22

TOTAL FOR PAPER: 100 MARKS

END

