Dr Oliver Mathematics
GCSE Mathematics
2011 November Paper 3H: Non-Calculator
1 hour 45 minutes

The total number of marks available is 100.
You must write down all the stages in your working.

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

   (a) Express £4 as a fraction of £20. (2)
   Give your answer in its simplest form.

   Theo gives £6 to his mother.

   (b) Express £6 as a percentage of £20. (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? (2)

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	$\ldots$	$\ldots$	52
$\ldots$	$\ldots$	$\ldots$	$\ldots$
10	$\ldots$	$\ldots$	$\ldots$

   (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 $999^2 + 1\,001^2$. (2)

3. The diagram shows a regular hexagon and a square. (4)
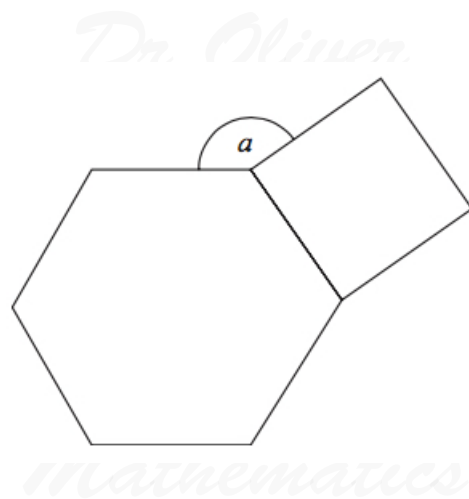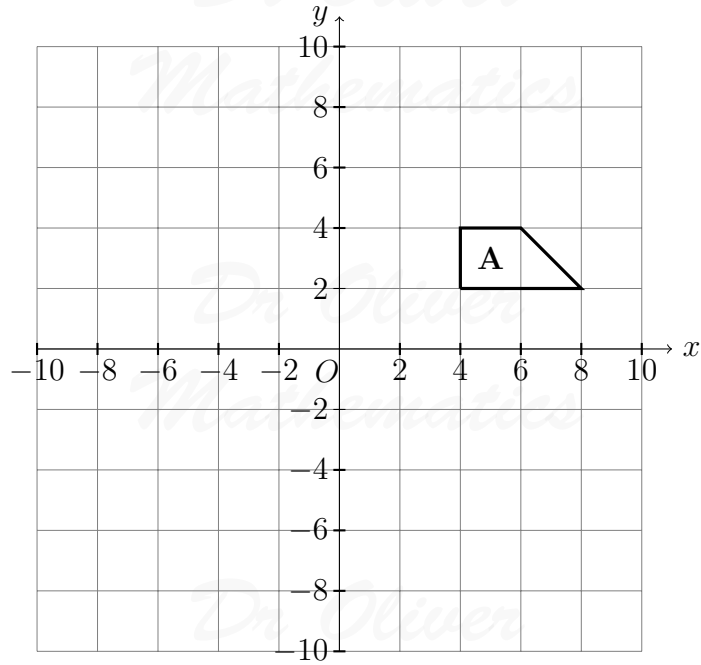
Calculate the size of the angle a.

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. (2)

$$
\begin{array}{c|ccccccc}
1 & 3 & 5 & 7 & 7 \\
2 & 0 & 6 & 8 & 8 & 8 & 9 \\
3 & 1 & 5 & 5 & 5 & 5 & 6 & 8 & 9 \\
4 & 1 & 5 \\
5 & 2 \\
\end{array}
$$

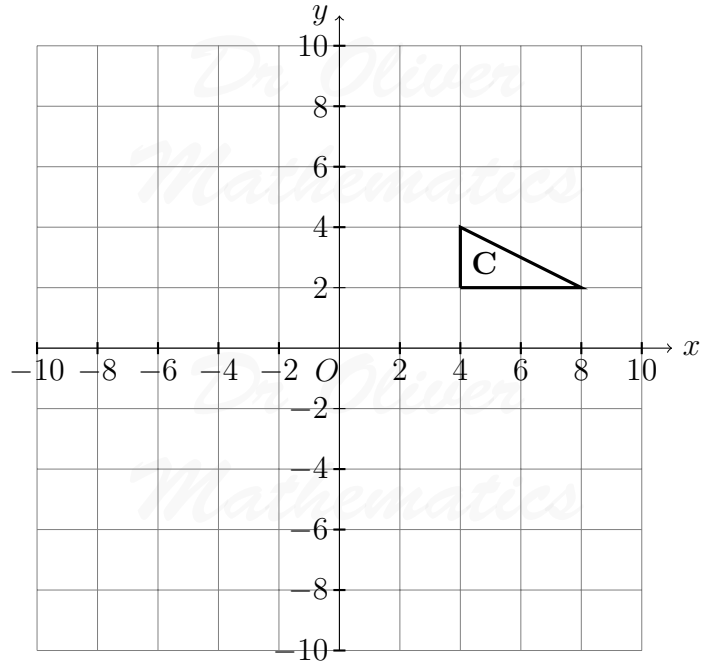Key: 5|2 means 5.2 cm.

Work out the median.

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

Label the new shape **B**.

(b) Reflect shape **C** in the line $y = x$. (2)

Label the new shape **D**.

6. The table gives distances in miles by road between some towns. (4)

Reading				
22	Slough			
28	40	Guildford		
30	22	47	Oxford	
45	28	66	25	Buckingham

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.

7. (a) Solve (3)
$$3(2t - 4) = 2t + 12.$$

(b) Expand and simplify (2)
$$2(x - y) - 3(x - 2y)$$

(c) Expand and simplify (2)
$$(x - 5)(x + 7).$$

8. Work out an estimate for the value of (2)

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

9. Two shops both sell the same type of suit. (3)
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.
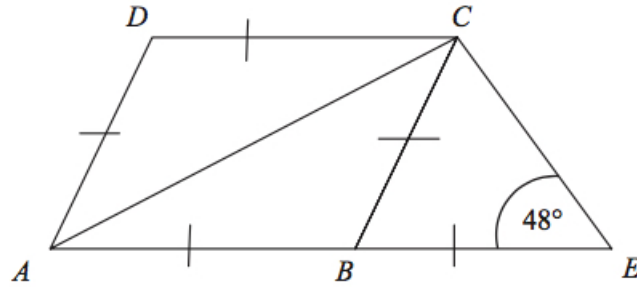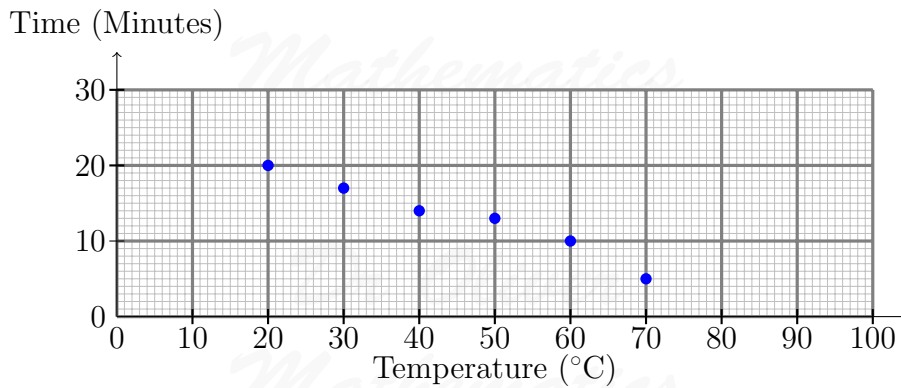
10. $ABCD$ is a rhombus. (3)

Diagram **NOT** accurately drawn

BCE is an isosceles triangle.
ABE is a straight line.
Work out the size of angle DCA.

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. (1)

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

5

(d) Explain why. (1)

12. Solve the simultaneous equations (4)

$$3x + 4y = 200$$
$$2x + 3y = 144.$$

13. (a) Work out the value of (2)
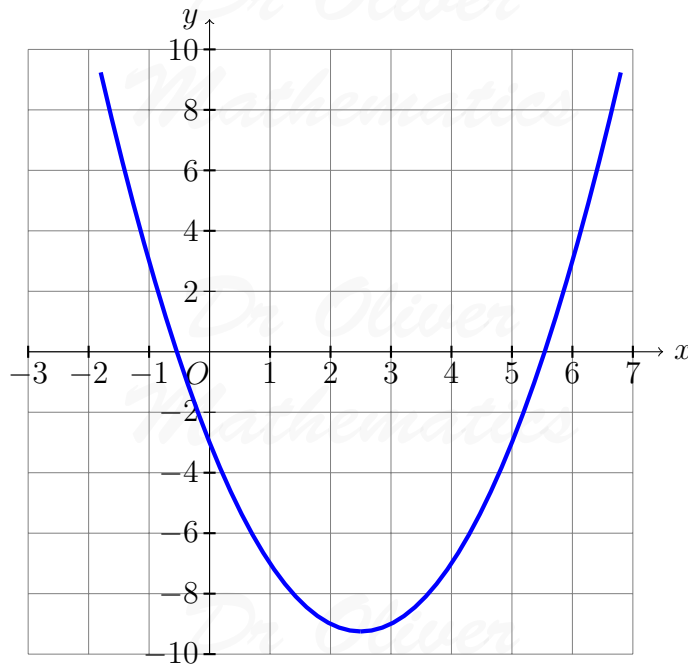$$(6 \times 10^8) \times (4 \times 10^7).$$

Give your answer in standard form.

(b) Work out the value of (2)
$$(6 \times 10^8) + (4 \times 10^7).$$

Give your answer in standard form.

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

(a) Use the graph to find estimates for the solutions of (3)
   (i) $x^2 - 5x - 3 = 0$,
   (ii) $x^2 - 5x - 3 = 6$.

(b) Use the graph to find estimates for the solutions of the simultaneous equations (3)

$$y = x^2 - 5x - 3$$
$$y = x - 4.$$

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
$0 < C \leqslant 200$	7
$200 < C \leqslant 400$	11
$400 < C \leqslant 600$	9
$600 < C \leqslant 800$	10
$800 < C \leqslant 1\,000$	8
$1\,000 < C \leqslant 1\,200$	5

(a) Write down the modal class interval. (1)
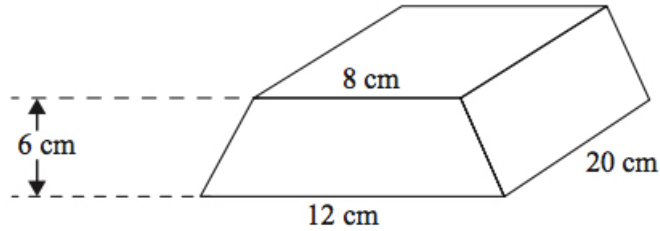
(b) Complete the cumulative frequency table. (1)

Cost $(£C)$	Cumulative Frequency
$0 < C \leqslant 200$	
$0 < C \leqslant 400$	
$0 < C \leqslant 600$	
$0 < C \leqslant 800$	
$0 < C \leqslant 1\,000$	
$0 < C \leqslant 1\,200$	

(c) On the grid, draw a cumulative frequency diagram for your table. (2)

7
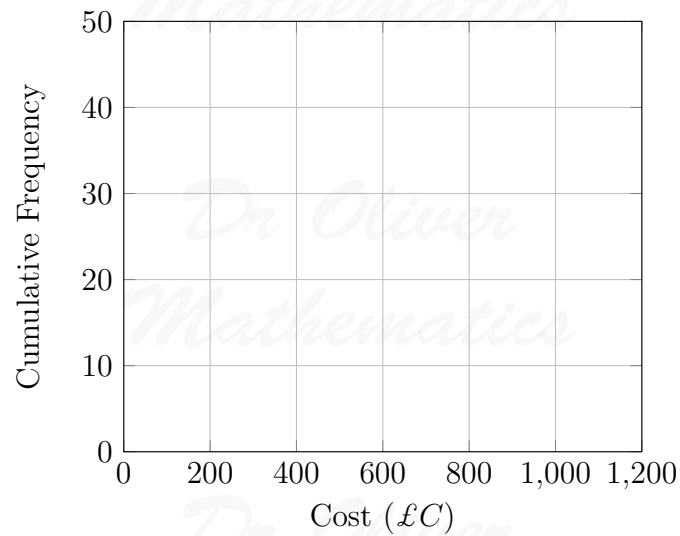
(d) Use the graph to find an estimate for the number of repairs which cost more than £700. (2)

16. The diagram shows a solid prism made from metal. (5)

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/cm³.
Calculate the mass of the prism.
Give your answer in kilograms.

17. $y = p - 2qx^2$.
$p = -10$.
$q = 3$.
$x = -5$.

(a) Work out the value of y. (2)

(b) Rearrange (3)
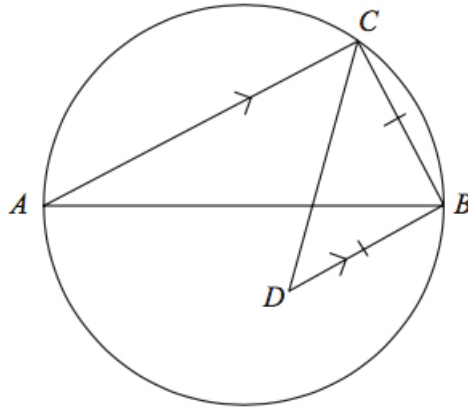$$y = p - 2qx^2$$
to make x the subject of the formula.

18. (a) Write down the value of 2^0. (1)

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

(b) Write down the value of y. (1)

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

19. AB is a diameter of a circle. (4)

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.

20. (a) Factorise   (2)
$$2x^2 - 9x + 4.$$

Hence, or otherwise,

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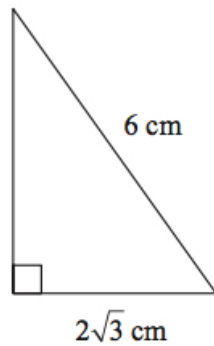$$2x^2 - 9x + 4 = (2x - 1)^2.$$

21. The diagram shows a right-angled triangle.   (5)

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

22. Jan has two boxes.
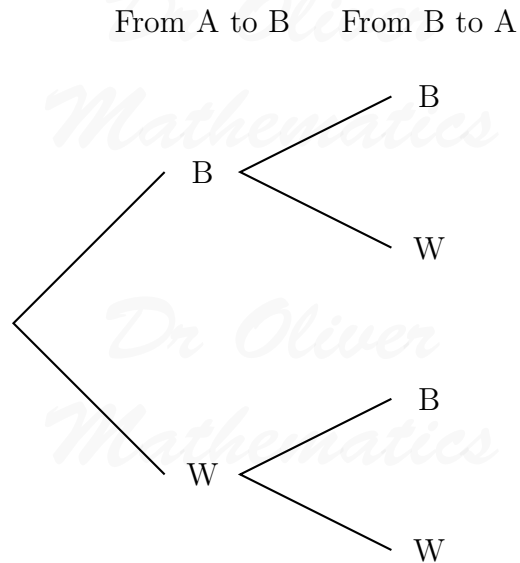There are 6 black and 4 white counters in box A.
There are 7 black and 3 white counters in box B.
Jan takes at random a counter from box A and puts it in box B.
She then takes at random a counter from box B and puts it in box A.

(a) Complete the probability tree diagram. (2)

From A to B   From B to A

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