DOWNE HOUSE
16+ ENTRANCE PAPER 2012/2013

MATHEMATICS
Time: 90 minutes

Name _____

School _____

Instructions to Candidates **Calculator allowed**

1. $A = 2^4 \times 3^2 \times 7$ $B = 2^3 \times 3^4 \times 5$

A and *B* are numbers written as the product of their prime factors.

Find

(i) the highest common factor of *A* and *B*,

.....

(ii) the lowest common multiple of *A* and *B*.

.....

(Total 3 marks)

2. $$y^2 = \frac{ab}{a+b}$$

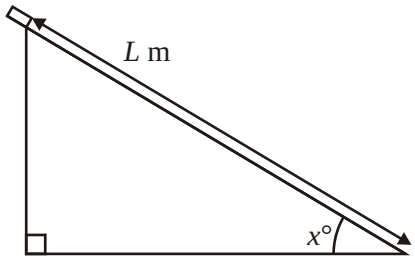
$a = 3 \times 10^8$
$b = 2 \times 10^7$

Find *y*.
Give your answer in standard form correct to 2 significant figures.

y = ...

(Total 3 marks)

3.



Elliot did an experiment to find the value of g m/s^2, the acceleration due to gravity.
He measured the time, T seconds, that a block took to slide L m down a smooth slope of angle $x°$.

He then used the formula $$g = \frac{2L}{T^2 \sin x°}$$

to calculate an estimate for g.

T = 1.3 correct to 1 decimal place.
L = 4.50 correct to 2 decimal places.
x = 30 correct to the nearest integer.

(a) Calculate the lower bound and the upper bound for the value of g.
Give your answers correct to 3 decimal places.

Lower bound .....

Upper bound .....

(4)

(b) Use your answers to part (a) to write down the value of g to a suitable degree of accuracy.
Explain your reasoning.

.....

.....

.....

(1)
(Total 5 marks)

4. Henry invests £4500 at a compound interest rate of 5% per annum.

At the end of n complete years the investment has grown to £5469.78.

Find the value of n.

……

(Total 2 marks)

5. The shutter speed, S, of a camera varies inversely as the square of the aperture setting, f.

When $f = 8$, $S = 125$

(a) Find a formula for S in terms of f.

.....

(3)

(b) Hence, or otherwise, calculate the value of S when $f = 4$

S = ...

(1)

(Total 4 marks)

6. Factorise

$$x^2 + 7x + 6$$

.....

(Total 2 marks)

7. The straight line $\mathbf{L}_1$ has equation $y = 2x + 3$

The straight line $\mathbf{L}_2$ is parallel to the straight line $\mathbf{L}_1$.
The straight line $\mathbf{L}_2$ passes through the point (3, 2).

Find an equation of the straight line $\mathbf{L}_2$.

.....

(Total 3 marks)

8. (a) Simplify $a^3 \times a^4$

……

(1)

(b) Simplify $3x^2y \times 5xy^3$

……

(2)

(c) Simplify $\dfrac{(x-1)^2}{x-1}$

……

(1)

(d) Factorise $x^2 - 9$

……

(1)

(Total 5 marks)

9. Solve

$$2x - 3y = 11$$
$$5x + 2y = 18$$

x = ...

y = ...

(Total 4 marks)

10. The diagram below shows a 6-sided shape.

All the corners are right angles.

All measurements are given in centimetres.

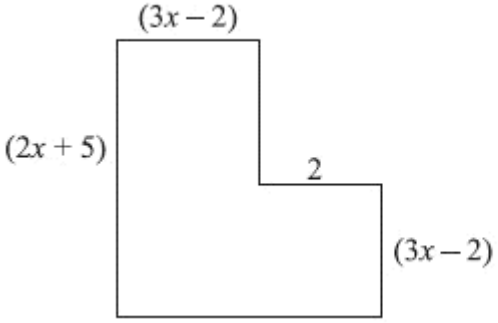


Diagram **NOT** accurately drawn

The area of the shape is 25 cm^2.

(a) Show that $6x^2 + 17x – 39 = 0$

(3)

(b) (i) Solve the equation

$6x^2 + 17x – 39 = 0$

x = …… or x = ……

(ii) Hence work out the length of the longest side of the shape.

……..cm

(4)

(Total 7 marks)

11. $\dfrac{x}{x+c} = \dfrac{p}{q}$

Make x the subject of the formula.

$x =$.....

(Total 4 marks)

12. Prove that $(n + 2)^2 - (n - 2)^2 = 8n$ for all values of n.

(Total 2 marks)

13.

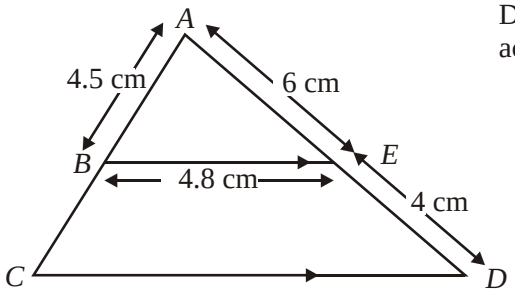


Diagram **NOT** accurately drawn

BE is parallel to *CD*.
AE = 6 cm, *ED* = 4 cm, *AB* = 4.5 cm, *BE* = 4.8 cm.

(a) Calculate the length of *CD*.

.....cm

(2)

(b) Calculate the perimeter of the trapezium *EBCD*.

.....cm

(2)
(Total 4 marks)

14.

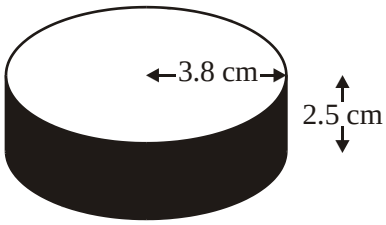


Diagram **NOT** accurately drawn

An ice hockey puck is in the shape of a cylinder with a radius of 3.8 cm, and a thickness of 2.5 cm.

It is made out of rubber with a density of 1.5 grams per cm^3.

Work out the mass of the ice hockey puck.
Give your answer correct to 3 significant figures.

..... grams

(Total 4 marks)

15.

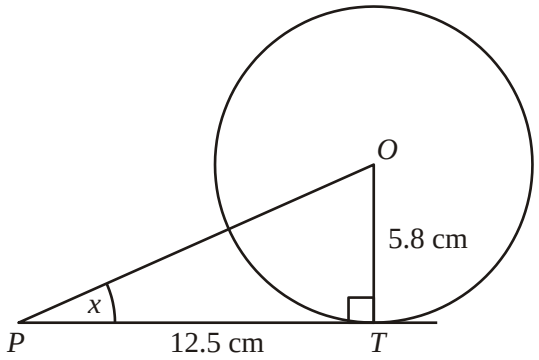


Diagram **NOT** accurately drawn

In the diagram, *T* is a point on a circle, centre *O*.
PT is the tangent to the circle at *T*.

(a) Angle *OTP* is a right angle.
Give a reason why

.....

(1)

The radius of the circle is 5.8 cm.
PT = 12.5 cm.

(b) Calculate the size of angle *x*.
Give your answer correct to 1 decimal place.

x =..... °

(3)

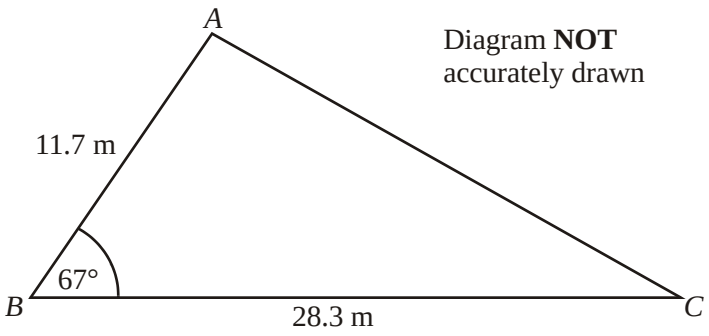
C is the point on the circle where the straight line *OP* crosses the circle.

(c) Calculate the length of *PC*.
Give your answer correct to 3 significant figures.

..... cm

(4)
(Total 8 marks)

16.



AB = 11.7 m.
BC = 28.3 m.
Angle *ABC* = 67°.

(a) Calculate the area of the triangle *ABC*.
Give your answer correct to 3 significant figures.

…… m^2

(2)

(b) Calculate the length of *AC*.
Give your answer correct to 3 significant figures.

…… m

(3)
(Total 5 marks)

17. The table shows information about the number of hours that 120 children used a computer last week.

Number of hours (h)	Frequency
$0 < h \leq 2$	10
$2 < h \leq 4$	15
$4 < h \leq 6$	30
$6 < h \leq 8$	35
$8 < h \leq 10$	25
$10 < h \leq 12$	5

(a) Work out an estimate for the mean number of hours that the children used a computer. Give your answer correct to two decimal places.

……hours

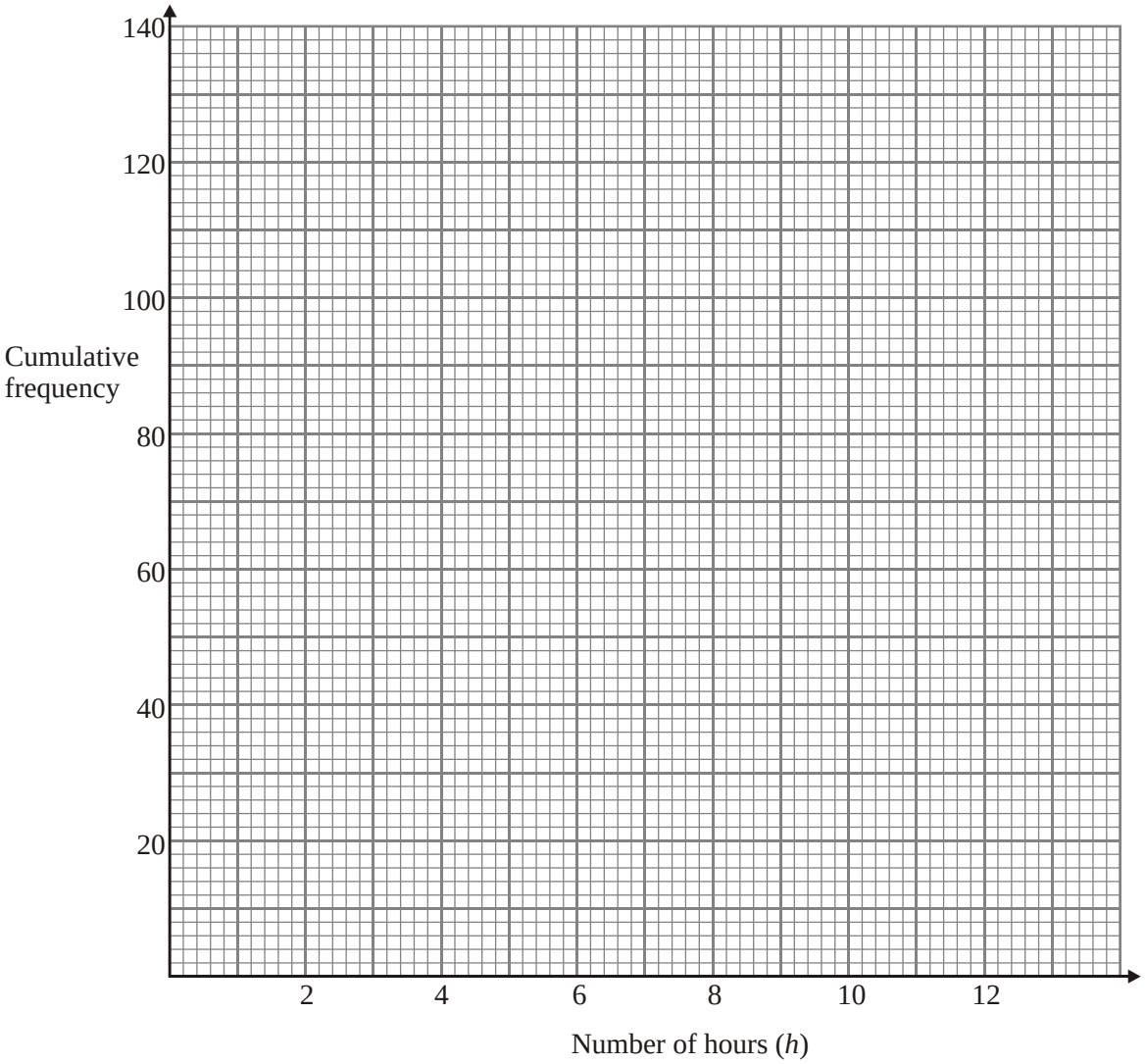
(4)

(b) Complete the cumulative frequency table.

Number of hours (h)	Cumulative frequency
$0 < h \leq 2$	10
$0 < h \leq 4$	
$0 < h \leq 6$	
$0 < h \leq 8$	
$0 < h \leq 10$	
$0 < h \leq 12$	

(1)

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



(2)

(d) Use your graph to find an estimate for the number of children who used a computer for **less** than 7 hours last week.

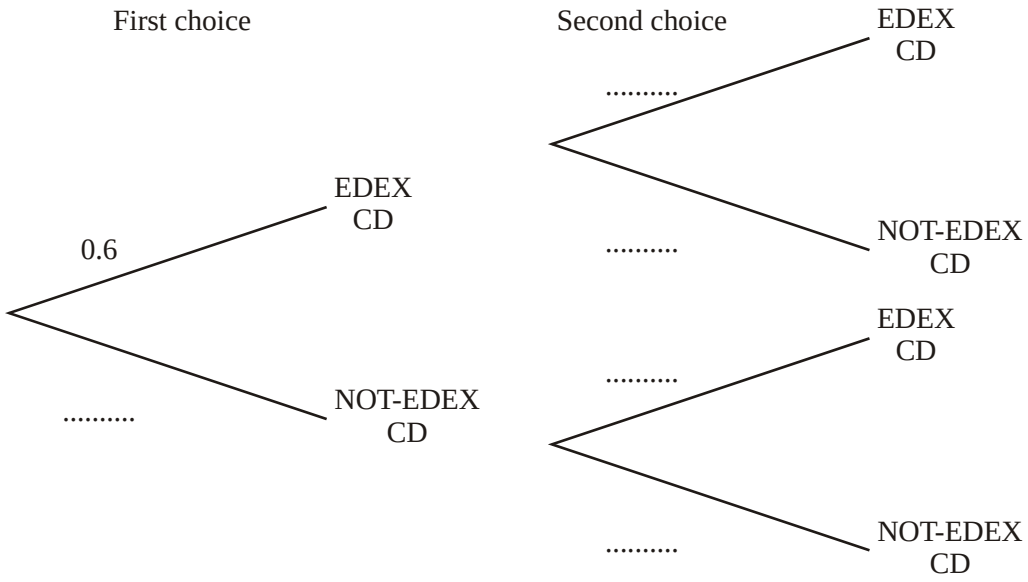
.....

(2)
(Total 9 marks)

18. Amy has 10 CDs in a CD holder.
Amy's favourite group is Edex.
She has 6 Edex CDs in the CD holder.

Amy takes one of these CDs at random.
She writes down whether or not it is an Edex CD.
She puts the CD back in the holder.
Amy again takes one of these CDs at random.

(a) Complete the probability tree diagram.



(2)

(b) Find the probability that Amy will pick two Edex CDs.

.....

(2)

Amy had 30 CDs.
The mean playing time of these 30 CDs was 42 minutes.

Amy sold 5 of her CDs.
The mean playing time of the 25 CDs left was 42.8 minutes.

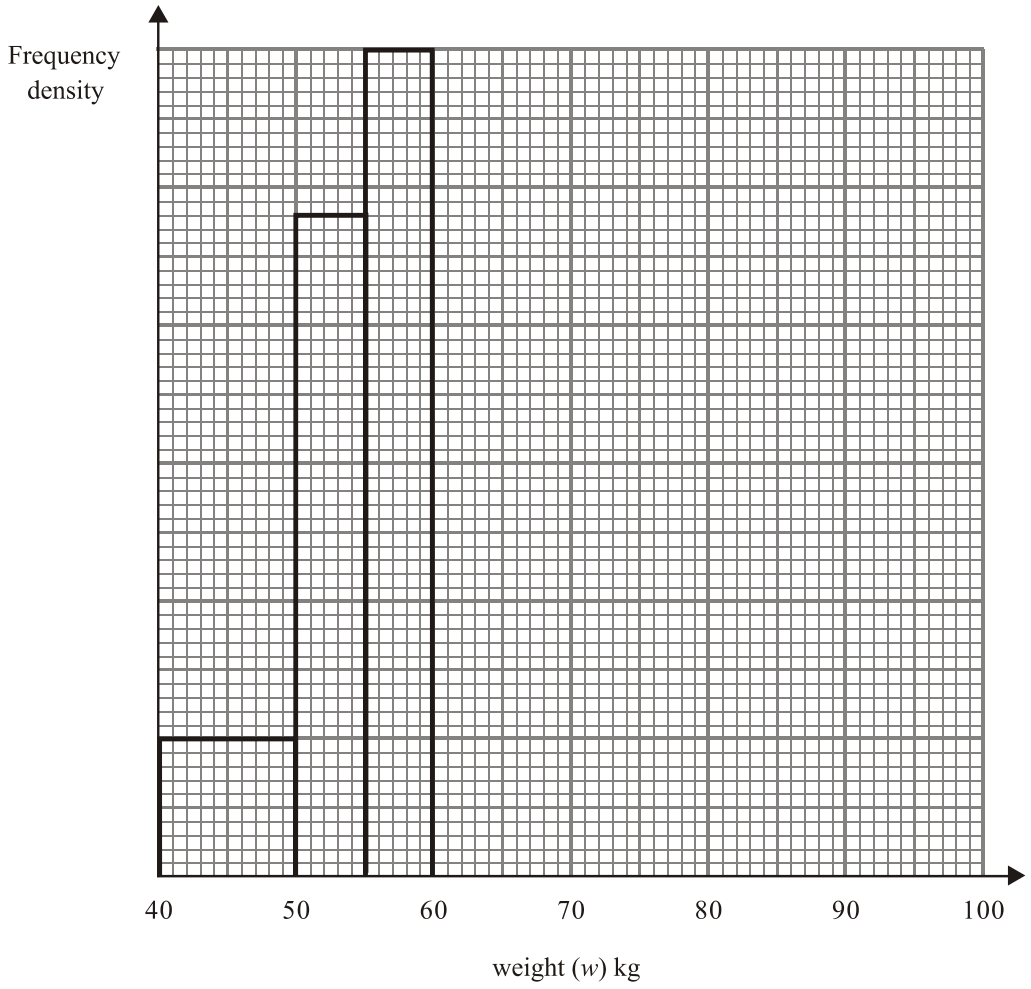
(c) Calculate the mean playing time of the 5 CDs that Amy sold.

..... minutes

(3)

(Total 7 marks)

19. The incomplete table and histogram give some information about the weights of people at a keep-fit session.



(a) Use the information in the histogram to complete the frequency table.

Weight (w) kg	**Frequency**
$40 \leq w < 50$	10
$50 \leq w < 55$	
$55 \leq w < 60$	
$60 \leq w < 75$	15
$75 \leq w < 95$	8

(2)

(b) Complete the histogram.

(2)

(Total 4 marks)

THE END