



ALEXANDERS COLLEGE

Suffolk England

MATHEMATICS ENTRANCE EXAM

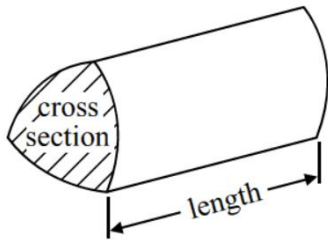
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INFORMATION

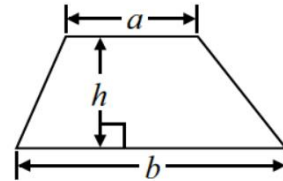
The total mark for this paper is 100
Calculators must not be used.

Formulae

Volume of prism = area of cross section \times length

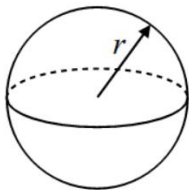


Area of trapezium = $\frac{1}{2} (a + b)h$



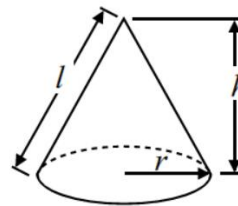
Volume of sphere = $\frac{4}{3}\pi r^3$

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

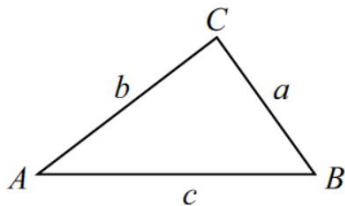


Volume of cone = $\frac{1}{3}\pi r^2 h$

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 questions.
Write your answers in the spaces provided.
You must write down all stages in your working.
You must NOT use a calculator.

Questions

Q1.

Work out $\frac{2}{5} + \frac{3}{8}$

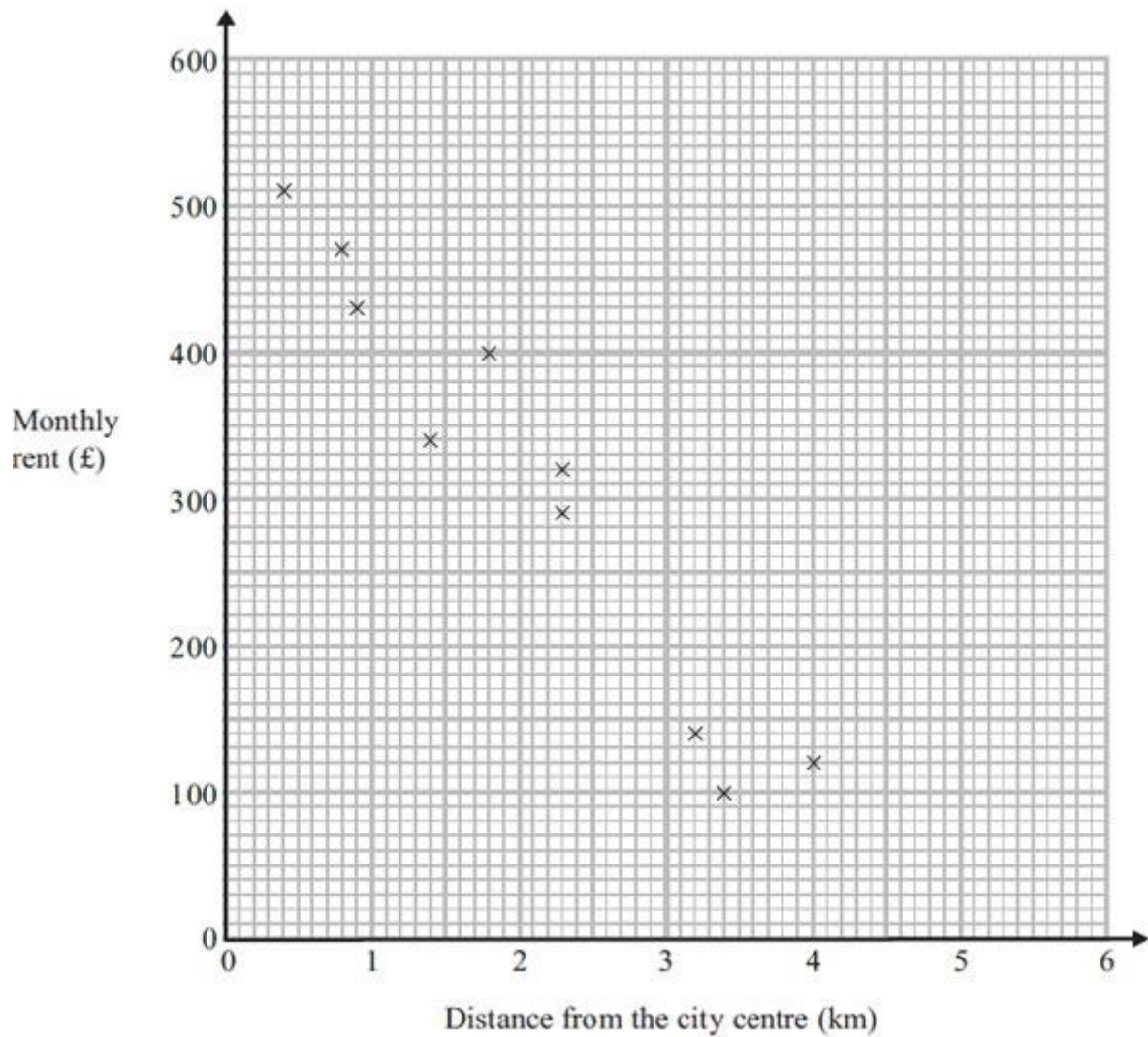
Give your answer in its simplest form.

.....
(Total for Question is 2 marks)

Q2.

The scatter graph shows information about 10 apartments in a city.

The graph shows the distance from the city centre and the monthly rent of each apartment.



The table shows the distance from the city centre and the monthly rent for two other apartments.

Distance from the city centre (km)	2	3.1
Monthly rent (£)	250	190

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

(1)

(b) Describe the relationship between the distance from the city centre and the monthly rent.

.....
.....

(1)

An apartment is 2.8 km from the city centre.

(c) Find an estimate for the monthly rent for this apartment.

.....

(2)

(Total for Question is 4 marks)

Q3.

Julia is investigating how much exercise people do in a week.

She uses these two questions in a questionnaire.

Question 1 What is your age?

Under 15

15 to 25

25 to 40

over 40

Question 2 How much exercise do you do?

A bit

Some

A lot

(a) Write down **one** thing wrong with each of these questions.

Question 1

.....
.....

Question 2

.....
.....

(2)

Julia wants to know how much time people spend exercising.

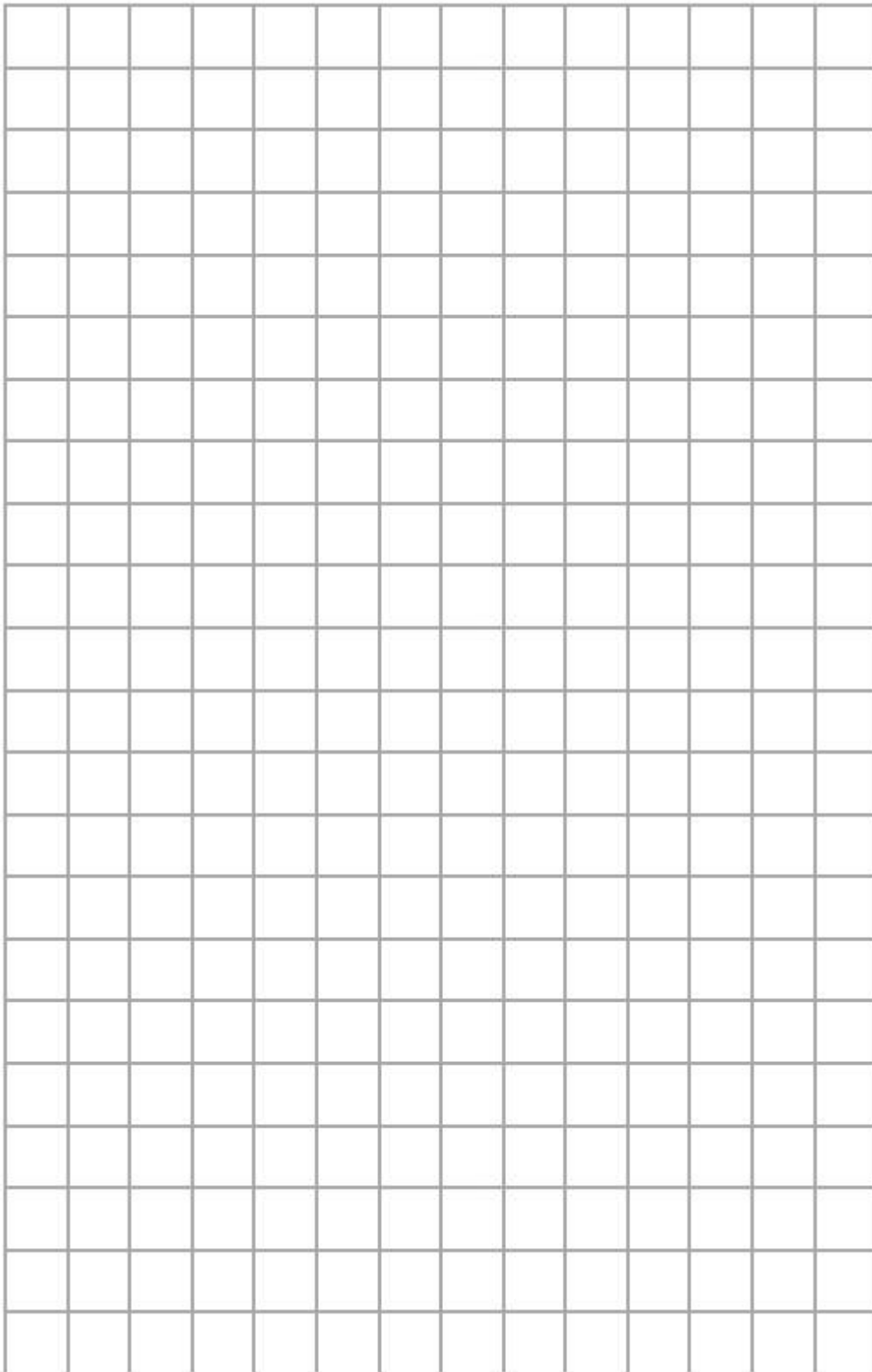
(b) Design a question Julia could use in her questionnaire.

(2)

(Total for Question is 4 marks)

Q4.

On the grid, draw the graph of $y = 3x + 2$ for values of x from -2 to 2



(Total for Question is 4 marks)

Q5.

Here are the first 5 terms of an arithmetic sequence.

6 10 14 18 22

(a) Write down an expression, in terms of n , for the n th term of this sequence.

.....

(2)

The n th term of a different sequence is $2n^2 - 4$

(b) Find the 3rd term of this sequence.

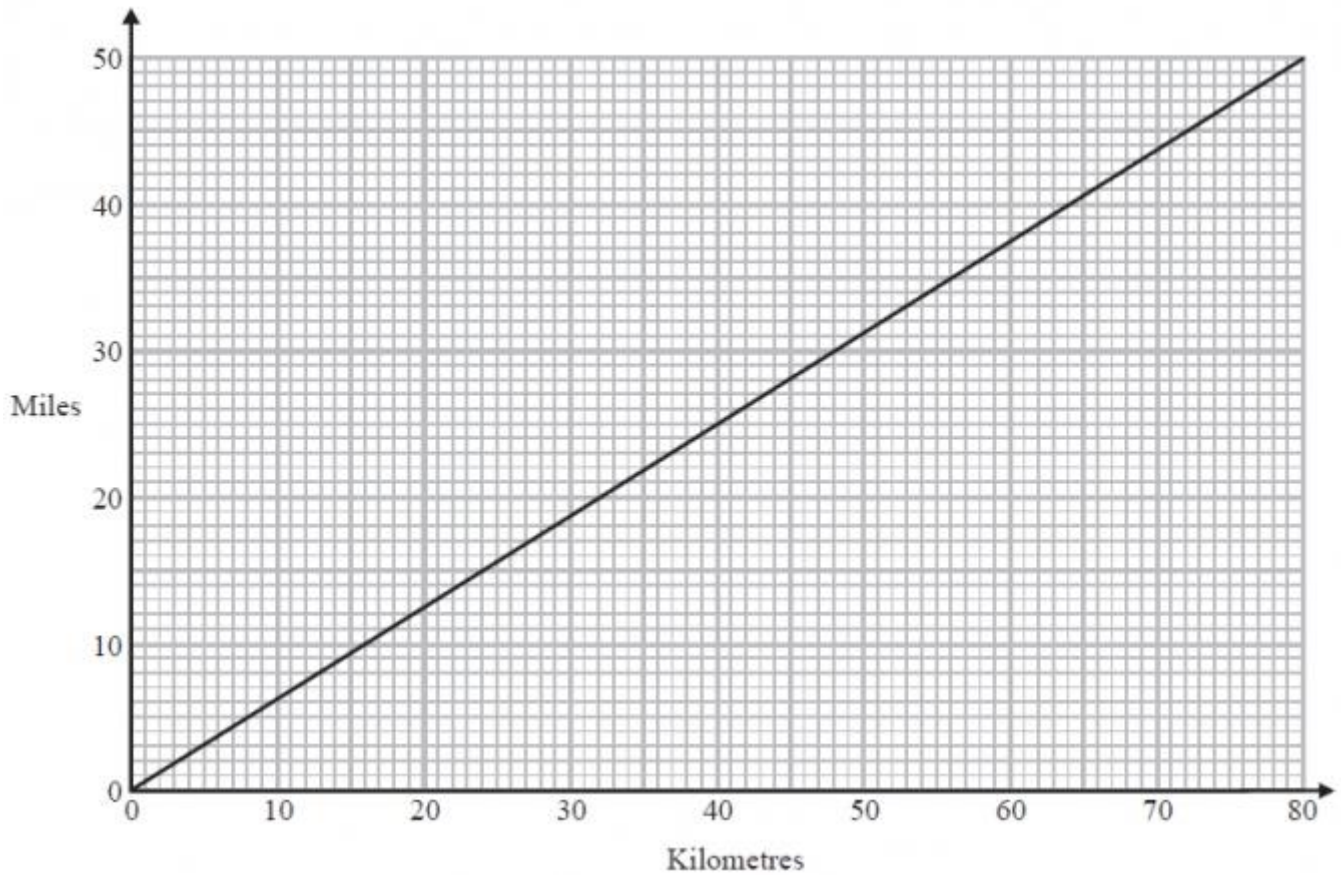
.....

(2)

(Total for Question is 4 marks)

Q6.

* You can use this conversion graph to change between miles and kilometres.



Mary has to drive from Paris to Calais, and then from Dover to Sheffield.
The total distance she has to drive is 350 miles.

Mary has already driven 240 km from Paris to the ferry at Calais.
She goes on a ferry to Dover.
She now has to drive from Dover to Sheffield.

Mary has enough petrol to drive 180 miles.

Will Mary have to stop for petrol on the way to Sheffield?

(Total for Question is 4 marks)

Q7.

Buses to Acton leave a bus station every 24 minutes.

Buses to Barton leave the same bus station every 20 minutes.

A bus to Acton and a bus to Barton both leave the bus station at 9 00 am.

When will a bus to Acton and a bus to Barton next leave the bus station at the same time?

.....

(Total for Question is 3 marks)

Q8.

Write down the value of

(i) 7^0

.....

(ii) 5^{-1}

.....

(iii) $9^{\frac{1}{2}}$

.....

(Total for Question is 3 marks)

Q9.

*

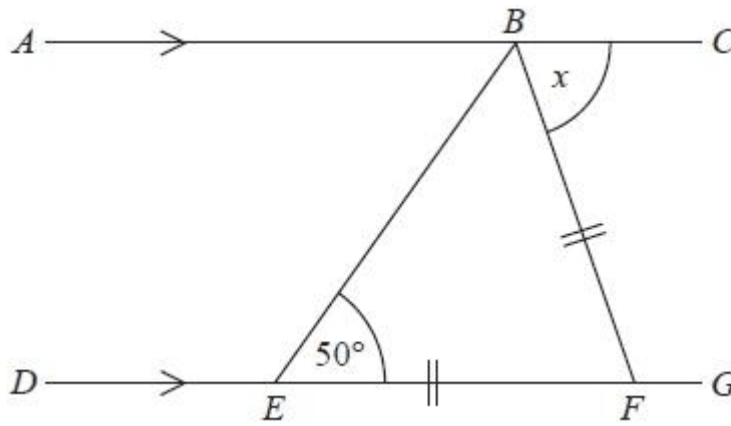


Diagram NOT
accurately drawn

ABC is a straight line.
DEFG is a straight line.
AC is parallel to *DG*.
 $EF = BF$.
Angle $BEF = 50^\circ$.

Work out the size of the angle marked x .
Give reasons for your answer.

.....°

(Total for Question is 4 marks)

Q10.

Ria is going to buy a caravan.

The total cost of the caravan is £7000 **plus** VAT at 20%.

Ria pays a deposit of £3000

She pays the rest of the total cost in 6 equal monthly payments.

Work out the amount of each monthly payment.

£.....

(Total for Question is 4 marks)

Q11.

Mrs Jennings shares £770 between her two sons, Pete and Tim.
She shares the money in the ratio of her sons' ages.

The combined age of her two sons is 66 years.

Pete is 6 years younger than Tim.

Work out how much money each son gets.

You must show all your working.

Pete £

Tim £

(Total for Question is 5 marks)

Q12.

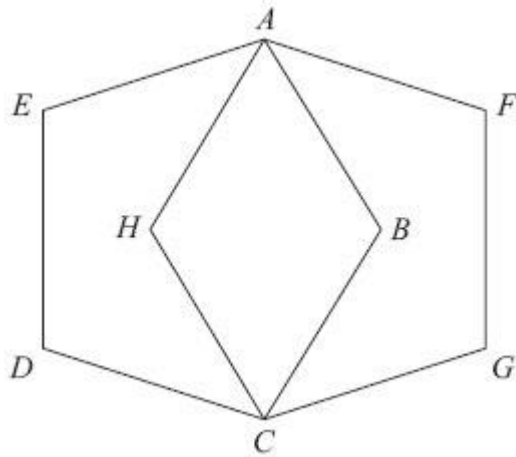


Diagram **NOT**
accurately drawn

$ABCDE$ and $AFGCH$ are regular pentagons.
The two pentagons are the same size.

Work out the size of angle EAH .
You must show how you got your answer.

.....

(Total for Question is 4 marks)

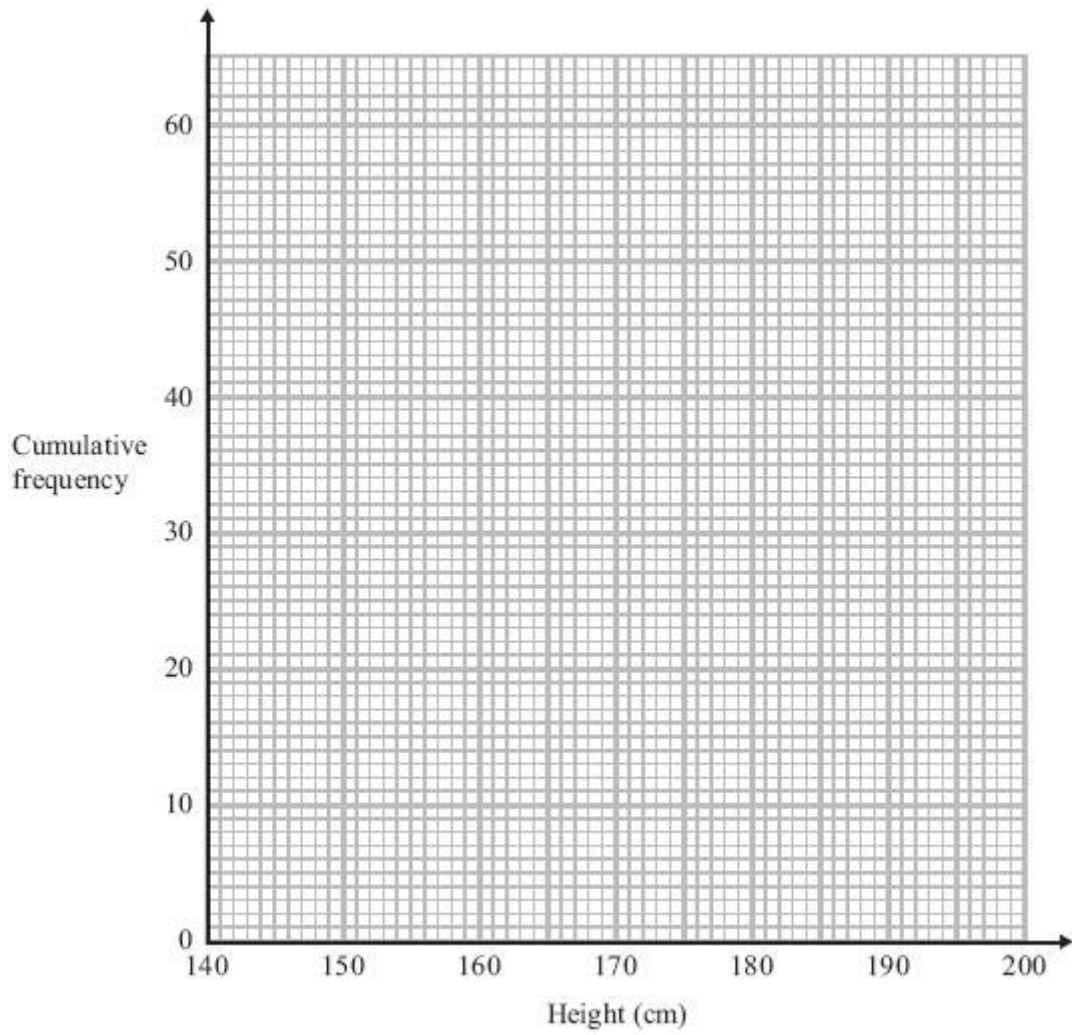
Q13.

The table below shows information about the heights of 60 students.

Height (x cm)	Number of students
$140 < x \leq 150$	4
$150 < x \leq 160$	5
$160 < x \leq 170$	16
$170 < x \leq 180$	27
$180 < x \leq 190$	5
$190 < x \leq 200$	3

(a) On the grid opposite, draw a cumulative frequency graph for the information in the table.

(3)



(b) Find an estimate

(i) for the median,

.....

(ii) for the interquartile range.

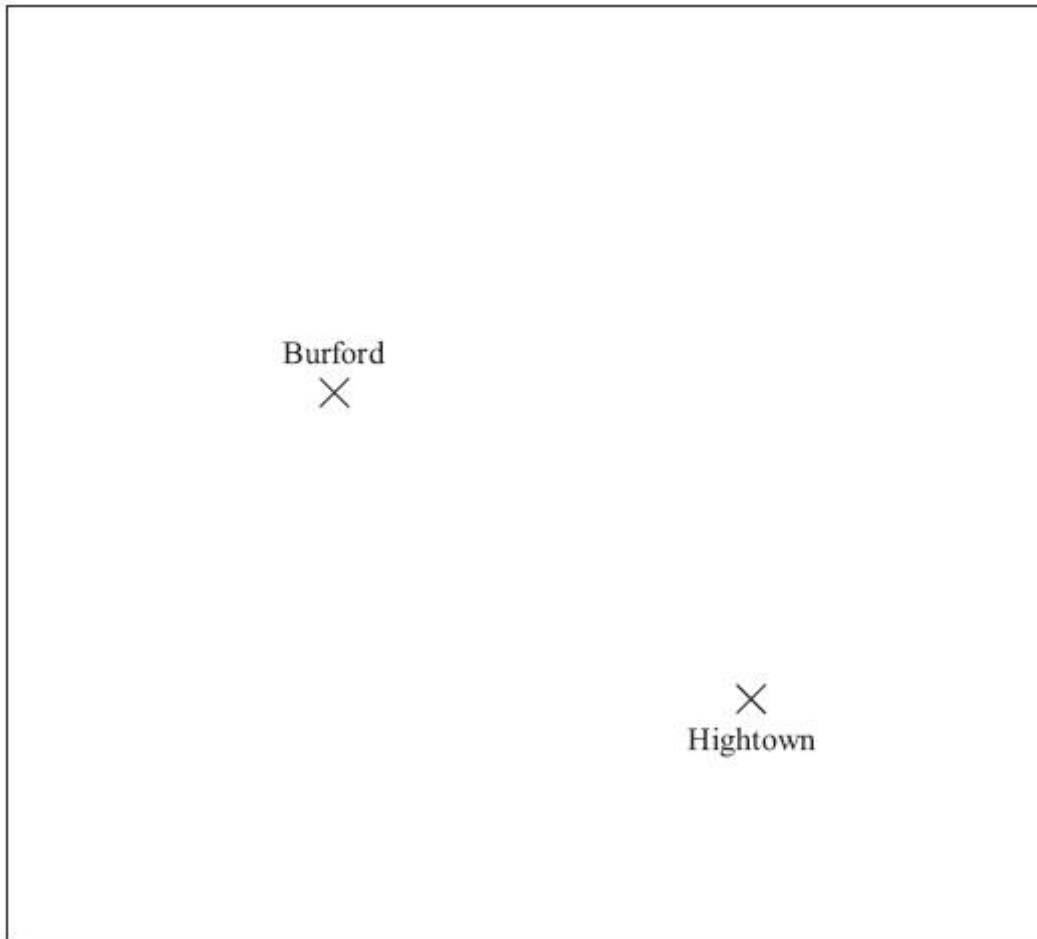
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(3)

(Total for Question is 6 marks)

Q14.

Here is a map.
The map shows two towns, Burford and Hightown.



Scale: 1 cm represents 10 km

A company is going to build a warehouse.
The warehouse will be less than 30 km from Burford **and** less than 50 km from Hightown.
Shade the region on the map where the company can build the warehouse.

(Total for Question is 3 marks)

Q15.

(a) Write down the value of 10^0

.....

(1)

(b) Write 6.7×10^{-5} as an ordinary number.

.....

(1)

(c) Work out the value of $(3 \times 10^7) \times (9 \times 10^6)$
Give your answer in standard form.

.....

(2)

(Total for Question is 4 marks)

Q16.

(a) Solve $\frac{4(8x - 2)}{3x} = 10$

.....
(3)

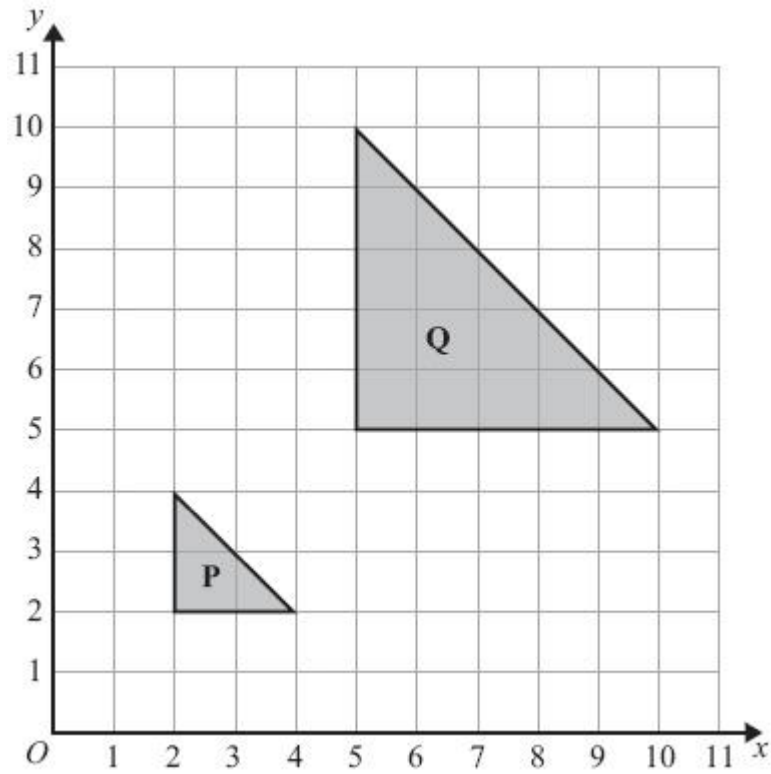
(b) Write as a single fraction in its simplest form

$$\frac{2}{y+3} - \frac{1}{y-6}$$

.....
(3)

(Total for Question is 6 marks)

Q17.



Describe fully the single transformation that maps shape **P** onto shape **Q**.

.....
.....

(Total for Question is 3 marks)

Q18.

The point A has coordinates $(3, 8)$.

The point B has coordinates $(7, 5)$.

M is the midpoint of the line segment AB .

Find the coordinates of M .

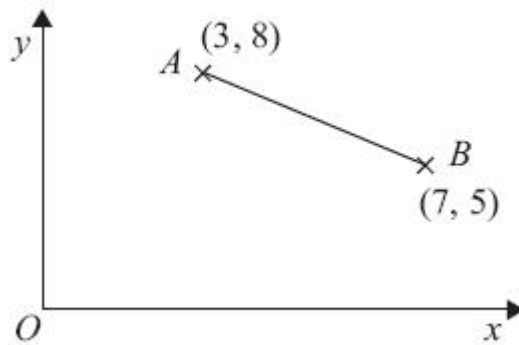


Diagram **NOT**
accurately drawn

(Total for Question is 2 marks)

Q19.

*

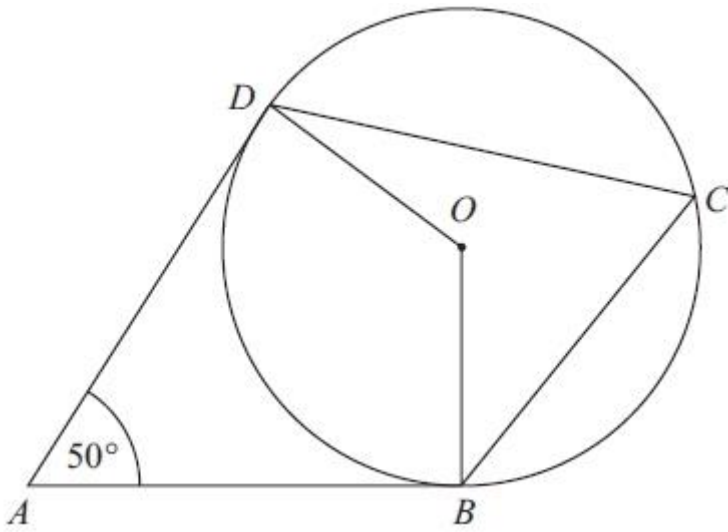


Diagram **NOT** accurately drawn

B, *C* and *D* are points on the circumference of a circle, centre *O*.
AB and *AD* are tangents to the circle.

Angle *DAB* = 50°

Work out the size of angle *BCD*.

Give a reason for each stage in your working.

(Total for Question is 4 marks)

Q20.

(a) Factorise fully $6ab + 10ac$

.....
(2)

(b) Expand and simplify $(x - 5)(x + 7)$

.....
(2)

(c) Simplify $\frac{2m^2t^6}{m^4t^2}$

Give your answer in its simplest form.

.....
(2)

(d) Factorise $y^2 - 16$

.....
(1)

(e) Simplify $(h^2)^{-3}$

.....
(1)

(Total for Question is 8 marks)

Q21.

* The diagram shows a pentagon.

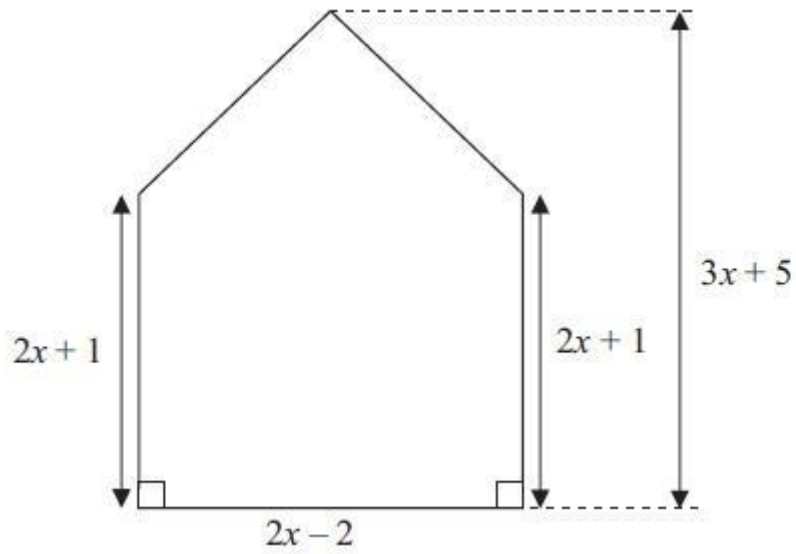


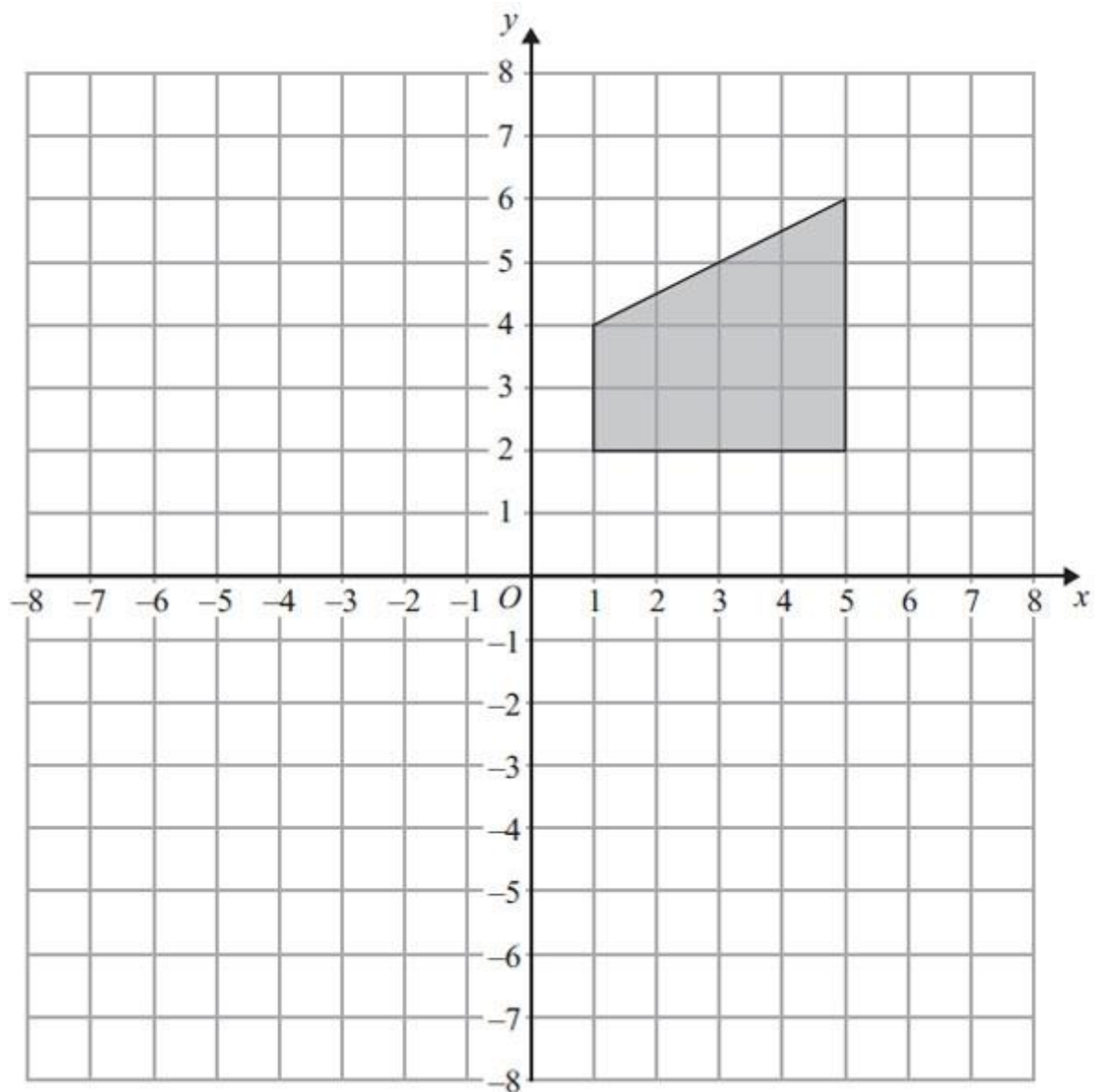
Diagram **NOT**
accurately drawn

All measurements are in centimetres.

Show that the area of this pentagon can be written as $5x^2 + x - 6$

(Total for Question is 4 marks)

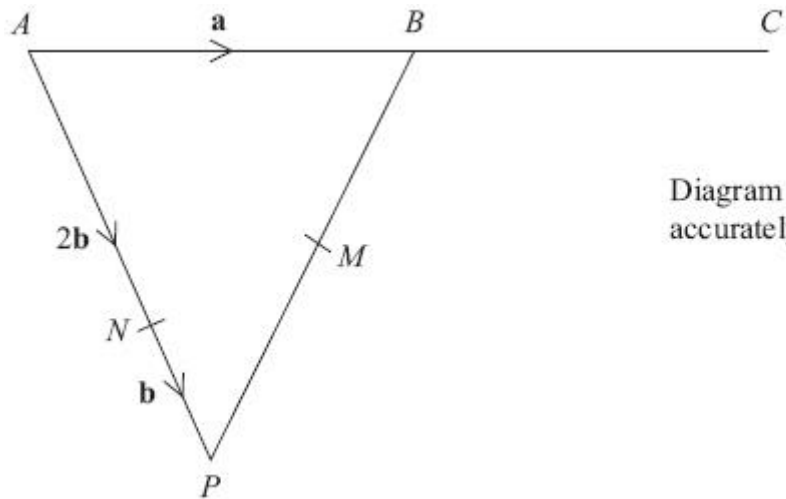
Q22.



Enlarge the shaded shape by scale factor $-\frac{1}{2}$ with centre $(-1, -2)$.

(Total for Question is 3 marks)

Q23.



APB is a triangle.
 N is a point on AP .

$$\vec{AB} = \mathbf{a} \quad \vec{AN} = 2\mathbf{b} \quad \vec{NP} = \mathbf{b}$$

(a) Find the vector \vec{PB} , in terms of \mathbf{a} and \mathbf{b} .

.....
(1)

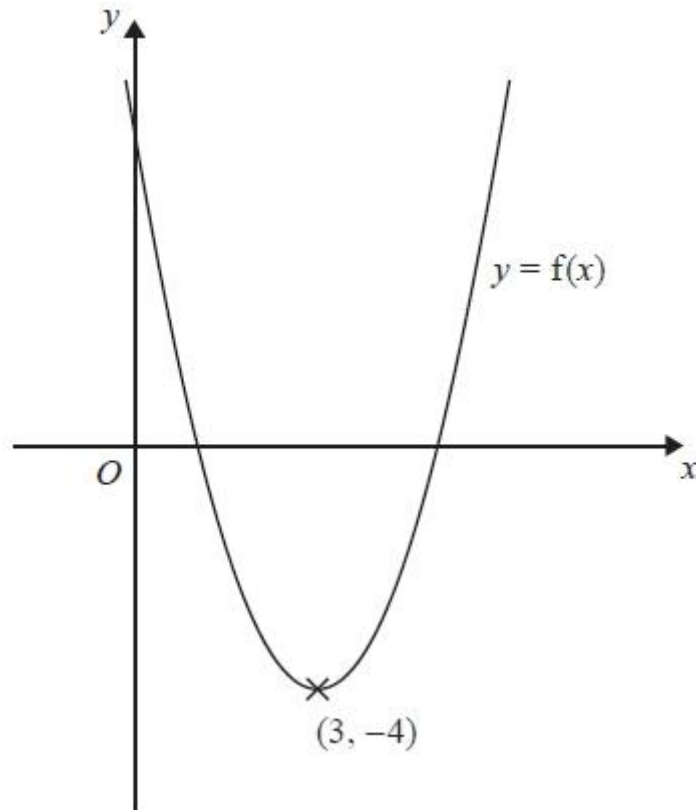
B is the midpoint of AC .
 M is the midpoint of PB .

* (b) Show that NMC is a straight line.

(4)

(Total for Question is 5 marks)

Q24.



The diagram shows part of the curve with equation $y = f(x)$.
The coordinates of the minimum point of this curve are $(3, -4)$

Write down the coordinates of the minimum point of the curve with equation

(i) $y = f(x) + 3$

(..... ,)

(ii) $y = f(2x)$

(..... ,)

(iii) $y = f(-x)$

(..... ,)

(Total for Question is 3 marks)

Q25.

Fiza has 10 coins in a bag.

There are three £1 coins and seven 50 pence coins.

Fiza takes at random, 3 coins from the bag.

Work out the probability that she takes exactly £2.50

.....
(Total for Question is 4 marks)