

Name:.....

Date of Birth:.....



Sixth Form Mathematics Entrance Exam

- You have **1 hour**
- Try and attempt all questions. If you cannot answer a question, move onto the next one.
- Calculators are **NOT** allowed.
- Please work in pen.
- There are 60 marks in total.

- 1) a) Factorise fully $2y^2 - 72$

.....

- b) Find the exact value of $1.03^2 - 0.97^2$

.....

- c) The operation $*$ is defined for the rational numbers x and y by

$$x * y = (x - y)^2$$

- i) Calculate $7 * (5 * 3)$

.....

- ii) Solve for x , the equation, $x * 2 = 36$

.....

(7 marks)

2) Find the value of $\left(\frac{27}{8}\right)^{-\frac{2}{3}}$.

..... (2 marks)

3) $x^{\frac{1}{2}} = 6$ and $y^{-3} = 64$ Work out the value of $\frac{x}{y}$

$\frac{x}{y} =$ (4 marks)

- 4) Simplify fully

$$\frac{4x^2 + 19x - 5}{9x^2 - 16} \div \frac{x + 5}{3x - 4}$$

..... (5 marks)

- 5) Rationalise the denominator of

$$\frac{a + \sqrt{a}}{\sqrt{a}}$$

where a is a prime number. Simplify your answer as much as possible.

..... (2 marks)

- 6) The point P has coordinates $(3, 4)$
The point Q has coordinates (a, b)
A line perpendicular to PQ is given by the equation $3x + 2y = 7$
Find an expression for b in terms of a .

..... (5 marks)

- 7) n is an integer.
Prove algebraically that the sum of $\frac{1}{2}n(n+1)$ and $\frac{1}{2}(n+1)(n+2)$ is always a square number.

.....(3 marks)

- 8) The point $(-3, -4)$ is the turning point of the graph of $y = x^2 + ax + b$, where a and b are integers. Find the values of a and b .

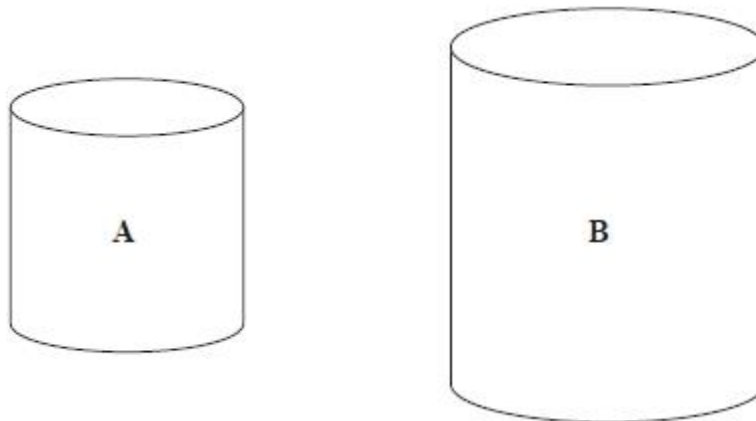
..... (3 marks)

- 9) The ratio $(y + x) : (y - x)$ is equivalent to $k : 1$

Show that $y = \frac{x(k+1)}{k-1}$

.....(3 marks)

- 10) **A** and **B** are two similar cylindrical containers.



the surface area of container **A** : the surface area of container **B** = 4 : 9

Tyler fills container **A** with water.

She then pours all the water into container **B**.

Tyler repeats this and stops when container **B** is full of water.

Work out the number of times that Tyler fills container **A** with water.

You must show all your working.

.....

(4 marks)

11) Given that $9^{-\frac{1}{2}} = 27^{\frac{1}{4}} \div 3^{x+1}$ find the exact value of x .

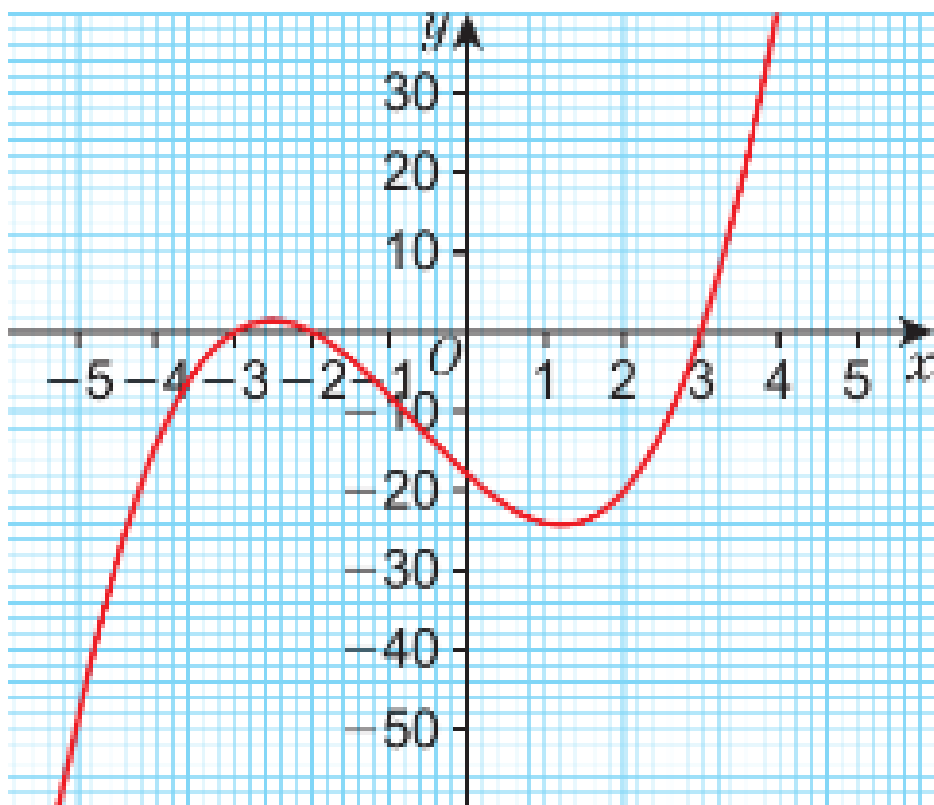
$x = \dots\dots\dots$ (3 marks)

12) Make t the subject of $n^2 = \frac{4d + t^3}{t^3}$

$\dots\dots\dots$

(4 marks)

- 13) The graph has equation $y = x^3 + ax^2 + bx + c$



Work out the values of a , b and c .

4 marks)

- 14) Here is a rectangle.

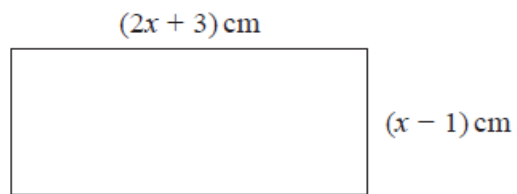


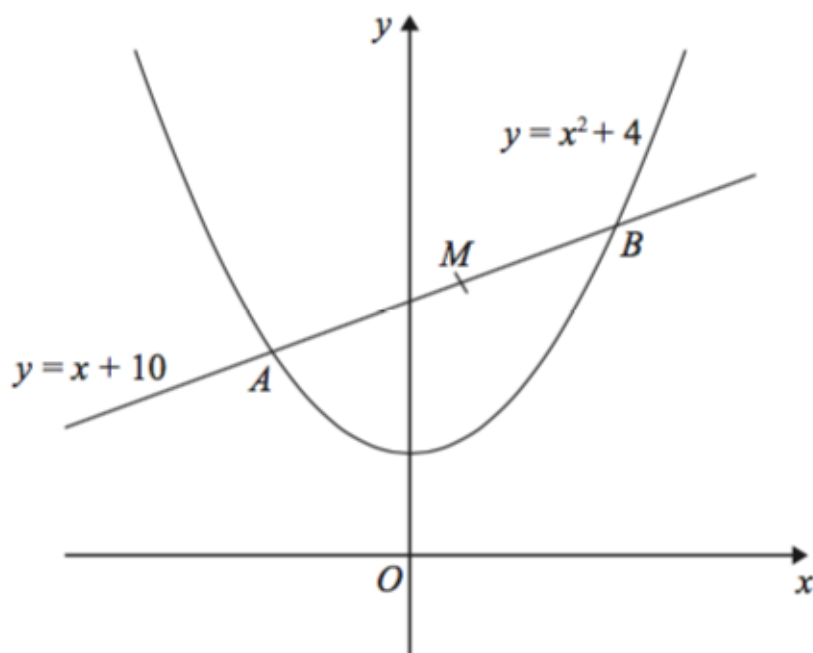
Diagram **NOT**
accurately drawn

Given that the area of the rectangle is less than 75 cm^2 , find the range of possible values of x

.....

(5 marks)

- 15) The sketch shows the curve with equation $y = x^2 + 4$ and the line with equation $y = x + 10$



The line cuts the curve at the points A and B .

M is the midpoint of AB .

Find the coordinates of M .

..... (6 marks)

END OF PAPER