

NCEA Level 2 Mathematics (Algebra)

Linear and quadratic equations

1. Simplify the following:

A

(a) $\frac{x^2-4x+4}{x-2}$

M

(b) $\frac{5x^2y}{2} \div \frac{10x}{y^2}$

A

2. Factorise $4x^2 + 12x - 7$.

A

3. Find the nature of the roots of the equation $x^2 + 3x - 28 = 0$.

M

4. Find the possible values of k such that $x^2 + (k - 1)x + k = 0$ has no real roots.

- E 5. The graph of $y = 2x^2 + (k + 3)x + (k + 2)$ does not cut the x -axis. Find the possible values of k .

- E 6. Find the range of values of k for which the roots of the equation $y = x^2 + (k - 2)x + (k + 3)$ are not real.

7. A cylinder which has a radius of $(x - 2)$ and a height of $(x - 8)$ has a volume given by

$$V = \pi(x - 2)^2(x - 8)$$

M

- (a) Find the possible height of the cylinder if its volume is 32π .

E

- (b) If L is the length of the longest rod that can be placed inside the cylinder, show that

$$x = \sqrt{\frac{L^2 - 80}{5}}$$

E

8. The roots of the quadratic equation $2x^2 - 9x + k = 0$ are $\frac{m}{2}$ and $m - 3$. Find k .

- E** 9. Find the values of m for which one root of the equation $4x^2 = mx - 5$ is three times the other root.

- M** 10. A theme park has a rectangular playground which is 30 metres long and 15 metres wide. It is surrounded by a border which has a constant width of x metres. The area of the border is twice the area of the playground. Find x .

- E** 11. The length of the longer of the parallel sides of a trapezium is the same as the height of the trapezium. It is also 8 cm longer than the shorter of the parallel sides. The area of the trapezium is less than 60 cm^2 . What is the height of the trapezium?

Logarithms and Exponents

12. Solve the following:

A (a) $\log_x 81 = 4$

A (b) $\log_9 y = \frac{1}{2}$

13. Write as a log of a single number:

A (a) $\log 3 + 3 \log 2$

A (b) $3 \log 2 - \log 4$

A 14. Write $\log 8 + \log 16$ in terms of $\log 2$.

A 15. Simplify fully $\log a + \log b - \log b^2$.

16. Solve the following:

A (a) $9^x = 3^{x+5}$

M (b) $2(1 + 0.07)^x = 15$

- M 17. A theme park will need to close if the number of people entering the park in any month falls below 30,000. A model for the number entering is

$$P = 45000 \times 0.96^{n+2}$$

where P is the number of people entering the park in a month and n is the number of months since the start of the year. Assuming this model continues to hold, after how many months will the park close?

18. Sam is investigating paper sizes. She takes measurements and finds that an A0 sized piece of paper has an area of 1 m^2 , a length of 119 cm, and a width of 84.1 cm. When an A0 sized piece of paper is cut in half, it is referred to as A1 sized paper and has an area of 0.5 m^2 . This pattern continues: the A_n sized piece of paper is double the area of the $A(n+1)$ sized paper.

- M (a) Give the equation for the area of a piece of A_n sized paper, and use this to find the area of an A10 sized piece of paper.

- E (b) The ratio of length to width of any piece of A-sized paper is always the same. Use this information to find the width of a piece of A7 paper.
