

22 Algebra Revision Questions



LC HL Project Maths

1. **Binomial Theorem**
e.g. use the Binomial Theorem to expand fully

$$(2x-3)^4$$

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2. Fractions

e.g. write as a single fraction in its simplest form

$$\frac{x - \frac{3}{x+2}}{x - \frac{15+4x}{x+2}}$$

3. Surds

e.g. simplify

$$\left(\frac{2\sqrt{x}}{1+x} \right) \left(\sqrt{x} + \frac{1}{\sqrt{x}} \right)$$

where $x \in \mathbb{R}, x > 0$

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5. Linear equations

e.g. solve the simultaneous equations

$$4x + 5y = 22$$

$$2x + 3y = 12$$

- (i) by algebra
- (ii) by drawing a graph

4. Making and manipulating formulae

e.g. A chemist has a large container of 10% acid solution and another large container of 25% acid solution. She mixes $x \text{ cm}^3$ of the 10% solution with $y \text{ cm}^3$ of the 25% solution. Express, in the simplest form, the acid concentration, $m\%$, of the mixture, i.e. the percentage of acid in the mixture.

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6. Linear simultaneous equations

e.g. solve the simultaneous equations

$$3x + 2y - z = 5$$

$$4x + 5y + 2z = 11$$

$$x - 3y + z = 8$$

7. Solving quadratic equations

e.g. solve the equation

$$2x^2 - 5x - 3 = 0$$

(i) by factors,

(ii) by completing the square,

(iii) by the quadratic formula

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8. Quadratic graphs

e.g. Construct a graph of the function

$$f : x \rightarrow 2x^2 - 7x - 2$$

by using the complete square form to find the co-ordinates of the turning point.

Use your graph to estimate the values of x for which $f(x) = 4$.

9. Nature of quadratic roots

e.g. show that for all values of $k \in \mathbb{R}$, the equation

$$x^2 - 3(k+1)x + (2k^2 + 5k + 2) = 0$$

has real roots

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10. Linear, non-linear simultaneous equations

e.g. solve the simultaneous equations

$$2x + y = 1$$

$$x^2 + 2xy = -8$$

11. Rational equations

e.g. Solve the equation

$$\frac{x+2}{x+3} + \frac{2x+3}{x+2} = \frac{3}{2}$$

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12. Irrational equations

e.g. solve

$$\sqrt{x+2} - \sqrt{x-6} = 2,$$

for $x \in \mathbb{R}$

13. Identities

e.g. if

$$(x+a)^2 - (x+b)^2 = 8x+24$$

for all $x \in \mathbb{R}$, find the values of the constants a and b

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14. Use the Factor Theorem to factorise cubics and solve cubic equations

e.g. if $x-1$ and $x-2$ are factors of

$$f : x \rightarrow ax^3 + bx^2 + x + 2,$$

find the values of the constants a and b , and find the third solution of the equation $f(x) = 0$

15. Quadratic factor of a cubic

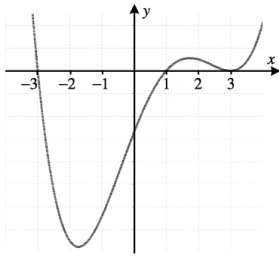
e.g. if $a \neq b$ and $x^2 + ax + b$ is a factor of $x^3 + bx^2 + ax + c$, show that

$$c = b(b+1)$$

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16. Graphing polynomial curves

e.g. The graph of the polynomial
 $y = f(x)$
of degree 4 is shown below.



- (i) Find an expression for the polynomial $f(x)$.
- (ii) If the curve contains the point $(0, -54)$, find the equation of the curve $y = f(x)$.

17. Modulus inequalities

e.g. solve $|7 - 2x| < 3$

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18. Abstract inequalities

e.g. show that

$$4a^2 \geq 3b(4a - 3b),$$

for all $a, b \in \mathbb{R}$

19. Rational inequalities

e.g. solve

$$\frac{x+3}{x-4} > -2, \quad x \in \mathbb{R}, x \neq 4$$

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20. Logs and log equations

e.g. solve the equation

$$\log_2(5x+1) = 2\log_2(x+1),$$

for $x > -1$

21. Equations with the unknown in the index

e.g. solve the equation

$$3^{2x+2} - 28(3^x) + 3 = 0,$$

for $x \in \mathbb{R}$.

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22. Exponential and log graphs

e.g. $f : \mathbb{R}^+ \rightarrow \mathbb{R} : x \rightarrow \log_5 x$.

(i) Copy and complete the table:

x	$\frac{1}{25}$	$\frac{1}{5}$	1	5	25
$y = f(x)$					

Hence construct the graph $y = f(x)$.

(ii) Using the same axes and the same scales, sketch the graph of

$$g : x \rightarrow x - 2.$$

(iii) Use your graph to find the solutions of the equation

$$\log_5 x = x - 2.$$

