

Core Mathematics Transition

Learn these before starting work

Indices

Laws of indices

Surds

$$a^0 = 1$$

$$a^m \times a^n = a^{m+n}$$

$$\sqrt{a} \times \sqrt{b} = \sqrt{ab}$$

$$a^{-1} = \frac{1}{a}$$

$$\frac{a^m}{a^n} = a^m \div a^n = a^{m-n}$$

$$\frac{\sqrt{a}}{\sqrt{b}} = \sqrt{\frac{a}{b}}$$

$$a^{\frac{1}{2}} = \sqrt{a}$$

$$(a^m)^n = a^{mn}$$

$$a^{\frac{m}{n}} = \sqrt[n]{a^m} = (\sqrt[n]{a})^m$$

Quadratic Equations

For $ax^2 + bx + c = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ this is known as the quadratic formula

SECTION A

(Please complete on separate paper)

1. Collecting like terms:

Simplify the following expressions

a) $x^3 + 2x^2 - 5x + 7x^2 + 3x - 4$

b) $x^4 - 3x^3 - 2x^2 + 2x^3 - 6x^2 - 4x$

c) $2ab - a^2 + 4b^2 - 2ab$

d) $3x^2 + 6xy - 12x - 2xy + 6y^2 + 8y$

2. Indices

Evaluate (i.e. work out)

a) 2^{-3}

b) $25^{\frac{1}{2}}$

c) $\left(\frac{1}{3}\right)^{-2}$

d) $\left(\frac{64}{27}\right)^{\frac{4}{3}}$

e) $\left(6\frac{1}{4}\right)^{\frac{1}{2}}$

f) $49^{\frac{3}{2}}$

3. Laws of Indices

Simplify the following expressions

a) $7^3 \times 7^4$ b) $\frac{3^4 \times 3^6}{3^5}$ c) $(4^3)^8$ d) $\frac{2^5 \times 2^9}{(2^3)^5}$ e) $4x^3 \times 2x^5$ f) $(3a)^3$

g) $(-2p^2q^3)^4$ h) $\frac{2x^2y^3z \times 6x^4yz^3}{(9xy^4z^2)^2}$

4. Changing the subject of a formula

Make the variable shown in brackets the subject

a) $v = u + at$ (a)

b) $s = \frac{1}{2}(u + v)t$ (v)

c) $A = 2\pi r^2 + 2\pi rh$ (h)

d) $y = \frac{x+1}{x-1}$ (x)

5. Expanding brackets

Multiply out and simplify

a) $6(2x + 3)$ b) $-2x(x - 5)$ c) $2xy^2(3x - 5y)$ d) $5y(4 - 3x) - 2x(3 - 2y)$

e) $(x + 7)(x - 7)$ f) $(2x - 3)(x + 5)$ g) $(2x + y)(2 - 3y)$ h) $(3a + 4b)(5b - 2a)$

6. Factorising expressions

Factorise fully

a) $7x + 21$ b) $3ab - 12b$ c) $7x^2y + 21x^3y^2$ d) $30xy + 6x^2 - 15x$

7. Factorising quadratic expressions

Factorise

a) $x^2 + 9x + 20$ b) $x^2 - 12x + 35$ c) $y^2 - 2y - 63$

d) $a^2 - 6a - 16$ e) $2x^2 + 3x + 1$ f) $2x^2 + 5xy - 3y^2$

g) $x^2 - 9$ h) $9x^2 - 25y^2$ i) $16x^2 - 3$

8. Solving quadratic equations

Solve the following equations

a) $x^2 + 15x + 54 = 0$

b) $t^2 - 3t - 40 = 0$

c) $3x^2 - x - 14 = 0$

d) $7a - 6a^2 + 20 = 0$

e) $9x^2 + 12x + 4 = 0$

f) $x + 1 = \frac{6}{x}$

9. Solving quadratic equations

Solve the following equations giving your answer in surd form

a) $x^2 + 12x + 20 = 0$

b) $t^2 + 9t + 4 = 0$

c) $3x^2 - 7x = 1$

10. Surds

Simplify the following into the form $a\sqrt{b}$, where b is as small as possible

a) $\sqrt{44}$

b) $\sqrt{320}$

c) $\sqrt{75}$

d) $\sqrt{304}$

e) $\sqrt{\frac{32}{25}}$

f) $\sqrt{\frac{27}{16}}$

g) $\sqrt{\frac{50}{9}}$

e) $\sqrt{\frac{496}{304}}$

11. Surds

Write each of the following in its simplest form

a) $4\sqrt{7} - 3\sqrt{7} + 6\sqrt{7}$

b) $4\sqrt{2} - \sqrt{50} + \sqrt{98}$

c) $\sqrt{3}(7 + 2\sqrt{3})$

d) $(\sqrt{7} - \sqrt{3})(\sqrt{7} + \sqrt{3})$

12. Solving Simultaneous equations

Solve each of the following pairs of simultaneous equations

a) $\begin{cases} 3x + 2y = 13 \\ 2x - y = 2 \end{cases}$

b) $\begin{cases} 2x + 3y = 10 \\ 5x + 2y = 3 \end{cases}$

c) $\begin{cases} 3x + y = 7 \\ 2x - 3y = 23 \end{cases}$

d) $\begin{cases} 8x + 4y = 5 \\ 6x - 8y = 1 \end{cases}$

13. Solving Simultaneous equations

Solve each of the following pairs of simultaneous equations

a) $\begin{cases} y = x^2 - x - 6 \\ y = x + 2 \end{cases}$

b) $\begin{cases} y = 2x + 3 \\ y(5 - x) = 20 \end{cases}$

SECTION B

1 Simplify these expressions.

a $\frac{x^3 \times x^4}{x^2}$ (1 mark)

b $(2x^3)^4$ (1 mark)

c $\frac{9x^{\frac{1}{2}}}{(27x^{-2})^{\frac{2}{3}}}$ (3 marks)

2 Solve $2x^2 \times 4x^4 = 512$ (2 marks)

3 Find the value of x .

$x^{-\frac{4}{3}} = \frac{1}{256}$ (2 marks)

4 a Write $\sqrt{240}$ in the form $a\sqrt{15}$, where a is an integer. (1 mark)

b Expand and simplify $(2 - \sqrt{3})(5 + 2\sqrt{3})$. (2 marks)

c Simplify $\frac{2 + \sqrt{5}}{3 - \sqrt{5}}$ giving your answer in the form $a + b\sqrt{c}$, where a , b and c are rational numbers. (3 marks)

5 The area of a triangle is given as $(7 + 3\sqrt{3}) \text{ cm}^2$.

The base of the triangle is $(5 - \sqrt{3}) \text{ cm}$, and the perpendicular height is $(p + q\sqrt{3}) \text{ cm}$.

Find the values of p and q . (4 marks)

6 Expand and simplify these expressions.

a $3(x - 2y)$ (1 mark)

b $(2x - 3)(3x + 5)$ (2 marks)

c $(x - 2)^2(x + 5)$ (3 marks)

7 Fully factorise these expressions.

a $2xy - 4x$ (1 mark)

b $x^2 + 2x - 3$ (1 mark)

8 Solve these equations.

a $3x - 7 = 17$ (1 mark)

b $x^2 - 6x + 5 = 0$ (2 marks)

c $2x^2 - 5x + 1 = 0$ (2 marks)

9 Solve these pairs of simultaneous equations.

a $2x + y = 7$ (3 marks)
 $3x - y = 8$

b $y = 3x - 1$ (3 marks)
 $3y = 6x + 1$

c $2x - y = 9$ (4 marks)
 $x^2 + y^2 = 17$

10 Solve these inequalities.

a $7x - 6 \leq 8$ (1 mark)

b $3x + 2 \geq 7x - 4$ (2 marks)

c $x^2 + 12x - 28 > 0$ (2 marks)

11 The function f is defined as $f(x) = 5x + 2$

Find the value of $f(-4)$. (1 mark)