

## Indices and products

Simplify fully:

a)  $a^3 \times a^2$

b)  $t^5 \times t \times t^3$

c)  $h \times h^{-4} \times h^3$

## Indices and algebraic fractions

Simplify fully:

a)  $\frac{r^9}{r^2}$

b)  $\frac{e^3 \times e^7}{e^6}$

c)  $\frac{c^4 \times g^2 \times g^5 \times c^3}{c^2 \times g^8}$

## Arithmetic with surds

Write in simplest form:

a)  $\sqrt{3} + 4\sqrt{3}$

b)  $3\sqrt{2} - 2\sqrt{2}$

c)  $\sqrt{16} - \sqrt{9}$

## Indices and surds

Write in the form  $x^n$  where  $n$  is a fraction in its simplest form:

a)  $\sqrt[4]{h^3}$

b)  $\sqrt[3]{d^{-5}}$

Write in the form  $\sqrt{x^b}$ :

c)  $w^{\frac{2}{3}}$

## Reducing surds

Simplify fully:

a)  $\sqrt{98}$

c)  $\sqrt{108}$

b)  $\sqrt{28}$

d)  $\sqrt{116}$

## Surds and brackets

Expand and fully simplify:

a)  $\sqrt{5}(3 + \sqrt{5})$

c)  $\sqrt{2}(\sqrt{14} - \sqrt{3})$

b)  $\sqrt{10}(\sqrt{20} - \sqrt{5})$

d)  $\sqrt{3}(\sqrt{27} + \sqrt{3})$

## Indices and division

Simplify fully:

a)  $p^9 \div p^4$

c)  $u^2 \div u^3$

b)  $w^{-3} \div w^{-5}$

d)  $d \div d^{-4}$

## Further simplification

Simplify:

a)  $3a^2b^5 \times 4a^3b^6$

c)  $\frac{9w^8}{15w}$

b)  $7d^{-3}e \times 2d^4e^{-3}$

d)  $\frac{2g^3h \times 9g^2h^5}{6g^5h^4}$

## Indices and brackets

Simplify:

a)  $(r^3)^2$

b)  $(x^4)^{-3}$

Write in the form  $kx^n$  where  $k$  and  $n$  are integers:

c)  $(2j^5)^3$

d)  $3(h^{-2})^{-3}$

## Rationalising denominators

Rationalise the denominator and simplify fully:

a)  $\frac{1}{\sqrt{3}}$

c)  $\frac{1}{1 + \sqrt{7}}$

b)  $\frac{2}{\sqrt{10}}$

d)  $\frac{13 + 5\sqrt{7}}{\sqrt{7}}$

## Calculations with brackets

Evaluate, leaving your answer as a fraction when necessary:

a)  $(-2)^3$

c)  $(\frac{2}{3})^{-4}$

b)  $(\frac{3}{4})^3$

d)  $(\frac{16}{25})^{\frac{3}{2}}$

## Products of binomials involving surds

Expand and fully simplify:

a)  $(3 + \sqrt{5})(3 + \sqrt{5})$

b)  $(2 + \sqrt{3})(4 - \sqrt{3})$

c)  $(5 + \sqrt{3})(5 - \sqrt{3})$

d)  $(\sqrt{3} + \sqrt{6})(3 + \sqrt{2})$