Starter

1) Are the points A(-2, 10), B(0, -4) and C(5, 11) collinear? Why/why not?

2) If the points P(-2, 5), Q(2, -3) and R(7, t) are collinear, find t.

3) Fully factorise:

a) $4b^2 - 16$ $4(b^2-4)$ $4(b+2)(b-2)$

b) $f^2 - 11f + 28$ $(f-7)(f-4)$

c) $6c^2 - 13c - 5$ $(2c-5)(3c+1)$

A surd is a square root which doesn't 'work out' as a rational number.

eg. $\sqrt{5}$ and $\sqrt{3}$ are surds

$\sqrt{4}$ isn't, because $\sqrt{4} = 2$

$2.\dot{1}\dot{6} = \frac{13}{6}$

A surd is a square root which doesn't 'work out' as a rational number.

Which square roots are surds?

$\sqrt{21}$ $\sqrt{49}$

$\sqrt{14}$ $\sqrt{100}$

$\sqrt{7}$ $\sqrt{36}$

Rules of Surds

1) $\sqrt{m} \times \sqrt{n} = \sqrt{mn}$

2) $\frac{\sqrt{m}}{\sqrt{n}} = \sqrt{\frac{m}{n}}$

e.g. Simplify:

1) $\sqrt{12}$
$= \sqrt{4 \times 3}$
$= \sqrt{4} \times \sqrt{3}$
$= 2 \times \sqrt{3}$
$= 2\sqrt{3}$

2) $\sqrt{5} \times \sqrt{10}$
$= \sqrt{50}$
$= \sqrt{25 \times 2}$
$= \sqrt{25} \times \sqrt{2}$
$= 5\sqrt{2}$

3) $5\sqrt{2} \times 3\sqrt{8}$
$= 5 \times \sqrt{2} \times 3 \times \sqrt{8}$
$= 15 \times \sqrt{16}$
$= 15 \times 4$
$= 60$

4) $\frac{\sqrt{3}}{\sqrt{27}}$
$= \sqrt{\frac{3}{27}}$
$= \sqrt{\frac{1}{9}} = \frac{\sqrt{1}}{\sqrt{9}} = \frac{1}{3}$

Starter

1) Simplify the surds:

a) $\sqrt{72}$
$= \sqrt{9 \times 8}$
$= 3\sqrt{8}$
$= 3\sqrt{4 \times 2}$
$= 3 \times \sqrt{4} \times \sqrt{2}$
$= 3 \times 2 \times \sqrt{2}$
$= 6\sqrt{2}$

b) $2\sqrt{54}$
$= 2 \times \sqrt{9 \times 6}$
$= 2 \times \sqrt{9} \times \sqrt{6}$
$= 2 \times 3 \times \sqrt{6}$
$= 6\sqrt{6}$

c) $3\sqrt{98}$
$= 3\sqrt{49 \times 2}$
$= 3 \times \sqrt{49} \times \sqrt{2}$
$= 3 \times 7 \times \sqrt{2}$
$= 21\sqrt{2}$

2) Fully factorise:

a) $m^2 + 7m - 44$ $(m-4)(m+11)$

b) $2f^2 - 7f - 15$ $(2f+3)(f-5)$

3) Calculate a fifth of £382 £76.40

Express each of the following in its simplest form.

a $\sqrt{24}$ **b** $\sqrt{500}$ **c** $\sqrt{32}$ **d** $\sqrt{75}$

e $\sqrt{1000}$ **f** $3\sqrt{8}$ **g** $6\sqrt{12}$ **h** $5\sqrt{50}$

Simplify the following:

$$\frac{\sqrt{45}}{\sqrt{20}}$$

Starter

1) Find the gradient between these points:

a) (2, 4) and (5, 7) **b)** (-1, -2) and (-10, 3)

2) Prove that the points A(0, 3), B(2, 1) and C(5, -2) are collinear.

3) Calculate $\frac{2}{5} + \frac{3}{10}$ $= \frac{7}{10}$

Challenge:

Simplify $\sqrt{12} + \sqrt{27}$

$\sqrt{3}+\sqrt{3} + \sqrt{3}+\sqrt{3}+\sqrt{3}$

$= \sqrt{4\times3} + \sqrt{9\times3}$

$= 2\sqrt{3} + 3\sqrt{3}$

$= 5\sqrt{3}$

$\sqrt{3}+\sqrt{3} = 2\sqrt{3}$

Adding/Subtracting Surds

Treat the surd like an x in algebra.

e.g. 1) Simplify $\sqrt{18} - \sqrt{8}$

$= \sqrt{9\times2} - \sqrt{4\times2}$

$= 3\sqrt{2} - 2\sqrt{2}$

$= \sqrt{2}$

2) Simplify $\sqrt{45} + \sqrt{5} - \sqrt{20}$

$= \sqrt{9\times5} + \sqrt{5} - \sqrt{4\times5}$

$= 3\sqrt{5} + \sqrt{5} - 2\sqrt{5}$

$= 2\sqrt{5}$

Starter

1) Find the gradient of the straight line joining:

a) (-2, 4) & (3, 6) **b)** (2, 4) and (-1, -10)

2) Multiply out the brackets and simplify:

(m + 1)(m - 2)(m + 2)

3) If a = 4 and b = -3, evaluate:

a) $a^2 - 2b$ **b)** $2(a + b) - b^2$

$= 16 - 2\times-3$

$= 16 + 6 = 22$

$2(1) - 9$

$= 2 - 9 = -7$

Today's Learning:

To add and subtract surds and to multiply out brackets.

Today's Learning:

To add and subtract surds and to multiply out brackets.

Write a question to test your partner on today's learning.

Swap, complete, swap, check.

Starter

1) Remove brackets and simplify: $(y - 2)(y + 5)^2$

$(y-2)(y^2+10y+25)$

$= y^3 + 10y^2 + 25y - 2y^2 - 20y - 50$

$= y^3 + 8y^2 + 5y - 50$

2) Factorise the following:

a) $2m^2 + 7m - 15$

$(2m-3)(m+5)$

b) $3y^2 - 27$

$= 3(y^2 - 9)$

$= 3(y+3)(y-3)$

Today's Learning:

To rationalise the denominator of a fraction.

Rationalising the Denominator

8/2/18

Rationalising the denominator means leaving no surds on the bottom of the fraction.

Examples:

Rationalise the denominator and simplify:

1) $\frac{1}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{\sqrt{3}}{3}$

2) $\frac{3}{\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}} = \frac{3\sqrt{5}}{5}$

3) $\frac{9}{2\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{9\sqrt{3}}{6}$

Rationalise the denominator and simplify:

4) $\frac{\sqrt{5}}{\sqrt{3}}$

Q12 on page 4

5) $\frac{15\sqrt{2}}{2\sqrt{5}}$

Starter

1) Find a fifteenth of 372

2) Write in completed square form: $e^2 - 4e + 1$

$(e-2)^2 - 3$

3) Without a calculator, find the circumference of a circle with diameter 5 cm. Take π to be 3.14.

$(e-2)(e-2)$

$e^2 - 4e + 4$

$C = \pi \times d$

$= 3.14 \times 5$

$= 15.7\text{cm}$

Multiplying Out Brackets

e.g. Expand and simplify:

1) $2\sqrt{2}(3-\sqrt{2})$

$= 6\sqrt{2} - 2\sqrt{4}$

$= 6\sqrt{2} - 2\times 2$

$= 6\sqrt{2} - 4$

2) $(6-\sqrt{2})^2$

$= (6-\sqrt{2})(6-\sqrt{2})$

$= 36 - 6\sqrt{2} - 6\sqrt{2} + \sqrt{4}$

$= 36 - 12\sqrt{2} + 2$

$= 38 - 12\sqrt{2}$

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

$= 12 - 6\sqrt{2} + 4\sqrt{2} - 2\sqrt{4}$

$= 12 - 2\sqrt{2} - 4$

$= 8 - 2\sqrt{2}$

Rationalising the Denominator

When there is more than one term on the bottom of the fraction, use the **conjugate surd** (the same terms with the opposite sign).

e.g. 1) $\frac{10}{(7+\sqrt{5})} \times \frac{(7-\sqrt{5})}{(7-\sqrt{5})}$

$= \frac{10(7-\sqrt{5})}{49-5} = \frac{10(7-\sqrt{5})}{44}$

2) $\frac{2}{\sqrt{3}-\sqrt{2}} \times \frac{\sqrt{3}+\sqrt{2}}{\sqrt{3}+\sqrt{2}} = \frac{5(7-\sqrt{5})}{22}$

$= \frac{2(\sqrt{3}+\sqrt{2})}{3-2} = \frac{2(\sqrt{3}+\sqrt{2})}{1}$

$= 2(\sqrt{3}+\sqrt{2})$

$= 2\sqrt{3} + 2\sqrt{2}$

page 5
Q14

Starter

1) Multiply out the brackets and simplify if possible:

a) $(\sqrt{2}+\sqrt{3})(7-\sqrt{2})$

$= 7\sqrt{2} - 2 + 7\sqrt{3} - \sqrt{6}$

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

$= 4 - 2\sqrt{3} + 2\sqrt{3} - 3$

$= 4 - 3 = 1$

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

$= 4\sqrt{9} - 2\sqrt{6} + 2\sqrt{6} - 2$

$= 12 - 2 = 10$

2) Without a calculator, find:

a) 0.35 x 0.2

0.07

$2 \times 0.35 = 0.7$

b) $\frac{10}{14} \times \frac{21}{30}$

$= \frac{1}{2}$

c) 20 - 0.407

19.593

Today's Learning:

To practice rationalising the denominator of surds.

Express with a rational denominator:

$\frac{2}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}$

$= \frac{2\sqrt{3}}{3}$

Express with a rational denominator:

$\frac{1}{2\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}}$

$= \frac{\sqrt{5}}{10}$

Express with a rational denominator:

$$\frac{5}{(4-\sqrt{3})} \times \frac{(4+\sqrt{3})}{(4+\sqrt{3})}$$

$$= \frac{20+5\sqrt{3}}{16+4\sqrt{3}-4\sqrt{3}-3}$$

$$= \frac{20+5\sqrt{3}}{13}$$

Starter

Rationalise the denominators:

1) $\frac{1}{2-\sqrt{5}} \times \frac{2+\sqrt{5}}{2+\sqrt{5}}$

$= \frac{2+\sqrt{5}}{4+2\sqrt{5}-2\sqrt{5}-5}$

$= \frac{2+\sqrt{5}}{4-5} = \frac{2+\sqrt{5}}{-1}$

$= -2-\sqrt{5}$

2) $\frac{2}{\sqrt{5}+\sqrt{3}} \times \frac{\sqrt{5}-\sqrt{3}}{\sqrt{5}-\sqrt{3}}$

$= \frac{2\sqrt{5}-2\sqrt{3}}{5-3}$

$= \frac{2\sqrt{5}-2\sqrt{3}}{2}$

$= \sqrt{5}-\sqrt{3}$

3) $\frac{1+\sqrt{2}}{3+\sqrt{3}} \times \frac{3-\sqrt{3}}{3-\sqrt{3}}$

$= \frac{3-\sqrt{3}+3\sqrt{2}-\sqrt{6}}{9-3}$

$= \frac{3-\sqrt{3}+3\sqrt{2}-\sqrt{6}}{6}$

4) $\frac{\sqrt{5}+2}{\sqrt{3}-\sqrt{5}} \times \frac{\sqrt{3}+\sqrt{5}}{\sqrt{3}+\sqrt{5}}$

$= \frac{\sqrt{15}+5+2\sqrt{3}+2\sqrt{5}}{3-5}$

$= \frac{\sqrt{15}+2\sqrt{3}+2\sqrt{5}+5}{-2}$

Today's Learning:

To think about what indices are and the rules for multiplying and dividing with them.

How else can we write 4 x 4 x 4?

$e^5 = e \times e \times e \times e \times e$ $\quad 4^3$

What is $4^3 \times 4^2$? 4^5

$4 \times 4 \times 4 \times 4 \times 4$

4^5

Rules of Indices 20/2/18

5 is the index in a^5. This means a x a x a x a x a

Rules:

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

What is $3^4 \div 3^3$? $= 3$

$$\frac{3 \times 3 \times 3 \times 3}{3 \times 3 \times 3}$$

Rules of Indices

5 is the index in a^5. This means a x a x a x a x a

Rules:

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

2) $\frac{a^m}{a^n} = a^{m-n}$

What is $(5^3)^2$? $= 5^6$

$5 \times 5 \times 5 \times 5 \times 5 \times 5$

Rules of Indices

5 is the index in a^5. This means a x a x a x a x a

Rules:

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

2) $\frac{a^m}{a^n} = a^{m-n}$

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

e.g. Simplify:

1) $\frac{g^3 \times g^2}{g^4} = \frac{g^5}{g^4} = g$

2) $(2h^3)^2 = 4h^6$

3) $r^2(r + r^5) = r^3 + r^7$

Starter

1) Factorise the following:

a) $w^2 + 10w + 21$ $(w+7)(w+3)$

b) $2g^2 - 5g - 12$ $(2g+3)(g-4)$

2) Write in completed square form:

a) $e^2 + 4e + 1$ $(e+2)^2 - 3$

b) $T^2 - 8T + 10$ $(T-4)^2 - 6$

3) Given that 68 x 625 = 42 500, without a calculator, find:

a) $\frac{425}{625}$ $68 = \frac{42500}{625}$ $0.68 = \frac{425}{625}$

b) $\frac{4250}{62.5}$ $\frac{4250}{625} = 6.8$ $\frac{4250}{62.5} = 68$

Today's Learning:

To learn more rules for working with indices.

What is the value of 3^0?

$3^1 = 3$

$3^3 \div 3^3 = 3^0$

$\frac{3 \times 3 \times 3}{3 \times 3 \times 3} = \frac{1}{1} = 1$

4) $a^0 = 1$

What is the value of 10^{-3}?

$10^0 \div 10^3 = 10^{-3}$ $2^{-3} = \frac{1}{2^3}$

$10^{-3} = \frac{1}{10^3}$ $\frac{1}{1000}$

4) $a^0 = 1$

5) $a^{-m} = \frac{1}{a^m}$

e.g. rewrite with a positive index:

1) 4^{-4} $= \frac{1}{4^4}$

2) $2b^{-3}$ $= \frac{2}{b^3}$

3) $\frac{3}{y^{-5}}$ $= 3y^5$

Starter

1) Write down the value of:

a) $\sqrt{16} = 4$ **b)** $\sqrt{9} = 3$ **c)** $\overline{16} = 2$

2) Factorise the following:

a) $h^2 - 2h - 24$ $(h+4)(h-6)$

b) $3g^2 + 8g + 4$ $(3g+2)(g+2)$

3) Find j: $\frac{1}{j} + \frac{1}{j} = \frac{1}{10}$ $j = 20$

Today's Learning:

To write numbers with fractional indices in other ways.

What is the value of $3^{1/2}$ $\sqrt{3}$

$(3^{1/2})^2 = 3^1$

$4^{\frac{1}{3}}$

$(4^{\frac{1}{3}})^3 = 4^1$

$\sqrt[3]{4}$

$3^{\frac{2}{3}}$ $\sqrt[3]{3^2}$

$(3^{\frac{2}{3}})^3 = 3^2$

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

e.g. Find the value of:

a) $16^{\frac{3}{4}}$

$= \sqrt[4]{16^3}$

$= 2^3$

$= 8$

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

$= \frac{1}{25^{1/2}}$

$= \frac{1}{\sqrt{25}} = \frac{1}{5}$

Today's Learning:

To be **confident** using all 6 indices rules.

Starter

Find someone to answer the question and write their name...

1) Factorise $m^2 - 2m - 24$ $(m+4)(m-6)$

2) Find 20% of £35.50 £7.10

3) Write in completed square form: $m^2 - 4m + 5$ $(m-2)^2+1$

4) Factorise $2m^2 - 6m - 8$ $(2m-8)(m+1)$ $2(m-4)(m+1)$

5) What is the value of 13^2? 169

6) What is the value of 2^{-2} $\frac{1}{2^2} = \frac{1}{4}$

7) Factorise $j^2 - 25$ $(j-5)(j+5)$

8) Factorise $4b^2 - 9a^2$ $(2b-3a)(2b+3a)$

Today's Learning:

To practice exam style questions on surds and indices.

Starter

1) Multiply out the brackets and simplify:

(f + 5)(f - 2)(f - 3)

$= (f^2+3f-10)(f-3)$

$= f^3+3f^2-10f-3f^2-9f+30$

$= f^3-19f+30$

2) Fully factorise: $2m^2 - 13m + 15$

~~$(2m+5)(m+3)$~~

$(2m-3)(m-5)$

3) Solve the equation: $3m - 2 = \frac{2m}{3} + 5$

$9m-6=2m+15$

$7m-6=15$

$7m=21$

$m=3$

4) Calculate $2 + 3.5 \times 4 - 1.2^2$

$= 2+3.5\times4-1.44$

$= 2+14-1.44$

$= 16-1.44$

$= 14.56$