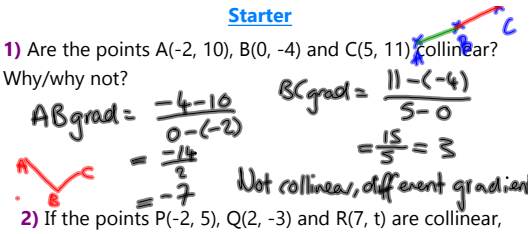
Starter

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



AB grad = $\frac{-4-10}{0-(-2)} = \frac{-14}{2} = -7$

BC grad = $\frac{11-(-4)}{5-0} = \frac{15}{5} = 3$

Not collinear, different gradient

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

PQ grad = $\frac{-3-5}{2-(-2)} = \frac{-8}{4} = -2$

QR grad = $\frac{-3-t}{2-7}$

$-2 = \frac{-3-t}{-5}$ ×-5

$10 = -3-t$

$13 = -t$

$t = -13$

3) Fully factorise:

a) $4b^2 - 16$ **b)** $f^2 - 11f + 28$ **c)** $6c^2 - 13c - 5$

$4(b^2-4)$ $(f-8)(f-3)$

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 $\sqrt{4} = 2$

Rules of Surds

21/2/17

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

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

e.g. Simplify:

1) $\sqrt{12}$

$= \sqrt{4 \times 3}$

$= \sqrt{4} \times \sqrt{3}$

$= 2\sqrt{3}$

2) $\sqrt{5} \times \sqrt{10}$

$= \sqrt{50}$

$= \sqrt{25 \times 2}$

$= \sqrt{25} \times \sqrt{2}$

$= 5 \times \sqrt{2} = 5\sqrt{2}$

3) $5\sqrt{2} \times 3\sqrt{6}$

$= 5 \times \sqrt{2} \times 3 \times \sqrt{6}$

$= 15 \times \sqrt{12}$

$= 15 \times 2\sqrt{3}$

$= 30\sqrt{3}$

4) $\frac{\sqrt{3}}{\sqrt{27}}$

$= \sqrt{\frac{3}{27}}$

$= \sqrt{\frac{1}{9}}$

$= \frac{\sqrt{1}}{\sqrt{9}} = \frac{1}{3}$

Starter

1) Find the gradient between these points:

a) (2, 4) and (5, 7) (x_1, y_1) (x_2, y_2)

grad = $\frac{7-4}{5-2} = \frac{3}{3} = 1$

b) (-1, -2) and (-10, 3)

grad = $\frac{3-(-2)}{-10-(-1)} = \frac{5}{-9} = \frac{-5}{9}$

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

AB grad = $\frac{1-3}{2-0} = \frac{-2}{2} = -1$

BC grad = $\frac{-2-1}{5-2} = \frac{-3}{3} = -1$

Gradients are equal and AB and BC both go through B → collinear.

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

$\frac{7}{10}$

Challenge:

Simplify

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

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

$= 5\sqrt{3}$

Adding/Subtracting Surds

Treat the surd like an x in algebra.

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

$= \sqrt{9 \times 2} - \sqrt{4 \times 2}$

$= \sqrt{9} \times \sqrt{2} - \sqrt{4} \times \sqrt{2}$

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

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

$3x - 2x = x$

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

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

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

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

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

$= 2\sqrt{5}$

Starter

1) Simplify the surds:

a) $\sqrt{72}$ **b)** $2\sqrt{54}$ **c)** $3\sqrt{98}$

2) Fully factorise:

a) $m^2 + 7m - 44$ **b)** $2f^2 - 7f - 15$

3) Calculate a fifth of £382

Today's Learning:

To add and subtract surds and to multiply out brackets.

Multiplying Out Brackets

e.g. Expand and simplify:

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

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

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

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

Today's Learning:

To be able to rationalise the denominator of a fraction.

Rationalising the Denominator

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

Examples:

Rationalise the denominator and simplify:

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

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

3) $\frac{9}{2\sqrt{3}}$

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

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

$=1$

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

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

$=12-2$

$=10$

2) Without a calculator, find:

a) 0.35 x 0.2

~~0.7~~

$2\times0.35=0.7$

$0.2\times0.35=0.07$

b) $\frac{\cancel{10}^{1}}{\cancel{14}_{2}}\times\frac{\cancel{21}^{3}}{\cancel{30}_{3}}$

$\frac{3}{6}=\frac{1}{2}$

c) 20 - 0.407

19.593

Rationalise the denominator and simplify: 1/3/17

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

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

$=\frac{\sqrt{15}}{3}$

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

$=\frac{15\sqrt{2}}{2\sqrt{5}}\times\frac{\sqrt{5}}{\sqrt{5}}$

$=\frac{15\sqrt{10}}{2\times5}$

$=\frac{15\sqrt{10}}{10}\div5\ \div5$

$=\frac{3\sqrt{10}}{2}$

Q12 on page 4

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) $\frac{10}{(7+\sqrt{5})}\times\frac{(7-\sqrt{5})}{(7-\sqrt{5})}$

$=\frac{70-10\sqrt{5}}{49-7\sqrt{5}+7\sqrt{5}-5}$

$=\frac{70-10\sqrt{5}}{44}\ \div2\ \div2$

$=\frac{35-5\sqrt{5}}{22}$

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

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

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

$=\frac{2\sqrt{3}+2\sqrt{2}}{1}$

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

page 5 Q14

Starter

Rationalise the denominators:

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

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

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

$=-2-\sqrt{5}$

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

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

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

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

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

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

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

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

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

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

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

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

Today's Learning:

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

7^{2}

How else can we write 4 x 4 x 4?

4^{3}

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

$4\times4\times4\times4\times4$

4^{5}

Rules of Indices

2/3/17

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 $3^4 \div 3^3$?

$\frac{3\times3\times3\times3}{3\times3\times3} = 3^1$

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 $(5^3)^2$?

$5^3 \times 5^3 = 5^6$

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

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

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

Starter

1) Factorise the following:

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

b) $2g^2 - 5g - 12$ $(2g+3)(g-4)$ ✓ $2g^2 - 8g + 3g - 12$

2) Write in completed square form:

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

$(e+2)(e+2) = e^2+2e+2e+4 = e^2+4e+4$

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

$(T-4)(T-4) = T^2-4T-4T+16 = T^2-8T+16$

3) Given that 68 x 625 = 42 500, without a calculator, find: **a)** $\frac{425}{625}$ **b)** $\frac{4250}{62.5}$

Today's Learning:

To learn more rules for working with indices.

What is the value of 3^0?

$3^4 \div 3^4 = 3^0$

$\frac{3\times3\times3\times3}{3\times3\times3\times3} = \frac{81}{81} = 1 = 3^0$

4) $a^0 = 1$

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

$1 \div 1000$ 0.001

$\frac{1}{10^3}$

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) $2b^{-3}$ $= 2 \times \frac{1}{b^3} = \frac{2}{b^3}$

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

Starter

1) Write down the value of:

$2\times2\times2\times2$

a) $\sqrt{16} = 4$ **b)** $\sqrt[3]{27} = 3$ **c)** $\overline{16} = 2$

2) Factorise the following:

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

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

$3g^2+6g+2g+4$

3) Find j:

$\frac{1}{j} + \frac{1}{j} = \frac{1}{10}$

$\frac{1}{20}+\frac{1}{20} = \frac{2}{20} = \frac{1}{10}$ $j = 20$

Today's Learning:

To write numbers with fractional indices in other ways.

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

$\frac{7}{2}$ $3 \times 1.5 = 4.5$ $3 \times 0.5 = \frac{1}{2}$

$(3^{\frac{1}{2}})^2 = 3^1 = 3$

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

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

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

$\sqrt[3]{4}$

$3^{\frac{2}{3}}$

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

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

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

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

Starter

e.g. Find the value of:

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

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

$= 2^3$

$= 8$

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

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

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

Today's Learning:

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

Starter

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

1) Factorise $m^2 - 2m - 24$

2) Find 20% of £35.50

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

4) Factorise $2m^2 - 6m - 8$

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

$2(m-4)(m+1)$

5) What is the value of 13^2

7) Factorise $j^2 - 25$

6) What is the value of 2^{-2}

8) Factorise $4b^2 - 9a^2$

$(2b-3a)(2b+3a)$

Today's Learning:

To practice exam style questions on surds and indices.