Starter

Factorise fully:

1) $4a^2b - 6abc$

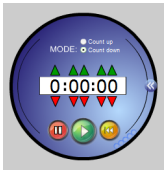
2) $3x^2 + 18x + 24$

3) $2x^2 - 18$

4) $2x^2 - x - 6$

30 seconds to write down EVERY square number between 1 and 100

4 16 64
9 25
49 36 81
100 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 $\sqrt{4} = 2$

$2^2 = 4$

$\sqrt{4} = 2$

$\sqrt{4}$ $\sqrt{81}$ $\sqrt{25}$ $\sqrt{9}$

Today's Learning:

To simplify surds.

Rules of Surds 22/8/17

A surd is a root that doesn't work out nicely - they are irrational numbers.

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) $5\sqrt{2} \times 3\sqrt{6}$
$= 15\sqrt{12}$
$= 15\sqrt{4 \times 3}$
$= 15 \times \sqrt{4} \times \sqrt{3}$
$= 15 \times 2 \times \sqrt{3}$
$= 30\sqrt{3}$

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

Starter

Fully factorise the following:

1) $x^2 + 7x + 10$
$(x+5)(x+2)$
5, 2 10, 1

2) $2x^2 - 16x + 14$
$2(x^2 - 8x + 7)$
$2(x-1)(x-7)$

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

4) $2x^2 + 13x + 15$
$(2x+3)(x+5)$

Challenge:

Simplify

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

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

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

$2x + 3x$

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 $\sqrt{45}+\sqrt{5}-\sqrt{20}$

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

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

$= 2\sqrt{5}$

Multiplying Out Brackets

e.g. Expand and simplify:

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

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

$= 6\sqrt{2} - 2\times2$

$= 6\sqrt{2} - 4$

$2\sqrt{2}\times\sqrt{2}$

$2\sqrt{2}\times2$

$= 2\sqrt{4}$

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

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

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

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

$= 38 - 12\sqrt{2}$

$3x\times2x = 6x$

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

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

$= 12 - 2\times2 - 2\sqrt{2}$

$= 8 - 2\sqrt{2}$

Today's Learning

To rationalise the denominator of any surd by using a conjugate surd.

Rationalising the Denominator

We don't like to have surds on the bottom of fractions, so we rationalise the denominator.

e.g. 1) $\frac{\sqrt{6}}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{\sqrt{18}}{\sqrt{9}} = \frac{\sqrt{9\times2}}{3}$

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

2) $\frac{7}{\sqrt{8}} \times \frac{\sqrt{8}}{\sqrt{8}} = \frac{7\sqrt{8}}{\sqrt{64}} = \frac{7\sqrt{4\times2}}{8}$

$= \frac{7\times2\times\sqrt{2}}{8}$

$= \frac{14\sqrt{2}}{8} = \frac{7\sqrt{2}}{4}$

$\frac{3}{\sqrt{20}} \times \frac{\sqrt{20}}{\sqrt{20}} = \frac{3\sqrt{20}}{\sqrt{400}}$

$= \frac{3\sqrt{4\times5}}{\sqrt{4\times100}}$

$= \frac{3\times2\times\sqrt{5}}{2\times10}$

$= \frac{6\sqrt{5}}{20} = \frac{3\sqrt{5}}{10}$

$\frac{4\sqrt{5}}{5\sqrt{3}} \times \frac{5\sqrt{3}}{5\sqrt{3}} = \frac{20\sqrt{15}}{25\sqrt{9}}$

$= \frac{20\sqrt{15}}{25\times 3} = \frac{20\sqrt{15}}{75} = \frac{4\sqrt{15}}{15}$

$4\sqrt{5}\times 5\sqrt{3}$
$= 4\times\sqrt{5}\times 5\times\sqrt{3}$

Multiply out the brackets and simplify:

a) $(2+\sqrt{3})(2-\sqrt{3})$ $= 4 - 2\sqrt{3} + 2\sqrt{3} - \sqrt{9}$
$= 4 - \sqrt{9}$
$= 4 - 3 = 1$

b) $(2\sqrt{3}+\sqrt{2})(2\sqrt{3}-\sqrt{2})$
$4\sqrt{9} - 2\sqrt{6} + 2\sqrt{6} - \sqrt{4}$
$= 4\times 3 - 2$
$= 12 - 2 = 10$

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) $\frac{10}{(7+\sqrt{5})} \times \frac{(7-\sqrt{5})}{(7-\sqrt{5})} = \frac{70-10\sqrt{5}}{49-7\sqrt{5}+7\sqrt{5}-5}$
$= \frac{70-10\sqrt{5}}{49-5}$
$= \frac{70-10\sqrt{5}}{44}$
$= \frac{35-5\sqrt{5}}{22}$

2) $\frac{2}{(\sqrt{3}-\sqrt{2})} \times \frac{(\sqrt{3}+\sqrt{2})}{(\sqrt{3}+\sqrt{2})} = \frac{2\sqrt{3}+2\sqrt{2}}{\sqrt{9}+\sqrt{6}-\sqrt{6}-\sqrt{4}}$
$= \frac{2\sqrt{3}+2\sqrt{2}}{3-2}$
$= \frac{2\sqrt{3}+2\sqrt{2}}{1}$
$= 2\sqrt{3}+2\sqrt{2}$

~~$\sqrt{2}+1$~~

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Exit Question:

Rationalise the denominator:

$\frac{3}{\sqrt{2}-4}$

Starter

Rationalise the denominators and simplify where possible:

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

2) $\frac{1}{3\sqrt{6}}$ $\frac{1}{3\sqrt{6}} \times \frac{\sqrt{6}}{\sqrt{6}} = \frac{\sqrt{6}}{3\sqrt{36}} = \frac{\sqrt{6}}{18}$

3) $\frac{5}{4-\sqrt{2}}$ $= \frac{5}{(4-\sqrt{2})} \times \frac{(4+\sqrt{2})}{(4+\sqrt{2})}$
$= \frac{20+5\sqrt{2}}{16+4\sqrt{2}-4\sqrt{2}-\sqrt{4}}$
$= \frac{20+5\sqrt{2}}{16-2}$
$= \frac{20+5\sqrt{2}}{14}$

4) $\frac{3}{\sqrt{2}-\sqrt{8}}$ $\frac{3}{\sqrt{2}-\sqrt{8}} \times \frac{(\sqrt{2}+\sqrt{8})}{\sqrt{2}+\sqrt{8}}$
$= \frac{3\sqrt{2}+3\sqrt{8}}{\sqrt{4}+\sqrt{16}-\sqrt{16}-\sqrt{64}}$
$= \frac{3\sqrt{2}+3\sqrt{4\times 2}}{2-8}$
$= \frac{3\sqrt{2}+3\times 2\times}{-6}$
$= \frac{3\sqrt{2}+6\sqrt{2}}{-6}$
$= \frac{9\sqrt{2}}{-6}$

Today's Learning:

To multiply and divide indices and to raise indices to powers.

m^5

$m\times m\times m\times m\times m$

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

$2\times2 \times 2\times2\times2 = 2^5$

What is $2^5 \div 2^2$?

$\frac{2\times2\times2\times\cancel{2}\times\cancel{2}}{\cancel{2}\times\cancel{2}} = 2^3$

What is $(2^3)^2$?

$2\times2\times2 \times 2\times2\times2 = 2^6$

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

$(h^3)^2$ r^1

e.g. Simplify:

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

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

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

Starter

1) Find the gradient of the straight line that joins (-2, -3) to (-4, -1).

$gr = \frac{y_2-y_1}{x_2-x_1} = \frac{-1-(-3)}{-4-(-2)} = \frac{2}{-2} = -1$

2) The area of a semicircle is 14cm². Find its radius.

14

$28 = \pi r^2$

$\frac{28}{\pi} = r^2$

$r = 2.99$

3) If all the numbers from 1 to 20 are on cards, and I pick one at random, what is the probability it is a prime number?

2, 3, 5, 7, 11, 13, 17, 19

$\frac{8}{20} = \frac{2}{5}$

4) Calculate 82% of 472.

387.04

Today's Learning:

To simplify indices with negative and fractional powers.

Rules of Indices

30/8/17

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

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

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

2) find the value of

a) $27^{\frac{2}{3}}$ $= \sqrt[3]{27^2} = 3^2 = 9$

b) $1000^{\frac{-2}{3}}$ $= \frac{1}{1000^{2/3}} = \frac{1}{\sqrt[3]{1000^2}} = \frac{1}{10^2} = \frac{1}{100}$

Today's Learning:

Multiplying out brackets using indices and trying exam type questions.

Multiplying out Brackets

e.g. 1) $\sqrt[2]{x}(x^2-1)$ $= x^{\frac{1}{2}}(x^2-1)$
$= x^{2.5} - x^{1/2}$

2) $\left(x+\frac{1}{x^2}\right)^2 = (x^1+x^{-2})(x^1+x^{-2})$
$= x^2 + x^{-1} + x^{-1} + x^{-4}$
$= x^2 + 2x^{-1} + x^{-4}$

3) $\frac{x+2}{x^2}$

Starter

Factorise fully:

1) $6x^2 - 4x$ $2x(3x-2)$

2) $x^2 + 5x - 14$ $(x+7)(x-2)$

3) $9m^2 - 25$ $(3m+5)(3m-5)$

4) $2x^2 - 5x - 3$ $(2x+1)(x-3)$

7, 2
1, 14
3
1, 3

Today's Learning:

To use indices in scientific notation.

Rewrite these numbers **in full**:

a) The speed of light: 3 x 10^8 m/s 300000000

b) The diameter of the earth: 1.268 x 10^4 km 12680

c) The approximate population of the earth: 7.4 x 10^9
7400000000

d) The number of dollars Bill Gates is worth: 7.92 x 10^{10}
79200000000

e) The radius of the orbit of an electron: 5 x 10^{-8}
0.00000005

Standard Form

A number is expressed as **m x 10^n**, where $1 \le m < 10$.

Examples. Write your answer in standard form:

1) A space probe can travel at a speed of 3.6 x 10^6 miles per day. What distance can it travel in a week?

3.6
4 x 7
252

$7 \times 3.6 \times 10^6$
$= 25.2 \times 10^6$
$= 2.52 \times 10 \times 10^6$
$= 2.52 \times 10^7$

2) (2 x 10^{-8}) x (3.5 x 10^2)
$= 2 \times 3.5 \times 10^{-8} \times 10^2$
$= 7 \times 10^{-6}$

Starter

1) Simplify $\sqrt{75} - \sqrt{12}$
$= \sqrt{25 \times 3} - \sqrt{4 \times 3}$
$= 5\sqrt{3} - 2\sqrt{3}$
$= 3\sqrt{3}$

$p^2 \div p = p$
$p \times p = p^2$
$p^2 \div p^2 = 1$
$p^2 \times 1 = p^2$

2) Rationalise the denominator: $\frac{3}{2\sqrt{6}}$
$= \frac{3}{2\sqrt{6}} \times \frac{2\sqrt{6}}{2\sqrt{6}} = \frac{6\sqrt{6}}{4\sqrt{36}}$
$= \frac{6\sqrt{6}}{4 \times 6} = \frac{6\sqrt{6}}{24}$
$= \frac{\sqrt{6}}{4}$

3) Simplify:

a) $(p^3)^4 \times p^{-4}$
$= p^{12} \times p^{-4}$
$= p^8$

b) $\frac{p^3 \times p^{-1}}{p^2}$
$= \frac{p^2}{p^2}$
$= p^0 = 1$

c) $\frac{7}{h^2} \div h$
$= 7h^{-2} \div h^1$
$= 7h^{-3}$

d) $p^{\frac{2}{3}} \times \sqrt[3]{p}$
$= p^{2/3} \times p^{1/3}$
$= p^1 = p$

Today's Learning:

To revise surds and indices work.

Simplify $2\sqrt{27}$

$= 2\sqrt{9 \times 3}$

$= 2 \times \sqrt{9} \times \sqrt{3}$

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

Calculate $2\sqrt{3} + \sqrt{12}$

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

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

$= 4\sqrt{3}$

Rationalise the denominator: $\frac{1}{2-\sqrt{3}}$

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

$= \frac{2+\sqrt{3}}{4+2\sqrt{3}-2\sqrt{3}-\sqrt{9}}$

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

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