

Surds, Indices & Scientific Notation

Express $\sqrt{50}$ as a surd in its simplest form. 1

Simplify $\frac{\sqrt{72}}{\sqrt{3}}$ 2

Simplify $\sqrt{48} - 3\sqrt{3}$ 2

Express $\sqrt{32} - \sqrt{2}$ as a surd in its simplest form. 2

Express $\sqrt{72} - \sqrt{2} + \sqrt{50}$ as a surd in its simplest form 3

Express $\sqrt{32} + \sqrt{8}$ as a surd in its simplest form. 3

Multiply out the brackets $\sqrt{2}(\sqrt{6} - \sqrt{2})$

Express your answer as a **surd** in its simplest form. 2

Express $\frac{3}{\sqrt{5}}$ as a fraction with a rational denominator. 2

Simplify $\frac{\sqrt{3}}{\sqrt{24}}$ Express your answer as a fraction with a rational denominator 3

Evaluate $27^{\frac{2}{3}}$ 2

Express in its simplest form $y^{10} \times (y^4)^{-2}$ 2

Simplify $a^3(a^{-7} + 5)$ 2

Express $\frac{3y^5 \times 4y^{-1}}{6y}$ in its simplest form. 3

Express $\frac{y^4 \times y}{y^{-2}}$ in its simplest form. 2

Express $\frac{b^{\frac{1}{2}} \times b^{\frac{3}{2}}}{b}$ in its simplest form. 2

Remove the brackets and simplify $b^{\frac{1}{2}} \left(b^{\frac{1}{2}} + b^{-\frac{1}{2}} \right)$ 3

Remove the brackets and simplify $a^{\frac{1}{2}} \left(a + \frac{1}{a} \right)$ 2

Each of these large oil containers holds 4.80×10^8 litres of the fuel. How many litres are there altogether in the full tanks shown? Give your answer in scientific notation.



2

The mass of a proton is approximately 1.8×10^3 times greater than the mass of an electron. If the mass of an electron is 9.11×10^{-31} kg, calculate the mass of a proton. Give your answer in scientific notation correct to 2 significant figures. 2

Large distances in space are measured in light years. A camera on a space telescope, photographs a galaxy, a distance of 50 million light years away. One light year is approximately 9.46×10^{12} kilometres. Calculate the distance of the galaxy from the space telescope in kilometres. Give your answer in scientific notation 2

Algebra

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

Remove the brackets and collect like terms $(3a - b)(2a - 5b)$ 2

Remove the brackets and simplify your answer $(2x - 1)(x + 3) + (x - 4)^2$ 4

Remove the brackets and simplify $(3y - 4)^2$ 2

Multiply out the brackets and simplify. $(2x - 3)(3x^2 + 4x - 1)$ 3

Factorise the following:

$$c^2 - 9$$

Factorise the following:

$$v^2 - 81$$

Factorise the following:

$$m^2 - 6m + 9$$

Factorise the following:

$$t^2 - 13t + 30$$

Factorise the following:

$$w^2 - w - 72$$

Factorise $6x^2 - 9x$ 2

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

Factorise the following:

$$2a^2 - 3a - 2$$

2

Factorise $3x^2 - 13x - 10$

2

Write $x^2 + 8x + 24$ in the form $(x + p)^2 + q$.

2

Write $x^2 - 2x + 8$ in the form $(x + p)^2 + q$.

2

Write $x^2 - 8x + 20$ in the form $(x + p)^2 + q$.

2

Write $x^2 + 10x + 35$ in the form $(x + p)^2 + q$.

2

Algebraic Fractions

i) Factorise **completely** $2x^2 - 6x$ 1

ii) Express $\frac{2x^2 - 6x}{x^2 - 9}$ in its simplest form. 2

a) Factorise the expression $9x^2 - y^2$ 1

b) Hence simplify $\frac{6x + 2y}{9x^2 - y^2}$ 2

a) Factorise $a^2 - 9b^2$ 1

b) Hence simplify $\frac{a^2 - 9b^2}{2a + 6b}$ 2

a) Factorise $x^2 - 9$ 1

b) Express $\frac{4(5x + 3)}{25x^2 - 9}$ in its simplest form 2

Express $\frac{15x - 20}{9x^2 - 16}$ in its simplest form 3

Express as a single fraction in its simplest form $\frac{1}{2x} - \frac{1}{3x}$, $x \neq 0$ 2

Express as a single fraction in its simplest form

$$\frac{3}{x} + \frac{2-x}{x^2}, \quad x \neq 0 \quad 3$$

Express as a single fraction in its simplest form

$$\frac{5}{x} - \frac{3}{(x-2)}, \quad x \neq 0 \text{ or } x \neq 2 \quad 3$$

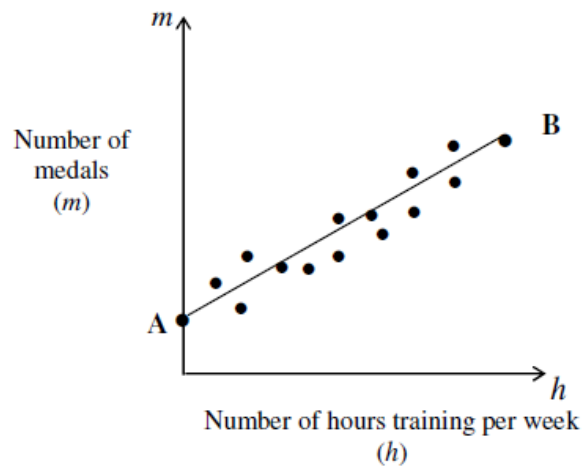
Gradient, Area & Volume

The graph shows the relationship between the number of hours (h) an athlete trains per week and the number of Championship medals (m) they have won.

A best fitting straight line AB has been drawn.

Athlete A does not train but has won 4 medals this year.

Athlete B who trains for 12 hours per week has won 40 medals this year.



Find the gradient of the line AB.

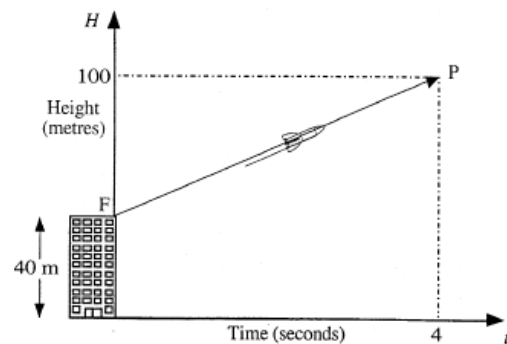
1

A boy sets off a rocket from the top of a 40 metre high block of flats.

The diagram shows the path of the rocket over the first 4 seconds.

It is represented by the straight line in the graph.

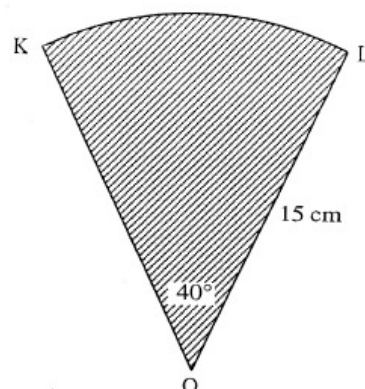
After 4 seconds, the rocket has reached a point 100 metres above the ground.



Find the gradient of the line FP.

Sector KOL of a circle centre O and radius 15 centimetres is shown opposite.

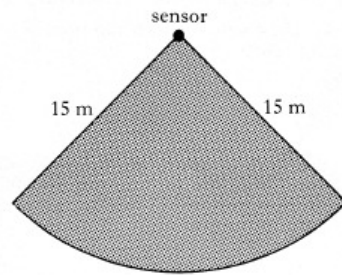
Calculate the area of this sector.



2

A sensor in a security system covers a horizontal area in the shape of a sector of a circle of radius 15 m.

The area of the sector is 200 square metres.
Find the length of the arc of the sector.

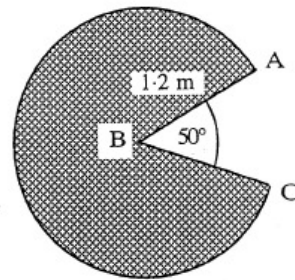


4



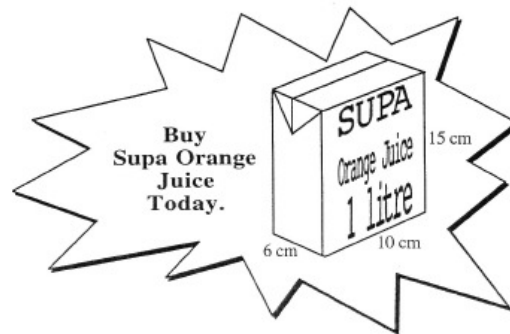
June is replacing the fabric on her garden parasol. She uses a sector of a circle, with radius 1.2 metres.

Calculate the area of fabric needed to replace the old material.



4

- a) Explain what is wrong with this advert for a 1 litre carton of Orange Juice.

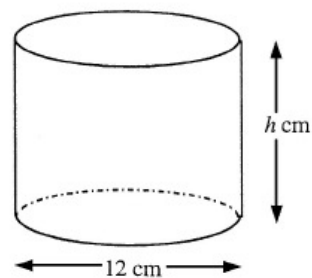


2

- b) The measurements 10 cm, 6 cm and 15 cm are correct.

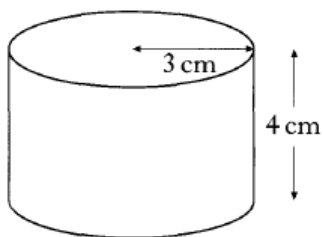
All of the juice is poured into this cylindrical container with base diameter 12 cm and it is found to exactly half fill it.

Calculate the height of the container.



4

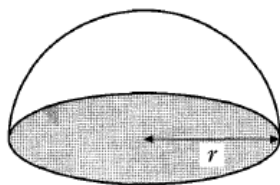
- (a) A cylindrical paperweight of radius 3 centimetres and height 4 centimetres is filled with sand.



Calculate the volume of sand in the paperweight.

2

- (b) Another paperweight, in the shape of a hemisphere, is filled with sand.



It contains the same volume of sand as the first paperweight.

Calculate the radius of the hemisphere.

[The volume of a hemisphere with radius r is given by the formula, $V = \frac{2}{3}\pi r^3$].

3

This cone and sphere have the same volume.

The radius of the sphere is 7cm and the height of the cone is 24cm.

Calculate the radius of the cone.

Round your answer to 3 significant figures.

5

