

$$49^{x+1} = \sqrt{7}$$

$$\left(\frac{1}{6}\right)^{x+3} = 36$$

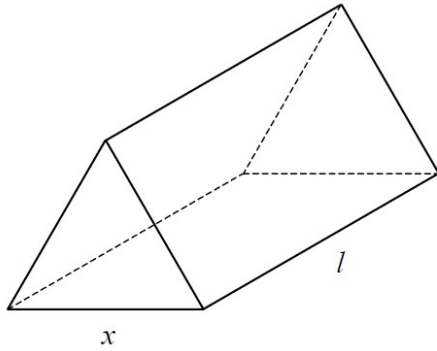
$$\left(\frac{1}{2}\right)^{3x-1} = 8$$

a Find the value of t such that

$$\left(\frac{1}{4}\right)^{t-3} = 8.$$

b Solve the equation

$$\left(\frac{1}{3}\right)^y = 27^{y+1}.$$



The diagram shows a solid triangular prism. The cross-section of the prism is an equilateral triangle of side x cm and the length of the prism is l cm.

Given that the volume of the prism is 250 cm^3 ,

- a find an expression for l in terms of x ,
- b show that the surface area of the prism, $A \text{ cm}^2$, is given by

$$A = \frac{\sqrt{3}}{2} \left(x^2 + \frac{2000}{x} \right).$$

Given that x can vary,

- c find the value of x for which A is a minimum,
- d find the minimum value of A in the form $k\sqrt{3}$,
- e justify that the value you have found is a minimum.

$$f(x) \equiv x^3 + 4x^2 + kx + 1.$$

a Find the set of values of the constant k for which the curve $y = f(x)$ has two stationary points.

Given that $k = -3$,

b find the coordinates of the stationary points of the curve $y = f(x)$.

Given that $x = 2^{t-1}$ and $y = 2^{3t}$,

a find expressions in terms of t for

i xy

ii $2y^2$

b Hence, or otherwise, find the value of t for which

$$2y^2 - xy = 0.$$

a Express $\sqrt[3]{24}$ in the form $k\sqrt[3]{3}$.

b Find the integer n such that

$$\sqrt[3]{24} + \sqrt[3]{81} = \sqrt[3]{n}.$$

Given

$$\frac{9^{x-1}}{3^{y+2}} = 81$$

express y in terms of x , writing your answer in simplest form.

A simple model for the cost of a car journey £ C when a car is driven at a steady speed of v mph is

$$C = \frac{4500}{v} + v + 10$$

- (a) Use this model to find the value of v which minimises the cost of the journey. (5)
- (b) Use $\frac{d^2C}{dv^2}$ to verify that C is a minimum for this value of v (2)
- (c) Calculate the minimum cost of the journey (2)

A curve has the equation $y = 4x^3 + 15x^2 - 18x + 5$

Find the coordinates of the stationary points and determine the nature of each stationary point.

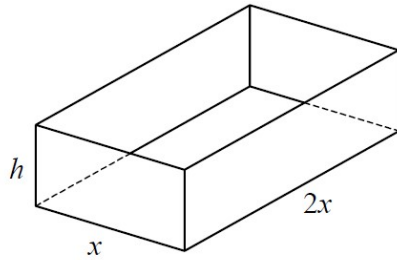
Given that $6^{y+1} = 36^{x-2}$,

a express y in the form $ax + b$,

b find the value of $4^{x - \frac{1}{2}y}$.

Solve the equation

$$4^{3x-2} = \frac{1}{2\sqrt{2}}$$

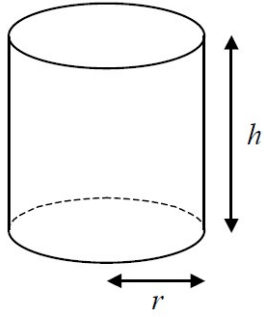


The diagram shows a baking tin in the shape of an open-topped cuboid made from thin metal sheet. The base of the tin measures x cm by $2x$ cm, the height of the tin is h cm and the volume of the tin is 4000 cm^3 .

- a Find an expression for h in terms of x .
- b Show that the area of metal sheet used to make the tin, $A \text{ cm}^2$, is given by

$$A = 2x^2 + \frac{12000}{x}.$$

- c Use differentiation to find the value of x for which A is a minimum.
- d Find the minimum value of A .
- e Show that your value of A is a minimum.



The diagram shows a closed plastic cylinder used for making compost. The radius of the base and the height of the cylinder are r cm and h cm respectively and the surface area of the cylinder is $30\,000\text{ cm}^2$.

- a** Show that the volume of the cylinder, $V\text{ cm}^3$, is given by

$$V = 15\,000r - \pi r^3.$$

- b** Find the maximum volume of the cylinder and show that your value is a maximum.