

Monster Questions – Set 7

Question 1

Write $5 - (x + 2) \div \left(\frac{x^2 - 4}{x - 3} \right)$ as a single fraction.

Simplify your answer fully.

$$5 - \left[\frac{\cancel{x+2}}{1} \times \frac{x-3}{\cancel{(x+2)}(x-2)} \right]$$

$$\frac{5}{1} - \frac{x-3}{x-2}$$

$$\frac{5(x-2)}{x-2} - \frac{(x-3)}{x-2}$$

$$\frac{5(x-2) - (x-3)}{x-2}$$

$$\frac{5x - 10 - x + 3}{x-2} = \frac{4x - 7}{x-2}$$

$$\frac{4x - 7}{x-2}$$

Question 2

The diagram shows a cylinder and a sphere.

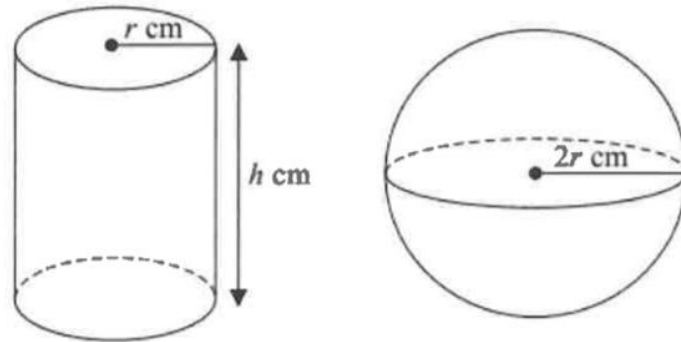


Diagram NOT
accurately drawn

The cylinder has radius r cm and height h cm.
The sphere has radius $2r$ cm.

The volume of the cylinder is equal to the volume of the sphere.

Find an expression for h in terms of r .

Give your answer in its simplest form.

$$\pi r^2 h = \frac{4}{3} \pi r^3$$

$$\pi r^2 h = \frac{4}{3} \pi \times (2r)^3$$

$$r^2 h = \frac{4}{3} \times 8r^3$$

$$r^2 h = \frac{32}{3} r^3$$

$$h = \frac{32}{3} r$$

$$h = \frac{32r}{3}$$

Question 3

(a) Factorise $4x^2 - 1$

$$(2x + 1)(2x - 1)$$

(b) Solve $\frac{4}{2x+1} + \frac{1}{4x^2-1} = 3$

Show clear algebraic working.

$$\frac{4}{2x+1} + \frac{1}{(2x+1)(2x-1)} = 3$$

$$\frac{4(2x-1)}{(2x+1)(2x-1)} + \frac{1}{(2x+1)(2x-1)} = 3$$

$$\frac{8x-4+1}{(2x+1)(2x-1)} = 3$$

$$\frac{8x-3}{(2x+1)(2x-1)} = 3$$

$$8x-3 = 3(2x+1)(2x-1)$$

$$8x-3 = 3[4x^2-1]$$

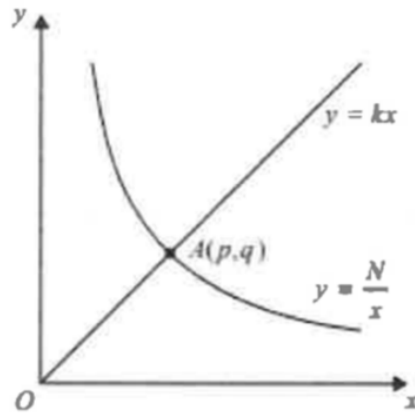
$$8x-3 = 12x^2-3$$

$$12x^2-8x = 0$$

$$4x(3x-2) = 0$$

$$x = 0 \text{ or } \frac{2}{3}$$

Question 4



The diagram shows the straight line with equation $y = kx$ intersecting the curve with equation $y = \frac{N}{x}$ at the point $A(p, q)$.

(a) Find p and find q .

Give each answer in its simplest form, in terms of k and N .

$$\begin{aligned} \frac{2}{k} &= kx \\ 2 &= kx^2 \\ x &= \sqrt{\frac{2}{k}} \end{aligned}$$

$$\begin{aligned} y &= kx \\ &= k \sqrt{\frac{2}{k}} \\ &= \frac{k}{\sqrt{k}} \sqrt{2} = \sqrt{k} \sqrt{2} = \sqrt{2k} \end{aligned}$$

$$p = \sqrt{\frac{2}{k}}$$

$$q = \sqrt{2k}$$

Given that $p = 2q$

(b) find the value of k .

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

$$\frac{2}{k} = 4 \cdot 2k$$

$$2 = 4 \cdot 2k^2$$

$$1 = 4k^2$$

$$k^2 = \frac{1}{4}$$

$$k = \pm \frac{1}{2}$$

$$k = \frac{1}{2}$$

Question 5

(a) Solve $x^2 - 4x - 1 = 0$

Show your working clearly.

Give your solutions correct to 3 significant figures.

$$a = 1$$

$$b = -4$$

$$c = -1$$

$$x = \frac{4 \pm \sqrt{(-4)^2 - 4 \times 1 \times (-1)}}{2}$$

$$= \frac{4 \pm \sqrt{20}}{2}$$

$$= 4.24 \text{ or } -0.236$$

Hence, or otherwise,

(b) solve $(x+3)^2 - 4(x+3) - 1 = 0$

giving your solutions correct to 3 significant figures.

$$x = x + 3$$

$$x + 3 = 4.24$$

$$x = 1.24$$

$$x + 3 = -0.236$$

$$x = -3.236$$

$$x = -3.24$$

(3 sf)