

Monster Questions – Set 6

Question 1

The functions g and h are defined as

$$g(x) = \frac{x}{2x-5}$$

$$h(x) = x + 4$$

(a) Find the value of $g(1)$

$$g(1) = \frac{1}{2 \times 1 - 5} = \frac{1}{2-5} = \frac{1}{-3}$$

$$\frac{-1}{3}$$

(1)

(b) State which value of x must be excluded from any domain of g

$$2x - 5 = 0 \quad x = \frac{5}{2}$$

$$\frac{5}{2}$$

(1)

(c) Find $gh(x)$
Simplify your answer.

$$h(x) = x + 4$$

$$g(x+4) = \frac{x+4}{2(x+4)-5}$$

$$= \frac{x+4}{2x+8-5}$$

$$= \frac{x+4}{2x+3}$$

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

(2)

(d) Express the inverse function g^{-1} in the form $g^{-1}(x) = \dots$

$$g(x) = \frac{x}{2x-5}$$

$$y = \frac{x}{2x-5}$$

$$y(2x-5) = x$$

$$2xy - 5y = x$$

$$2xy - x = 5y$$

$$x(2y-1) = 5y$$

$$x = \frac{5y}{2y-1}$$

$$g^{-1}(x) = \frac{5x}{2x-1}$$

Question 2

8.)

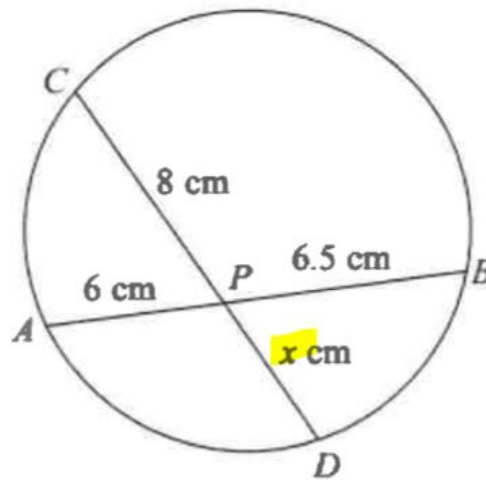


Diagram NOT
accurately drawn

APB and *CPD* are chords of a circle.

$AP = 6$ cm, $PB = 6.5$ cm, $CP = 8$ cm, $PD = x$ cm

Work out the value of x .

$$8x = 6 \times 6.5$$

$$8x = 39$$

$$x = 4.875$$

Question 3

✓

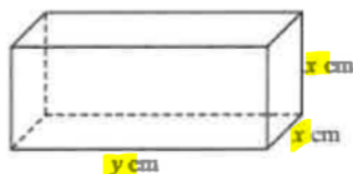


Diagram NOT
accurately drawn

The diagram shows a cuboid of volume $V \text{ cm}^3$

The length of the cuboid is $y \text{ cm}$

The width and height of the cuboid are both $x \text{ cm}$

The total length of all the edges of the cuboid is 112 cm

(a) Show that $V = 28x^2 - 2x^3$

$$V = yx^2$$

$$V = (28 - 2x)x^2$$

$$V = 28x^2 - 2x^3$$

$$V = yx^2 \quad (2)$$

$$4y + 8x = 112 \quad (1)$$

$$4y = 112 - 8x$$

$$y = 28 - 2x$$

$$V = 28x^2 - 2x^3$$

(3)

(b) Find $\frac{dV}{dx} = 56x - 6x^2$

$$\frac{dV}{dx} = 56x - 6x^2$$

(2)

(c) Find the maximum value of V

Give your answer correct to 3 significant figures.

$$56x - 6x^2 = 0$$

$$56 - 6x = 0$$

$$6x = 56$$

$$x = \frac{56}{6}$$

$$= \frac{28}{3}$$

$$V = 28x^2 - 2x^3$$

$$= 28 \times \left(\frac{28}{3}\right)^2 - 2 \times \left(\frac{28}{3}\right)^3$$

$$= 813 \text{ cm}^3$$

Question 4

The size of each interior angle of a regular polygon with n sides is 140°

Work out the size of each interior angle of a regular polygon with $2n$ sides.



$$n = \frac{360}{40} = 9$$

$$\begin{aligned} n &= 18 & i &= 180 - \frac{360}{18} \\ & & &= 180 - 20 \\ & & &= 160 \end{aligned}$$

Question 5

The diagram shows a sector $OAPB$ of a circle, centre O .

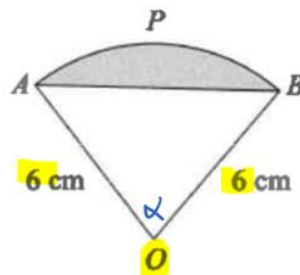


Diagram NOT
accurately drawn

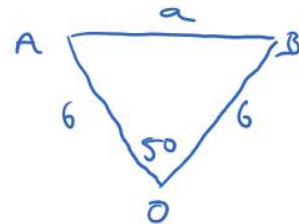
AB is a chord of the circle.

$OA = OB = 6$ cm.

The area of sector $OAPB$ is 5π cm².

Calculate the perimeter of the shaded segment.

Give your answer correct to 3 significant figures.



$$\frac{\alpha}{360} \times \pi r^2 = 5\pi$$

$$\frac{\alpha}{360} \times 36 = 5$$

$$\frac{1}{10} \alpha = 5$$

$$\alpha = 50$$

$$a^2 = 6^2 + 6^2 - 2 \times 6 \times 6 \times \cos 50$$

$$a^2 = 25.7 \dots$$

$$a = 5.07141 \dots$$

$$AB = \frac{50}{360} \times \pi \times 12$$

$$= 5.23598 \dots$$

$$\text{Perimeter} = 10.2 \text{ cm (3 s.f.)}$$