



Q14 : Sand is pouring from a pipe at the rate of $12 \text{ cm}^3/\text{s}$. The falling sand forms a cone on the ground in such a way that the height of the cone is always one-sixth of the radius of the base. How fast is the height of the sand cone increasing when the height is 4 cm?

Answer :

The volume of a cone (V) with radius (r) and height (h) is given by,

$$V = \frac{1}{3} \pi r^2 h$$

It is given that,

$$h = \frac{1}{6} r \Rightarrow r = 6h$$

$$\therefore V = \frac{1}{3} \pi (6h)^2 h = 12\pi h^3$$

The rate of change of volume with respect to time (t) is given by,

$$\frac{dV}{dt} = 12\pi \frac{d}{dh}(h^3) \cdot \frac{dh}{dt} \quad [\text{By chain rule}]$$

$$= 12\pi (3h^2) \frac{dh}{dt}$$

$$= 36\pi h^2 \frac{dh}{dt}$$

It is also given that $\frac{dV}{dt} = 12 \text{ cm}^3/\text{s}$.

Therefore, when $h = 4 \text{ cm}$, we have:

$$12 = 36\pi (4)^2 \frac{dh}{dt}$$

$$\Rightarrow \frac{dh}{dt} = \frac{12}{36\pi (16)} = \frac{1}{48\pi}$$

Hence, when the height of the sand cone is 4 cm, its height is increasing at the rate of $\frac{1}{48\pi} \text{ cm/s}$.

Answer needs Correction? [Click Here](#)

Q15 : The total cost $C(x)$ in Rupees associated with the production of x units of an item is given by

$$C(x) = 0.007x^3 - 0.003x^2 + 15x + 4000$$

Find the marginal cost when 17 units are produced.

Answer :

Marginal cost is the rate of change of total cost with respect to output.

$$\therefore \text{Marginal cost (MC)} = \frac{dC}{dx} = 0.007(3x^2) - 0.003(2x) + 15$$

$$= 0.021x^2 - 0.006x + 15$$

$$\text{When } x = 17, \text{ MC} = 0.021(17^2) - 0.006(17) + 15$$

$$= 0.021(289) - 0.006(17) + 15$$

$$= 6.069 - 0.102 + 15$$

$$= 20.967$$

Hence, when 17 units are produced, the marginal cost is Rs. 20.967.

Answer needs Correction? [Click Here](#)

Q16 : The total revenue in Rupees received from the sale of x units of a product is given by

$$R(x) = 13x^2 + 26x + 15$$

Find the marginal revenue when $x = 7$.

Answer :

Marginal revenue is the rate of change of total revenue with respect to the number of units sold.

$$\therefore \text{Marginal Revenue (MR)} = \frac{dR}{dx} = 13(2x) + 26 = 26x + 26$$

$$\text{When } x = 7,$$

$$\text{MR} = 26(7) + 26 = 182 + 26 = 208$$

Hence, the required marginal revenue is Rs 208.

Answer needs Correction? [Click Here](#)

Q17 : The rate of change of the area of a circle with respect to its radius at $r = 6$ cm is

(A) 10π (B) 12π (C) 8π (D) 11π

Answer :

The area of a circle (A) with radius (r) is given by,

$$A = \pi r^2$$

Therefore, the rate of change of the area with respect to its radius r is

$$\frac{dA}{dr} = \frac{d}{dr}(\pi r^2) = 2\pi r.$$

\therefore When $r = 6$ cm,

$$\frac{dA}{dr} = 2\pi \times 6 = 12\pi \text{ cm}^2/\text{s}$$

Hence, the required rate of change of the area of a circle is $12\pi \text{ cm}^2/\text{s}$.

The correct answer is B.

Answer needs Correction? [Click Here](#)

Q18 : The total revenue in Rupees received from the sale of x units of a product is given by

$R(x) = 3x^2 + 36x + 5$. The marginal revenue, when $x = 15$ is

(A) 116 (B) 96 (C) 90 (D) 126

Answer :

Marginal revenue is the rate of change of total revenue with respect to the number of units sold.

$$\therefore \text{Marginal Revenue (MR)} = \frac{dR}{dx} = 3(2x) + 36 = 6x + 36$$

\therefore When $x = 15$,

$$\text{MR} = 6(15) + 36 = 90 + 36 = 126$$

Hence, the required marginal revenue is Rs 126.

The correct answer is D.

Answer needs Correction? [Click Here](#)

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