Derivatives as a Rate Measurer Ex 13.2 Q1

Let $x$ be the side of square.

Given, $\frac{dx}{dt} = 4$ cm/min, $x = 8$ cm

We know that

$$\text{Area } (A) = x^2$$

$$\frac{dA}{dt} = 2x\frac{dx}{dt}$$

$$\left(\frac{dA}{dt}\right)_{8 \text{ cm}} = 2 \times (8)(4)$$

$$\frac{dA}{dt} = 64 \text{ cm}^2/\text{min}$$

Area increases at a rate of 64 $\text{cm}^2/\text{min}$.

Derivatives as a Rate Measurer Ex 13.2 Q2

Let edge of the cube is $x$ cm.

$$\frac{dx}{dt} = 3 \text{ cm/sec}, x = 10 \text{ cm}$$

Let $V$ be volume of cube,

$$V = x^3$$

$$\frac{dV}{dt} = 3x^2\frac{dx}{dt}$$

$$= 3(10)^2 \times (3)$$

$$= 900 \text{ cm}^3/\text{sec}$$

So,

Volume increases at a rate of 900 $\text{cm}^3/\text{sec}$.

Derivatives as a Rate Measurer Ex 13.2 Q3

Let $x$ be the side of the square.

Here, $\frac{dx}{dt} = 0.2$ cm/sec.

$$P = 4x$$

$$\frac{dP}{dt} = 4\frac{dx}{dt}$$

$$= 4 \times (0.2)$$

$$\frac{dP}{dt} = 0.8 \text{ cm/sec}$$

So, perimeter increases at the rate of 0.8 cm/sec.

Derivatives as a Rate Measurer Ex 13.2 Q4

The circumference of a circle ($C$) with radius ($r$) is given by

$C = 2\pi r$.

Therefore, the rate of change of circumference (C) with respect to time ($t$) is given by,

$$\frac{dC}{dt} = \frac{dC}{dr} \cdot \frac{dr}{dt} \text{ (By chain rule)}$$

$$= \frac{d}{dr}(2\pi r) \frac{dr}{dt}$$

$$= 2\pi \cdot \frac{dr}{dt}$$

It is given that $\frac{dr}{dt} = 0.7$ cm/s.

Hence, the rate of increase of the circumference is $2\pi(0.7) = 1.4\pi$ cm/s.

*********** END **********