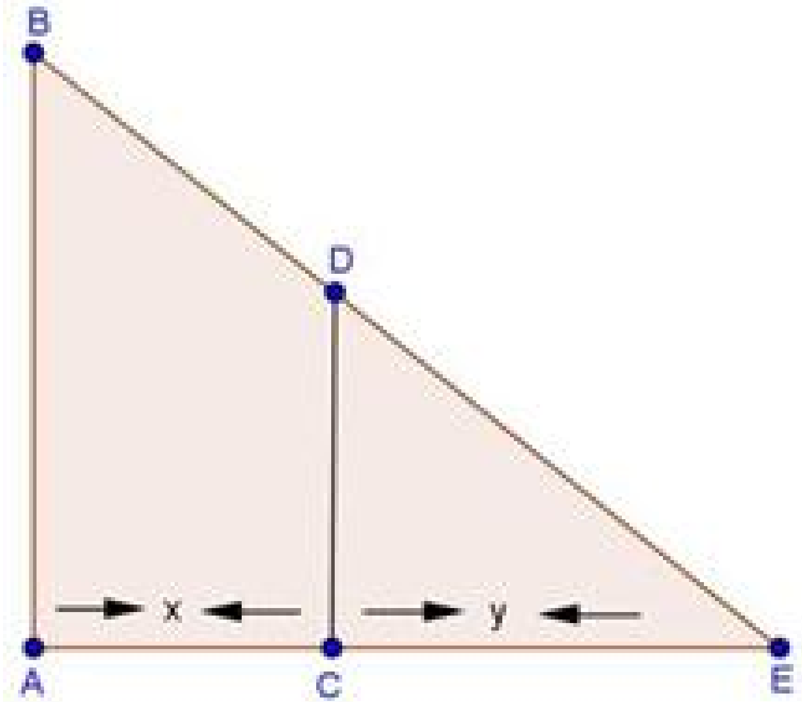
Derivatives as a Rate Measurer Ex 13.2 Q8



Let AB be the lamp-post. Suppose at time t, the man CD is at a distance of x meters from the lamp-post and y meters be the length of his shadow CB.

Here, $\frac{dx}{dt} = 5$ km/hr

$CD = 2$ m, $AB = 6$ m

Here, ΔABE and ΔCDE are similar, so

$$\frac{AB}{CD} = \frac{AE}{CE}$$
$$\frac{6}{2} = \frac{x+y}{y}$$
$$3y = x + y$$
$$2y = x$$
$$2\frac{dy}{dt} = \frac{dx}{dt}$$
$$\frac{dy}{dt} = \frac{5}{2} \text{ km/hr}$$

So, the length of his shadow increases at the rate of $\frac{5}{2}$ km/hr.

Derivatives as a Rate Measurer Ex 13.2 Q9

The area of a circle (A) with radius (r) is given by $A = \pi r^2$.

Therefore, the rate of change of area (A) with respect to time (t) is given by,

$$\frac{dA}{dt} = \frac{d}{dt}\left(\pi r^2\right) = \frac{d}{dr}\left(\pi r^2\right)\frac{dr}{dt} = 2\pi r\frac{dr}{dt} \text{ [By chain rule]}$$

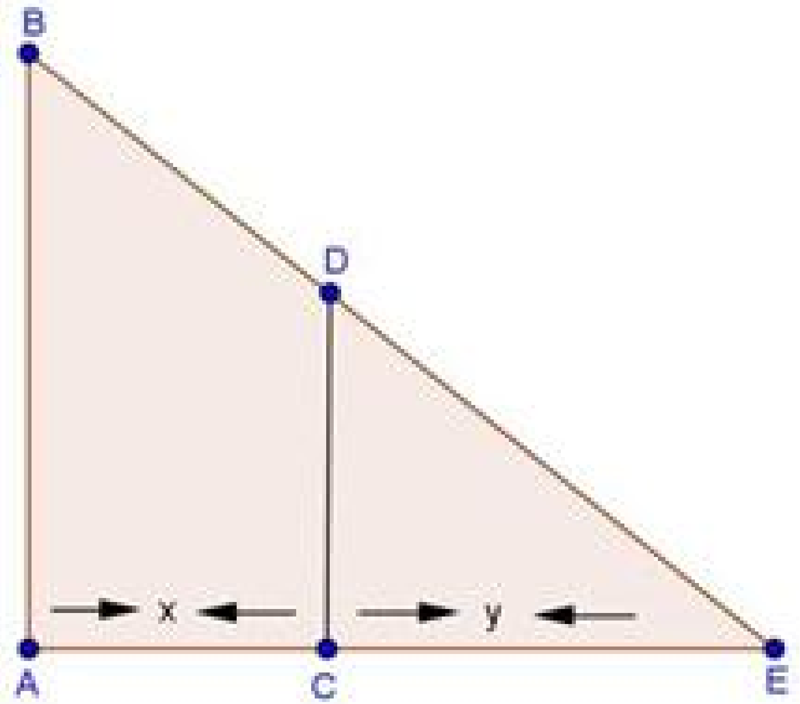
It is given that $\frac{dr}{dt} = 4$ cm/s.

Thus, when $r = 10$cm,

$$\frac{dA}{dt} = 2\pi(10)(4) = 80\pi$$

Hence, when the radius of the circular wave is 8 cm, the enclosed area is increasing at the rate of 80π cm^2/s

Derivatives as a Rate Measurer Ex 13.2 Q10



Let AB be the height of pole. Suppose at time t, the man CD is at a distance of x meters from the lamp-post and y meters be the length of his shadow CE, then

$$\frac{dx}{dt} = 1.1 \text{ m/sec}$$

ΔABE is similar to ΔCDE,

$$\frac{AB}{CD} = \frac{AE}{CE}$$

$$\frac{600}{160} = \frac{x+y}{y}$$

$$\frac{15}{4} = \frac{x+y}{y}$$

$$15y = 4x + 4y$$

$$11y = 4x$$

$$11\frac{dy}{dx} = 4\frac{dx}{dt}$$

$$\frac{dy}{dt} = \frac{4}{11}(1.1)$$

$$\frac{dy}{dt} = 0.4 \text{ m/sec}$$

Rate of increasing of shadow = 0.4 m/sec.

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