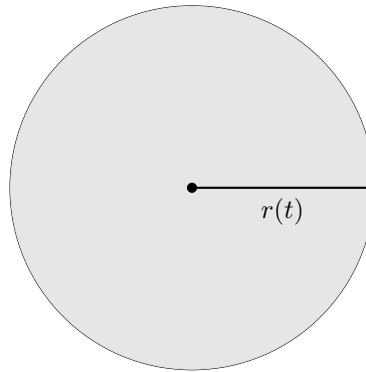


Question 5

A circular ripple is formed on the surface of a still pond when a pebble is dropped into it. The radius of the ripple increases at a constant rate of 0.05 m/s.

- (a) At what rate is the area enclosed by the ripple increasing when the radius is 0.3 m?
- (b) At what rate is the circumference of the ripple increasing at that moment?



Expanding ripple with changing radius

Question 5 - Solution

Let $r(t)$ be the radius of the ripple at time t , in meters.

(a) Rate of Change of Area

The area of a circle is:

$$A = \pi r^2$$

Differentiate both sides with respect to time t :

$$\frac{dA}{dt} = 2\pi r \frac{dr}{dt}$$

We're given:

$$\frac{dr}{dt} = 0.05 \text{ m/s}, \quad r = 0.3 \text{ m}$$

Substitute:

$$\frac{dA}{dt} = 2\pi(0.3)(0.05) = 0.03\pi \approx \boxed{0.0942 \text{ m}^2/\text{s}}$$

(b) Rate of Change of Circumference

Circumference is given by:

$$C = 2\pi r$$

Differentiate:

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

Substitute:

$$\frac{dC}{dt} = 2\pi(0.05) = \boxed{0.1\pi \approx 0.3142 \text{ m/s}}$$