

# Related Rates Problems Part I

**Example 1:** A rock is tossed into the lake creating a circular ripple to spread out from the point where the rock hit. The radius of the circle is growing out at a rate of 25 cm/s.

a) Determine the rate of increase of the circumference of the circle with respect to time

$$\frac{dC}{dt} = ?$$

$$\frac{dr}{dt} = 25 \text{ cm/s}$$

$$C = 2\pi r$$

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

$$\frac{dC}{dt} = 2\pi(25)$$

$$\frac{dC}{dt} = 50\pi \text{ cm/s}$$

∴ the circumference is increasing at a rate of  $50\pi \text{ cm/s}$

b) Determine the rate of increase of the area of the circle when its area is  $225\pi \text{ cm}^2$

$$\frac{dA}{dt} = ?$$

$$\frac{dr}{dt} = 25 \text{ cm/s}$$

$$A = \pi r^2$$

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

$$\frac{dA}{dt} = 2\pi(15)(25)$$

$$\frac{dA}{dt} = 750\pi \text{ cm}^2/\text{s}$$

∴ the area is increasing at a rate of  $750\pi \text{ cm}^2/\text{s}$

$$\odot A = 225\pi$$

$$\pi r^2$$

$$225 = r^2 \quad r = 15$$

**Example 2:** The volume of a spherical balloon is increasing at a rate of 10 cm<sup>3</sup>/s. How fast is the radius increasing when the radius is 1.5 cm?

$$\frac{dV}{dt} = 10 \text{ cm}^3/\text{s}$$

$$V = \frac{4}{3}\pi r^3$$

$$\frac{dV}{dt} = \frac{4}{3}\pi \cdot 3 \cdot r^2 \cdot \frac{dr}{dt}$$

$$10 = 4\pi(1.5)^2 \cdot \frac{dr}{dt}$$

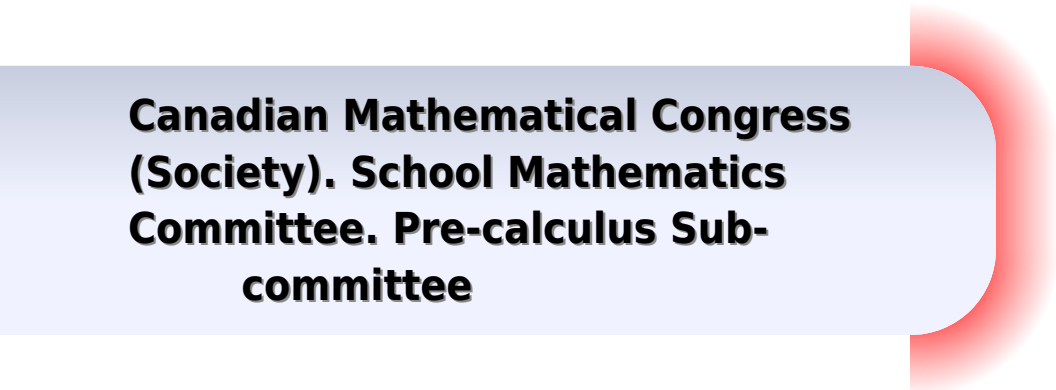
$$\frac{dr}{dt} = \frac{10}{4\pi(2.25)}$$

$$\frac{dr}{dt} = 0.0035 \text{ cm/s}$$

∴ the radius is increasing at a rate of  $0.0035 \text{ cm/s}$

# Nelson Grade 12 Calculus Solutions

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