$\frac{10}{10}$

Tecnológico de Monterrey Preparatoria

Related Rates

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Related rates

1. A spherical balloon is being filled at a rate of $50\text{in}^3/\text{sec}$, at what rate does the radius increase when the radius is 5in?

$\frac{dV}{dt} = 50 \frac{in^3}{s}$ $V = \frac{4}{3}\pi r^3$

$\frac{dr}{dt} = ?$ $r = 5in$ $\frac{dV}{dt} = \frac{4}{3}\pi 3r^2 \left(\frac{dr}{dt}\right)$

$50 = 4\pi(5)^2\left(\frac{dr}{dt}\right)$

$\frac{dr}{dt} = \frac{50}{4\pi(25)}$

$\frac{dr}{dt} = \frac{1}{2\pi} \frac{in}{s}$ //

2. The area of a circle is increasing at a rate of $20\text{in}^2/\text{min}$. Find the rate at which the radius is increasing when the radius is 4in.

$\frac{dA}{dt} = 20\ in^2/min$ $A = \pi r^2$

$\frac{dr}{dt} = ?$ $r = 4in$ $\frac{dA}{dt} = \pi 2r\left(\frac{dr}{dt}\right)$

$\frac{dr}{dt} = \frac{20}{\pi 2(4)} = \frac{\cancel{20}\ 5}{\pi 8\ 2}$

$\therefore \frac{dr}{dt} = \frac{5}{2\pi}\ in/min$ //

3. A stone is thrown into a lake and a circular ripple moves out at a constant rate of 0.5 meters/sec. Find the rate at which the circle's area is increasing at r = 0.4 meters.

$r = 0.4m$ $\frac{dA}{dt} = ?$ $\frac{dA}{dt} = \pi 2r\frac{dr}{dt}$

$A = \pi r^2$

$\frac{dr}{dt} = 0.5 m/s$

$\frac{dA}{dt} = \pi 2(0.4)(0.5)$

$\frac{dA}{dt} = 0.4\pi\ m^2/s$ //

4. Air is being pumped into a spherical balloon making the radius change at a constant rate of 0.5cm/sec. Find the rate of change of the volume and the rate of change of the surface area when the radius is 10cm $(V = \frac{4}{3}\pi r^3,\ A = 4\pi r^2)$

$\frac{dr}{dt} = 0.5\ cm/sec$ $\frac{dV}{dt} = 4\pi(10)^2\left(\frac{dr}{dt}\right)$ 0.5

$\frac{dV}{dt} = ?$ $\frac{dA}{dt} = ?$ $\frac{dV}{dt} = 200\pi\ cm^3/s$ //

$r = 10\ cm$

$\frac{dA}{dt} = 4\pi 2r\left(\frac{dr}{dt}\right)$

$\frac{dA}{dt} = 8\pi(10)(0.5)$

$\frac{dA}{dt} = 40\pi\ cm^2/s$ //

5. A cone is increasing in size as time goes by in such a way that the volume is changing at a constant rate of $75\text{cm}^3/\text{min}$. The height is twice the radius. Determine the rate of change of the height, when the height is 5cm. $(V = \frac{1}{3}\pi r^2 h)$

$\frac{dv}{dt} = 75\ cm^3/min$ $V = \frac{1}{3}\pi\left(\frac{h}{2}\right)^2 h$

$h = 2r$ $\frac{dh}{dt} = ?$ $V = \frac{\pi}{12}h^3$

$h = 5cm$ $\frac{dv}{dt} = \frac{\pi}{12}3h^2\left(\frac{dh}{dt}\right)$

$\frac{dh}{dt} = \frac{75(4)}{\pi(5)^2} = \frac{12}{\pi}$

$\frac{dh}{dt} = \frac{12}{\pi} \frac{cm}{min}$