$\frac{10}{10}$

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Tecnológico de Monterrey

Related Rates

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Related rates

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

$\frac{dv}{dt} = 50\frac{in^3}{s}$ $r = 5$ $V = \frac{4}{3}\pi r^3$

$\frac{dv}{dt} = \frac{4}{3}\pi r^3 \left(\frac{dr}{dt}\right)$

$\frac{dv}{dt} = \frac{4}{3}\pi 3 r^2 \left(\frac{dr}{dt}\right)$

$50 = \frac{4}{3}\pi 3 r^2 \left(\frac{dr}{dt}\right)$

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

$\frac{50}{100\pi} = \frac{1}{2\pi}$ $\boxed{\frac{dr}{dt} = \frac{1}{2\pi}\frac{in}{s}}$

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

$\frac{dA}{dt} = 20\frac{in^2}{min}$ $r = 4$

$\hookrightarrow \pi r^2$

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

$\hookrightarrow \pi 2r \left(\frac{dr}{dt}\right)$

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

$\frac{20}{8\pi} = \frac{5}{2\pi} = \frac{dr}{dt}$

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

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.

$\frac{da}{dt} =$ $.5$ $r = .4$

$\hookrightarrow \pi r^2$

$\frac{da}{dt} = \pi r^2$

$\hookrightarrow \pi 2r \left(\frac{dr}{dt}\right)$

$\frac{da}{dt} = \pi 2(.4)(.5)$

$\boxed{\frac{da}{dt} = .4\pi \ m^2/s}$

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 $(V = \frac{4}{3}\pi r^3,\ A = 4\pi r^2)$

$\frac{dr}{dt} = .5 \ cm/s$ $r = 10$

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

$\frac{4}{3}\pi 3r^2\left(\frac{dr}{dt}\right)$

$\frac{4}{3}(3)(10^2)(.5)\pi$

$\hookrightarrow 200\pi$

$\frac{da}{dt} = 4\pi r^2$

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

$4(2)(10)(.5)\pi = 40\pi \ cm^2/s$

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

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

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 $75cm^3/min$. The height is twice the radius. Determine the rate of change of height, when the height is 5cm. $(V = \frac{1}{3}\pi r^2 h)$

dV $75 \ cm^3/min$ $r = \frac{h}{2}$

$\frac{dh}{dt} = \frac{12}{}$ cm/m