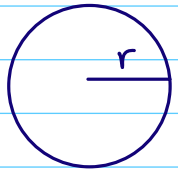
Feb 12

A spherical snowball is melting in such a way that its volume is decreasing at a rate of $1 \frac{cm^3}{min}$. At what rate is the radius decreasing when the radius is 5 cm.



Given $\frac{dv}{dt} = -1 \frac{cm^3}{min}$

Find $\frac{dr}{dt}$ @ $r = 5$ cm

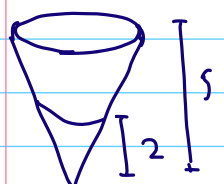
$\frac{d}{dt}\left(V = \frac{4}{3}\pi r^3\right)$ take derivative with respect to time

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

$-1 \frac{cm^3}{min} = 4\pi (5\,cm)^2 \frac{dr}{dt}$

$\frac{dr}{dt} = -\frac{1}{100\pi} \frac{cm}{min}$

A water tank built in the shape of a circular cone with height 5 cm and radius 3 m at the top. Water is being pumped into the tank at a rate of $1.6 \frac{m^3}{min}$. Find the rate at which the water level is rising when the water 2 m deep.



$V = \frac{1}{3}\pi r^2 h$

$V = \frac{1}{3}\pi \left(\frac{3h}{5}\right)^2 h$

$V = \frac{3}{25}\pi h^3$

$\frac{dv}{dt} = 1.6 \frac{m^3}{min}$

Find $\frac{dh}{dt}$ @ $h = 2m$

$\frac{3}{5} = \frac{r}{h}$

$r = \frac{3h}{5}$

$V = \frac{3}{25}\pi h^3$

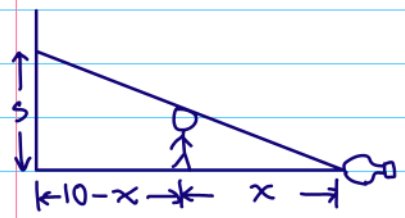
$\frac{dv}{dt} = \frac{9}{25}\pi h^2 \frac{dh}{dt}$

$1.6 \frac{m^3}{min} = \frac{9}{25}\pi (2m)^2 \frac{dh}{dt}$

$\frac{dh}{dt} = \frac{1.6 \times 25}{36\pi}$

$\frac{dh}{dt} = \frac{10}{9\pi} \frac{m}{min}$

A spotlight on the ground shines on a wall 10 m away. A 2m tall person walks away from the spotlight at a rate of 1.2 m/s. How fast is the shadow decreasing when the person is 3m from wall?



$\frac{2}{x} = \frac{s}{10}$ $\qquad \frac{dx}{dt} = 1.2 \frac{m}{s}$

$s = 20x^{-1}$ $\qquad$ Find $\frac{ds}{dt}$ @ $x = 7m$

$$\frac{ds}{dt} = -20x^{-2}\frac{dx}{dt}$$

$$\frac{ds}{dt} = \frac{-20}{7^2} \times \frac{12}{10}$$

$$\frac{ds}{dt} = \frac{-20}{49} \times \frac{12}{10}$$

$$\frac{ds}{dt} = \frac{-24}{49}$$

Feb 14 At 9:00 AM ship A is 50 km east of ship B. Ship A is sailing north at 40 km/h and ship B is sailing south at 30 km/h. How fast is the distance between them changing at noon.