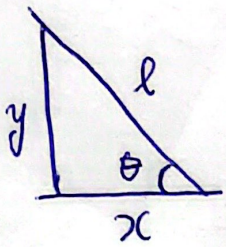
~~xx~~.

vi.



l : length of the ladder
x : Ground
y : Wall
θ : Angle that is formed between ground and bottom of the ladder.

$l = 15$ feet $\quad \frac{dt}{dy} = ?$

$\frac{dx}{dt} = 4$ feet/sec

* $l^2 = x^2 + y^2 \rightarrow$

$\Rightarrow y = 15^2 = [x(t)]^2 + [y(t)]^2$

* $0 = 2x\frac{dx}{dt} + 2y\frac{dy}{dt}$

$\Rightarrow \frac{dy}{dt} = \frac{-2x}{2y}\frac{dx}{dt}$

a) If $x = 6$, $15^2 = 6^2 + y^2$

$y = \sqrt{15^2 - 6^2}$

$y = \sqrt{189}$

$\rightarrow \frac{dy}{dt} = \frac{-6 \times 4}{\sqrt{189}}$ ft/sec

$\frac{dy}{dt} = -1.74$ ft/sec

b) If $x = 8$, $15^2 = 8^2 + y^2$

$y = \sqrt{15^2 - 8^2}$

$y = \sqrt{161}$

$\rightarrow \frac{dy}{dt} = \frac{8 \times 4}{\sqrt{161}}$ ft/sec

$\frac{dy}{dt} = -2.52$ ft/sec

c) If $x = 10$, $y = \sqrt{15^2 - 10^2} = \sqrt{125}$

$\rightarrow \frac{dy}{dt} = \frac{10 \times 4}{\sqrt{125}}$ ft/sec

$dy/dt = -3.57$ ft/sec

d) If $x = 13$, $y = \sqrt{15^2 - 13^2} = \sqrt{56}$

$\rightarrow \frac{dy}{dt} = \frac{13 \times 4}{\sqrt{56}}$ ft/sec $= -6.95$ ft/sec

e) If $x = 15$, $y = 15^2 - 15^2 = 0$

$\rightarrow \frac{dy}{dt} = \frac{15 \times 4}{0}$ ft/sec $= -\infty$

$\cos\theta = \frac{x}{l}$, $\frac{d\theta}{dt} = ?$

$\rightarrow \frac{d}{dt}\cos\theta = \left(\frac{1}{15}x\right)\frac{d}{dt}$

$\rightarrow -\sin\theta \frac{d\theta}{dt} = \frac{1}{15}\frac{dx}{dt}$

$\rightarrow \frac{d\theta}{dt} = \frac{-1}{15\sin\theta} \times \frac{dx}{dt}$

or $\sin\theta = \frac{y}{l}$

$\rightarrow \frac{d\theta}{dt} = \frac{-1}{15 \times \frac{y}{15}} \times \frac{dx}{dt}$

$\rightarrow \frac{d\theta}{dt} = \frac{-dx/dt}{y}$

a') if $x = 6$, $y = \sqrt{189}$

$\frac{d\theta}{dt} = \frac{-4}{\sqrt{189}}$ ft/sec $= -0.29$ rad/sec

b') if $x = 8$, $y = \sqrt{161}$

$\frac{d\theta}{dt} = \frac{-4}{\sqrt{161}}$ ft/sec $= -0.31$ rad/sec

c') if $x = 10$, $y = \sqrt{125}$

$\frac{d\theta}{dt} = \frac{-4}{\sqrt{125}}$ ft/sec $= -0.35$ rad/sec

d') If $x = 13$, $y = \sqrt{56}$

$\rightarrow \frac{d\theta}{dt} = \frac{-4}{\sqrt{56}}$ ft/sec $= -0.53$ rad/sec

e') If $x = 15$, $y = 0$

$\rightarrow \frac{d\theta}{dt} = \frac{-4}{0}$ ft/sec $= -\infty$