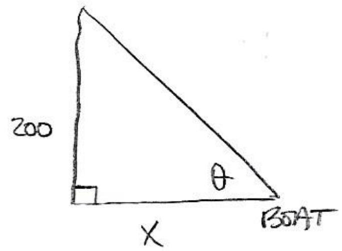
Name: KEY

1. A boat is sailing toward Bell Island at a rate of 0.5 m/sec. The height of the cliff is 200 ~~feet~~ m. How fast is the angle of elevation changing at the instant it is $\frac{\pi}{3}$ radians?

$$x = \frac{200}{\sqrt{3}}$$

$$\sec^2\frac{\pi}{3} = 4$$



$$\frac{dx}{dt} = -\frac{1}{2}$$

$$\left.\frac{d\theta}{dt}\right|_{\theta=\frac{\pi}{3}}$$

$$\tan\theta = \frac{200}{x}$$

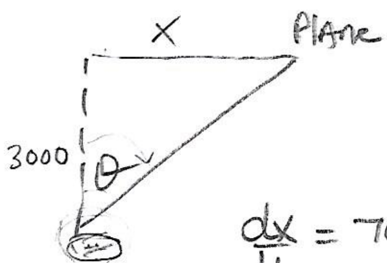
$$\sec^2\theta\,\frac{d\theta}{dt} = \frac{-200}{x^2}\,\frac{dx}{dt}$$

$$\sec^2\frac{\pi}{3}\,\frac{d\theta}{dt} = \frac{-200}{\left(\frac{200}{3}\right)^2}\left(\frac{-1}{2}\right)$$

$$\frac{d\theta}{dt} = \frac{3}{1600} \text{ Rad/sec}$$

2. A 10 ft. ladder is slipping down the side of a house. The angle of elevation is decreasing at a rate of 2 degrees per second. How fast is it slipping away when the angle at the base of the ladder is 30 degrees?

3. A plane at a constant altitude of 3000 ft. is flying at a rate of 700 ft/sec. A searchlight under its path tracks it. How fast is the light pivoting when the plane is 4000 ft East of the light?



$$\frac{dx}{dt} = 700$$

$$\left.\frac{d\theta}{dt}\right|_{x=4000}$$

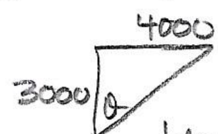
$$\tan\theta = \frac{x}{3000}$$

$$3000\tan\theta = x$$

$$3000\sec^2\theta\,\frac{d\theta}{dt} = \frac{dx}{dt}$$

$$3000\left(\frac{25}{9}\right)\left(\frac{d\theta}{dt}\right) = 700$$

$$\frac{d\theta}{dt} = \frac{21}{250} \text{ Rad/sec}$$



$$\tan\theta = 4/3$$

$$1 + \tan^2\theta = \sec^2\theta$$

$$1 + (4/3)^2 = \frac{25}{9}$$