

Name _____

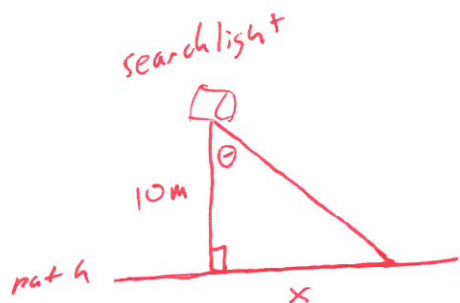
MATH-1951

Quiz 6 - (3.9, 3.10)

Answer the following questions, and show your work. Answers need not be simplified.

Scientific calculator only.

[1] (7 points total) A search light, which is on the ground, is tracking a man that is running on a straight path. If the man is running at a rate of 4 m/s and the light is located 10 m from the path, determine the speed at which the light is rotating when the man is 8 m from the point on the path closest to the light.



$$\frac{dx}{dt} = 4 \text{ m/s}$$

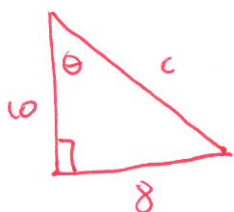
$$\tan \theta = \frac{x}{10}$$

$$\sec^2 \theta \frac{d\theta}{dt} = \frac{1}{10} \frac{dx}{dt}$$

$$\frac{1}{\cos^2 \theta} \frac{d\theta}{dt} = \frac{1}{10} \frac{dx}{dt}$$

$$\frac{d\theta}{dt} = \frac{\cos^2 \theta}{10} \frac{dx}{dt}$$

when $x=8$



$$8^2 + 10^2 = c^2$$

$$164 = c^2$$

$$c = \sqrt{164}$$

$$\text{So, } \cos \theta = \frac{10}{\sqrt{164}}$$

$$\cos^2 \theta = \frac{100}{164}$$

$$\frac{d\theta}{dt} = \frac{1}{10} \cdot \frac{100}{164} \cdot 4$$

$$\frac{d\theta}{dt} = \frac{10}{41} \text{ rad/sec}$$

[2] (3 points total) Use linear approximation to approximate $\sqrt[3]{1.03}$.

$$f(x) = \sqrt[3]{x} \quad a = 1 \quad f'(x) = \frac{1}{3} x^{-2/3}$$

$$f(x) \approx f(a) + f'(a)(x-a)$$

$$f'(a) = f'(1)$$

$$= \frac{1}{3} \cdot 1^{-2/3}$$

$$f(1.03) \approx \sqrt[3]{1} + \frac{1}{3}(1.03-1)$$

$$= \frac{1}{3}$$

$$= 1 + \frac{1}{3}(.03)$$

$$= 1 + \frac{1}{3} \cdot \frac{3}{100}$$

$$= 1 + \frac{1}{100} = 1.01$$

$$\sqrt[3]{1.03} = f(1.03) \approx 1.01$$