

Name: KEY  
 Math 144: Business Calculus  
 Quiz 7

1. Use differentials or a tangent line approximation to estimate  $\sqrt{25.1}$ .

$$f(a+dx) \approx f(a) + dy, \quad dy = f'(a)dx$$

$$f(x) = \sqrt{x}$$

$$f'(x) = \frac{1}{2\sqrt{x}}$$

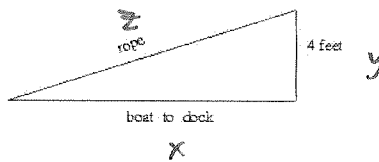
$$\text{so } \sqrt{25.1} \approx \sqrt{25} + dy = 5 + 0.01 = \boxed{5.01}$$

$$a = 25$$

$$dx = 0.1 = \frac{1}{10}$$

$$dy = f'(25) \cdot \frac{1}{10} = \frac{1}{2 \cdot 5} \cdot \frac{1}{10} = \frac{1}{10} \cdot \frac{1}{10} = \frac{1}{100} = 0.01$$

2. A boat is being pulled toward a dock. If the rope is being pulled in at 3 feet per second, how fast is the distance between the dock and the boat decreasing when it is 30 feet from the dock?



$$z^2 = x^2 + y^2 \quad x = 30, \quad y = 4 \quad \frac{dy}{dt} = 0, \quad \frac{dz}{dt} = 3, \quad \frac{dx}{dt} = ?$$

$$\frac{d}{dt} [z^2 = x^2 + y^2] \Rightarrow 2z \frac{dz}{dt} = 2x \frac{dx}{dt} + 2y \frac{dy}{dt} \rightarrow 0$$

$$\Rightarrow \frac{dx}{dt} = \frac{z}{x} \frac{dz}{dt} = \frac{z}{30} (3)$$

$$z = \sqrt{30^2 + 4^2} = \sqrt{916} \Rightarrow \frac{dx}{dt} = \frac{\sqrt{916}}{30} \cdot 3 = \boxed{\frac{\sqrt{916}}{10} \text{ ft/sec}}$$