



MA1021

Calculus I

B Term, 2014

Quiz 5

Print Name: _____

Sign: _____

Compute each of the following derivatives. Write up your solutions neatly and show all your work.

1. (4 pts) Compute each of the following:

a) $\frac{d}{dx} \left(\ln(x^2) + \frac{1}{3x} - \frac{1}{x^2} \right) =$

$$\frac{d}{dx} \left(\ln(x^2) + \frac{1}{x} \right) = \frac{1}{x^2} \frac{d}{dx} (x^2) + \frac{1}{3x} \frac{d}{dx} (3x) - (-1)x^{-2} = \frac{1}{x^2} 2x + \frac{1}{3x} 3 + \frac{1}{x^2} = \frac{2}{x} + \frac{1}{x} + \frac{1}{x^2}$$

b) $\frac{d}{dx} (e^{3x} + e^{-x} - e^2) =$

$$\frac{d}{dx} (e^{3x} + e^{-x} - e^2) = e^{3x} \frac{d}{dx} (3x) + e^{-x} \frac{d}{dx} (-x) - 0 = 3e^{3x} - e^{-x}$$

2. (6 pts.) A man 6 feet tall is walking at 2 feet/second toward a streetlight mounted on a 30 foot tall pole. How fast is the length of his shadow decreasing when he is 24 feet from the pole.

The triangle between the top of the lamp, the base of the lamp, and the tip of the man's shadow; is similar to the triangle formed by the top of the man's head, the base of the man, and the tip of his shadow.

Set s to be the length of the shadow and x to be the distance of the man from the lighthouse.

The the similar triangles give $\frac{s}{6} = \frac{s+x}{30}$ or $5s = s + x$, or $4s = x$, that is the related quantities.

Additionally we are given $\frac{d}{dt}x = 2$ and the question is $\frac{d}{dt}s = ?$.

Related rates tells us $4\frac{ds}{dt} = \frac{dx}{dt} = 2$, so $\frac{ds}{dt} = -1/2$.