

## Math 124 Quiz #8 Solutions

1. (a) Note that  $f(0) = 1 - 3 \sin 0 + 5(0)e^0 = 1$ .

$$\begin{aligned} \text{Also, note that } f'(x) &= 0 - 3 \cos x + 5 \cdot e^x + 5x \cdot e^x && \text{(Using the product rule)} \\ &= -3 \cos x + 5e^x + 5xe^x. \end{aligned}$$

$$\Rightarrow f'(0) = -3 \cos 0 + 5e^0 + 5(0)e^0 = -3 + 5 = 2.$$

So, the linearization  $L(x) = 2(x - 0) + 1 = 2x + 1$ .

$$(b) f(0.2) \approx L(0.2) = 2(0.2) + 1 = 1.4 \qquad f(-0.1) \approx L(-0.1) = 2(-0.1) + 1 = 0.8$$

2. To find the slope of the curve, we must find the derivative  $\frac{dy}{dx} = \frac{y'(t)}{x'(t)}$ .

$$\text{Note that } y'(t) = e^t \text{ and } x'(t) = \cos(4t) \cdot 4 = 4 \cos(4t). \quad \text{So, } \frac{dy}{dx} = \frac{e^t}{4 \cos(4t)}.$$

To find the slope at the point (0,1), we will need the  $t$ -value associated with the point (0,1).

$$\text{To find } t \text{ given that } x = 0 \text{ and } y = 1: \quad 0 = \sin(4t) \quad \text{and} \quad 1 = e^t$$

Solving either equation yields that  $t = 0$ . (The first equation has an infinite number of solutions, but the only one that will also satisfy the second equation is  $t = 0$ .)

$$\text{So, the slope at (0,1) is given by } \left. \frac{dy}{dx} \right|_{t=0} = \frac{e^0}{4 \cos(4 \cdot 0)} = \frac{1}{4}.$$

$$\text{Equation of Line: } y = \frac{1}{4}x + 1$$