

Math 131 - Quiz 8

March 29, 2023

Name key

Score _____

Show all work to receive full credit. Supply explanations when necessary.

1. (3 points) Find the linearization of $f(x) = \sqrt{x}$ at $x = 9$. Then use your linearization to approximate $\sqrt{9.06}$.

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

$$L(x) = 3 + \frac{1}{6}(x-9)$$

$$f(9) = 3$$

$$f'(9) = \frac{1}{6}$$

$$\sqrt{9.06} \approx 3 + \frac{1}{6}(9.06-9) = 3 + \frac{1}{6}(0.06) = 3.01$$

2. (3 points) Use a linearization to approximate $(0.99)^\pi$.

$$f(x) = x^\pi \quad f(1) = 1$$

\Rightarrow

$$L(x) = 1 + \pi(x-1)$$

$$f'(x) = \pi x^{\pi-1} \quad f'(1) = \pi$$

$$(0.99)^\pi \approx 1 + \pi(0.99-1)$$

$$= 1 + \pi(-0.01) = 0.968584$$

3. (2 points) Let $y = e^{-2x}$. Use differentials to approximate Δy as x changes from $x = 0$ to $x = 0.12$.

$$\frac{dy}{dx} = -2e^{-2x}$$

$$x=0, \Delta x=0.12$$

$$\Delta y \approx -2e^0(0.12)$$

$$\Delta y \approx -2e^{-2x} \Delta x$$

$$= -0.24$$

4. (2 points) Suppose that x and y are differentiable functions of t and that $y = 4x^2$. Find dx/dt when $x = 2$ if $dy/dt = 3$.

$$\frac{dy}{dt} = 8x \frac{dx}{dt}$$

$$3 = (8)(2) \frac{dx}{dt}$$

\Rightarrow

$$\frac{dx}{dt} = \frac{3}{16}$$