

Name: _____

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Instructor: Bueler | Jurkowski | Maxwell

There are 25 points possible on this quiz. No aids (book, calculator, etc.) are permitted. Show all work for full credit.

1. [15 points] Compute the derivatives of the following functions. You need not simplify your answers.

a. $f(x) = e^x - 6 + x^{\frac{5}{2}}$

$$f'(x) = e^x + \frac{5}{2}x^{\frac{3}{2}}$$

b. $g(w) = \frac{\pi}{w^2} - 3w$

$$g'(w) = \pi \left(\frac{d}{dw} w^{-2} \right) - 3 = -2\pi w^{-3} - 3$$

$$= -\frac{2\pi}{w^3} - 3$$

c. $h(x) = \frac{1}{2-x^2}$

$$h'(x) = \frac{-\frac{d}{dx}(2-x^2)}{(2-x^2)^2} = \frac{2x}{(2-x^2)^2}$$

d. $R(s) = (s^3 - 1)e^s$

$$R'(s) = 3s^2 e^s + (s^3 - 1)e^s$$

$$= [s^3 + 3s^2 - 1]e^s$$

e. $f(x) = \frac{2-x^3}{3+x}$

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

$$= \frac{-2 - 9x^2 - 2x^3}{(3+x)^2}$$

2. [6 points] The temperature in °C of coffee in a cup is given by

$$T(t) = 20 + \frac{50}{e^t}.$$

where t is measured in hours.

a. What is the temperature of the coffee at time $t = 0$? Include units in your answer.

$$T(0) = 20 + \frac{50}{1} = 70^\circ\text{C}$$

b. What is the rate of change of temperature of the coffee at time $t = 0$? Include units in your answer.

$$T'(t) = \frac{d}{dt} \frac{50}{e^t} = -\frac{50}{(e^t)^2} e^t = -50e^{-t}$$

$$T'(0) = -50e^{-0} = -50^\circ\text{C}/\text{hour}$$

3. [4 points] Find the equation of the tangent line to the graph of $y = \sqrt{3x}$ at $x = 2$.

$$\frac{dy}{dx} = \frac{d}{dx} \sqrt{3} x^{1/2} = \frac{\sqrt{3}}{2} x^{-1/2}$$

$$\text{@ } x=2: y = \sqrt{6}$$

$$\frac{dy}{dx} = \frac{\sqrt{3}}{2\sqrt{2}}$$

$$\text{tangent line } y = \sqrt{6} + \frac{\sqrt{3}}{2\sqrt{2}}(x - 2)$$