Name: _____   _____ / 25

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

   $$f'(x) = \boxed{\frac{3}{2} x^{1/2} - e^x}$$

   b. $g(w) = 7w - \dfrac{\pi}{w^2}$

   $$g'(w) = 7 - \pi \frac{d}{dw} w^{-2} = 7 + 2\pi w^{-3} = \boxed{7 + \frac{2\pi}{w^3}}$$

   c. $h(x) = \dfrac{1}{4 - x^2}$

   $$h'(x) = -\frac{\frac{d}{dx}(4 - x^2)}{(4 - x^2)^2} = \boxed{\frac{2x}{(4 - x^2)^2}}$$

   d. $R(s) = (s^2 - 1)e^s$

   $$R'(s) = 2s e^s + (s^2 - 1)e^s$$
   $$= \boxed{(s^2 + 2s - 1)e^s}$$

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

   $$f'(x) = \frac{\left[\frac{d}{dx}(3 - x^3)\right](2 + x) - (3 - x^3)\frac{d}{dx}(2 + x)}{(2 + x)^2} = \frac{-3x^2(2 + x) - (3 - x^3)}{(2 + x)^2}$$
   $$= \boxed{-\frac{3 + 6x^2 + 2x^3}{(2 + x)^2}}$$

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

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

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

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

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

3. [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.

$$\cdot \; T(0) = 20 + \frac{50}{1} = 70°C$$

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

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

$$T'(0) = -50\,e^{-0} = -50 \; °C/hour$$