CORRECTED!

Math 251: Quiz 4 SOLUTIONS **18 February, 2020**

Name: _____ _____ / 25

Circle one: **Faudree (F01)** | **Bueler (F02)** | **VanSpronsen (UX1)**

25 points possible. No aids (book, calculator, etc.) are permitted. Show all work and use proper notation for full credit.

1. **[12 points]** Differentiate the functions. Write your answer using appropriate derivative notation, but you need not simplify your answers.

   a. $g(u) = u^{1/3} - u^{4/3}$

   $g'(u) = \frac{1}{3}u^{-2/3} - \frac{4}{3}u^{1/3}$

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

   $f'(x) = -6x^{-4}$

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

   $h'(x) = (e-1)x^{e-2}$

   d. $s(t) = (4-t)e^t$

   $s'(t) = (-1)e^t + (4-t)e^t$

   $= e^t(3-t)$

   e. $F(t) = \dfrac{At}{B+Ct^2}$

   $F'(t) = \dfrac{A(B+Ct^2) - At(2Ct)}{(B+Ct^2)^2}$

   $= \dfrac{AB - ACt^2}{(B+Ct^2)^2}$

2. [4 points] Suppose that $f(2) = 5$, $g(2) = 1$, $f'(2) = -3$, and $g'(2) = 4$. Find the following values.

a. $(fg)'(2) = f'(2)g(2) + f(2)g'(2)$

$= (-3)(1) + (5)(4) = 17$

b. $\left(\frac{f}{g}\right)'(2) = \frac{f'(2)g(2) - f(2)g'(2)}{g(2)^2}$

$= \frac{(-3)(1) - (5)(4)}{1^2} = -23$

3. [6 points] The equation of motion of a particle is $s = t^4 - 2t^3 - 3$, where s is in meters and t is in seconds. **Include the units for each answer.**

a. What is the acceleration as a function of t?

$v(t) = s'(t) = 4t^3 - 6t^2$

$a(t) = s''(t) = 12t^2 - 12t \ \frac{m}{s^2}$

b. Find the velocity at the time $t > 0$ when the acceleration is 0.

$a(t) = 0 \iff 12t^2 - 12t = 0 \iff 12t(t-1) = 0$

$\iff t = 0, t = 1$

$v(1) = 4 \cdot 1 - 6 \cdot 1 = -2 \ \frac{m}{s}$

4. [3 points] For what value of x does the graph of $f(x) = 2e^x - 5x$ have a horizontal tangent?

$f'(x) = 2e^x - 5 = 0 \iff x = \ln\left(\frac{5}{2}\right)$