Name: Solutions _____ / **20**

There are 20 points possible on this quiz. No aids (book, calculator, etc.) are permitted. Show all work for full credit.

1. [8 points] For each function below, find its derivative. You do not need to simplify your answer.

a. $h(t) = \dfrac{2}{t^2} + \dfrac{t^2}{2}$ $= 2t^{-2} + \frac{1}{2}t^2$

$h'(t) = 2(-2)t^{-3} + \frac{1}{2}(2t)$

b. $f(x) = \dfrac{2\sqrt{x}}{3} - x^e + \sqrt{2}$ $= \frac{2}{3}x^{1/2} - x^e + \sqrt{2}$

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

c. $g(x) = x^{2/3}(e^x - 1)$

$g'(x) = x^{2/3}(e^x) + (e^x - 1)\left(\frac{2}{3}x^{-1/3}\right)$

d. $y = \dfrac{2x^3 - 3}{x^2 - x}$

$y' = \dfrac{(x^2 - x)(6x) - (2x^3 - 3)(2x - 1)}{(x^2 - x)^2}$

2. [6 points] Suppose that $g(3)=3$, $g'(3)=-1$, $h(3)=-2$, and $h'(3)=5$. Find the following values:

a. $(g-h)'(3)=$ $g'(3)-h'(3) = -1-(5) = -6$

b. $(4h-g)'(3)=$ $4h'(3)-g'(3) = 4(5)-(-1) = 21$

c. $(gh)'(3)=$ $g(3)h'(3)+h(3)g'(3) = 3(5)+(-2)(-1) = 15+3 = 18$

d. $(\frac{h}{g})'(3)=$ $\dfrac{g(3)h'(3)-h(3)g'(3)}{(g(3))^2} = \dfrac{3(5)-(-2)(-1)}{3^2} = \dfrac{15-3}{9} = \dfrac{12}{9} = \dfrac{4}{3}$

3. [3 points] If $s=2e^t-6t$ is the equation of motion of a particle at time t seconds, what is the velocity **and** acceleration of that particle at time $t=0$? If s is measure in meters, give correct units for both answers.

$v(t)=s'(t)=2e^t-6 \Rightarrow v(0)=2e^0-6=2-6=-4$ m/s

$a(t)=v'(t)=2e^t \Rightarrow a(0)=2e^0=2$ m/s^2

4. [3 points] At what x-value or values on the curve $y=x^3+2x^2-2x-9$ is the tangent line perpendicular to the line $y=\frac{1}{2}x+\frac{5}{3}$? [Hint: recall two lines are perpendicular if their slopes are opposite reciprocals.]

To be perpendicular, we need the slope to equal -2.

So solve $y'=-2 \Rightarrow -2=3x^2+4x-2 \Rightarrow 0=3x^2+4x$

$\Rightarrow 0=x(3x+4)$ so $\boxed{x=0 \text{ or } x=-4/3}$ are the values we are looking for.