Math 234 BD4 Quiz 5 (2.4, 2.6) **Name (Last,First):** Solutions

You must show all your work to receive credit.

1.] (2 pts) Differentiate the function; simplify your answer.

$h(x) = (5x-1)^{-1/2}$ $\quad h'(x) = -\frac{1}{2}(5x-1)^{-1/2-1}\cdot(5x-1)'$

$= -\frac{1}{2}(5x-1)^{-3/2}\cdot(5) = -\frac{5}{2}(5x-1)^{-3/2}$ or $\dfrac{-5}{2\sqrt{(5x-1)^3}}$.

2.] (3 pts) Differentiate the function; fully simplify your answer (so that the numerator and denominator have no common factors).

$f(x) = \dfrac{2x+5}{(1-2x)^3}$ $\quad f'(x) = \dfrac{(2x+5)'(1-2x)^3 - (2x+5)\left[(1-2x)^3\right]'}{\left[(1-2x)^3\right]^2}$

$= \dfrac{2(1-2x)^3 - (2x+5)\left[3(1-2x)^2(1-2x)'\right]}{(1-2x)^6} = \dfrac{2(1-2x)^3 - (2x+5)(3)(1-2x)^2(-2)}{(1-2x)^6}$

$= \dfrac{2(1-2x)-(2x+5)(-6)}{(1-2x)^4} = \dfrac{8x+32}{(1-2x)^4}$

3.] (2pts) Does the tangent line to the graph of $f(x)$ ever become horizontal? Justify your answer. If 'yes', give some x value which makes the tangent line horizontal.

$f(x) = \left(1-\sqrt{x^5}\right)^3$ $\quad f'(x) = 3(1-x^{5/2})^2(1-x^{5/2})' = 3(1-x^{5/2})^2(-\frac{5}{2}x^{3/2})$

$= -\frac{15}{2}x^{3/2}(1-x^{5/2})^2$.

Yes, $x=0$ makes $f'(0) = -\frac{15}{2}(0)(1-0)^2 = 0$.

4.] (3pts) The equation below describes a curve; use implicit differentiation to find the slope of the tangent line at the point $(-\frac{1}{2}, -1)$. (Remember that y is a function of x)

$y + \dfrac{x}{y} = x$ We want y' evaluated at $(-\frac{1}{2},-1)$: $x=-\frac{1}{2}$, $y=-1$

First find y':

① $\left(y+\frac{x}{y}\right)' = (x)'$

$y' + (xy^{-1})' = 1$

$y' + (x'y^{-1} + x(y^{-1})') = 1$

② $y' + y^{-1} + x(-1y^{-2}y') = 1$

$y' + \frac{1}{y} + \frac{-x}{y^2}y' = 1$

$y' - \frac{x}{y^2}y' = 1 - \frac{1}{y}$

$\left(1-\frac{x}{y^2}\right)y' = 1-\frac{1}{y}$

③ $y' = \dfrac{1-\frac{1}{y}}{1-\frac{x}{y^2}}$.

④ $y'\Big|_{(-\frac{1}{2},-1)} = \dfrac{1-\frac{1}{(-1)}}{1-\frac{(-1/2)}{(-1)^2}}$

$= \dfrac{1-(-1)}{1-(-1/2)} = \dfrac{2}{1+1/2} = \dfrac{2}{3/2}$

$= 2\cdot\frac{2}{3} = \boxed{4/3} = m_{tan}$