Name: ______________________ **PID:** ______________

1. (3 points) Compute the derivative of $f(x) = \sec(x)(x^3 + \cos(2x))$.

   Solution: use the product rule

$$f'(x) = \tan(x)\sec(x)(x^3 + \cos(2x)) + \sec(x)(3x^2 - 2\sin(2x))$$

2. (3 points) Compute the derivative of $f(x) = \dfrac{\sin(5x)}{x+1}$.

   Solution: first rewrite $f(x)$ as $f(x) = \sin(5x)(x+1)^{-1}$, use the product rule:

$$f'(x) = 5\cos(5x)(x+1)^{-1} - \sin(5x)(x+1)^{-2}$$

3. (4 points) A particle moves according to the law of motion $s = \dfrac{30}{t+2}$, $\quad t \geq 0$, t is in seconds and s is in feet.

   (a) Compute the average velocity over the interval $[0, 3]$.

   Solution: average velocity $=\frac{\text{distance}}{\text{time}} = \frac{s(3)-s(0)}{3-0} = \frac{\frac{30}{3+2} - \frac{30}{0+2}}{3-0} = -3$ ft/s

   (b) Find the velocity of the particle at time t.

   Solution: rewrite the position function s as $s = 30(t+2)^{-1}$, then $v(t) = s'(t) = -30(t+2)^{-2}\text{ft/s}$

   (c) Calculate the acceleration of the particle at time t.

   Solution: use the $v(t)$ calculated above, we have $a(t) = v'(t) = 60(t+2)^{-3}$ ft$/s^2$