Name

Other than the sketch of a graph, do your work on another sheet and write in your answers on this sheet. Staple all work to this page when handing this assignment in.

1. Determine the derivative of the given function

   \( f(x) = \ln(x^2 + x + 3) \) \hspace{1cm} \( g(x) = \sqrt{1 + 2x^3} \)

   \( h(x) = \frac{1 - x}{4 - 2 \sin(3x)} \) \hspace{1cm} \( y(x) = e^{-2x} \tan(5x) \)

   \( q(x) = \arctan(7x^2) \) \hspace{1cm} \( p(x) = \frac{1}{3x^2 - 5} \)

   \( y = \frac{8}{\sqrt{4 + x^2}} \) \hspace{1cm} \( x(t) = 4te^{-t^2} \)

   \( f(x) = 3 \sec(2x) \cot(5x) \) \hspace{1cm} \( y(x) = x^{\sqrt{7}} \)

   \( k(x) = x^5 \cos^3(\pi x) \) \hspace{1cm} \( f(x) = (3x - 2 \ln(7 + x^2))^4 \)

2. Determine the linear approximation to the curve:
   \( xy + y^2 + x^2 = 7 \) at the point \((2, 1)\) and use it to approximate \( y \) when \( x = 2.1 \).
3. A hummingbird moves on a circle of radius 7m. As it passes through $(2, 3\sqrt{5})$, the 
$x$-coordinate of its velocity is $-20$ m/s. What is the $y$-coordinate of its velocity?

4. (a) A television camera is positioned 400 ft from the base of a rocket launching 
    pad. A rocket rises vertically and its speed is 20 ft/s when it has risen 300 
    ft. How fast is the distance from the camera to the rocket changing at that 
    moment?

(b) If the television camera is always kept focused on the rocket, how fast is the 
    camera’s angle of elevation changing at that moment?

5. (a) Determine the exact value(s) of the critical point(s) of the function 
    \[ y = 2x^3 + 3x^2 - 36x + 10. \]

(b) Determine the point(s) of inflection of the function given.

(c) Sketch the function $f(x)$, labeling these points found and the $y$-intercept.

6. (a) Determine the critical points of the function 
    \[ f(x) = e^{-x}(3x^2 + 2x - 2). \]

(b) For each value of $x$ found in part (a), state whether there is a local maximum or 
    local minimum or neither occurring on the function. Show how you got your 
    answer by evaluating the derivative using a number line.

(c) What is the exact range of the function of $[-1, 4]$? (No decimals please.)