

1. Find the equation of the tangent line to  $y = e^x + \ln x$  at the point  $(1, e)$ .

2. Solve the following differential equations.

(a)  $F'(x) = 2x + 3, F(1) = 0$

(b)  $g'(t) = 2g(t) - 1, g(0) = 40$

(c)  $p'(x) = \cos(x), p(\frac{\pi}{2}) = 2$

3. Snow is falling on the ground at the rate of 3 inches per hour. The air temperature is slightly above freezing, so every hour, 75 % of it melts away. If there is one foot of snow on the ground to begin with, how much will there be after 4 hours? How about if the storm continues indefinitely?

4. Determine all horizontal and vertical asymptotes of  $f(x) = \frac{2x^2-5x-3}{x^2-10x+21}$

5. Determine  $\lim_{x \rightarrow 0} (1 + 3x)^{\frac{1}{2x}}$ .

6. Plot my distance from home as a function of time in the following scenario.

“I left my house for a birthday party, driving at a constant speed. I realized I had forgotten the gift, turned around and sped back home. When I got the present I drove even faster, as I didn't want to be late. I spotted a cop and hit my brakes. Unfortunately, the cop spotted me as well, and pulled me over, which took some time. I drove the rest of the way to the party at the same constant speed at which I had started out. ”

7. Find the point guaranteed by the mean value theorem on the curve  $y = \sin(x)$  on the interval  $(\frac{\pi}{6}, \frac{\pi}{2})$ .

8. Suppose that a cannon fires a shot off of a 200 foot cliff with initial upward velocity of 75 feet per second. When will the shot reach the ground, and how fast will it be going when it hits? Also, find the maximum height that the cannon ball attains. (You should know the acceleration due to gravity. If you don't, it can be sold to you during the test.)

9. (10 points) The formula for the temperature (in degrees F) of a corpse is given by

$$H(x) = 68 + 30.6e^{-.4t}$$

A woman claims 'The man was dead when I got here, four hours ago.' If the body temperature is 77 degrees Fahrenheit, is the woman correct? If you determine she is wrong, figure out when the murder occurred.