Name:	
Perm:	

Math 34A Midterm 3, Summer 2022

(*100 pts total*)

1. (*6 pts*) Use the log table provided with this exam to answer the following questions:

   (a) Find $\log(10) + \log(0.316)$.

   (b) If $\log(y) = 6.3$, then find y.

   $y =$

   (c) Find the average rate of change of 10^x between $x = 0.7$ and $x = 0.9$.

   $\frac{\Delta y}{\Delta x} =$

2. (*6pts*) Compute the following derivatives.

(a) $\dfrac{d}{dx}\left(3x^5 - 2x^2 - 14\sqrt{x}\right) =$

(b) $\dfrac{d}{dx}\left(4x^2 + 5e^{2x} - 5e^{3x}\right) =$

(c) Consider the function

$$f(x) = \frac{a}{\sqrt[3]{x}} - \frac{b}{(e^x)^2}$$

where a and b are constants. Find $f'(1)$.

$f'(1) =$

3. (*8pts*) This question is about the graph of the function

$$f(x) = 2x^3 + 3x^2 - 12x + 172.$$

(a) What is the slope of the graph at $x = 0$?

slope = $\boxed{}$

(b) What is the equation of the tangent line to the graph at $x = 2$? Use the form $y = mx + b$.

$y =$ $\boxed{}$

(c) For which x value(s) does the graph have 0 slope?

$x =$ $\boxed{}$

(d) For which x values is the graph $y = f(x)$ concave down?

$\boxed{}$

4. (*10pts*) A large Nerf ball is launched upward from the top of a cliff. Its height (in meters) t seconds after launch is modeled by the equation

$$h(t) = -5t^2 + 30t + 50.$$

(In this problem we are ignoring horizontal movement.)

(a) Find the function which gives the velocity of the ball after t seconds.

(b) What is the initial height of the ball?

h = m

(c) What is the acceleration of the ball after 5 seconds?

acceleration = m/s^2

(d) When does the ball stop rising and begin to fall? (Hint: What would the ball's speed be at that moment?)

at t = s

(e) What was the ball's maximum height?

h = m

5. (*4pts*) A bacteria colony on a petri dish is growing in the shape of a circle. After t days, the radius of the circle is $t^2 + 2t$ mm.

   (a) What is the area of the circle after t days?

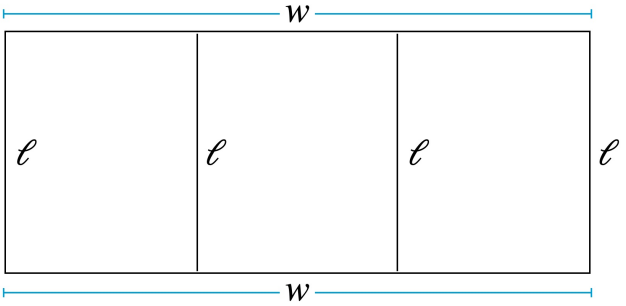
$$A(t) = \boxed{} \text{ mm}^2$$

   (b) How quickly is the area of the circle growing after t days?

$$A'(t) = \boxed{} \text{ mm}^2/\text{day}$$

6. (*6pts*) You have 600m of fencing for a rectangular field, but the field needs to also be subdivided into 3 equal areas by fencing as shown in the figure to the right. If ℓ and w (length and width) are the dimensions of your pen, the total combined fencing must be 600m, so

$$4\ell + 2w = 600.$$



   (a) Express the **area** of the pen in terms of ℓ only.

$$A(\ell) = \boxed{} \text{ m}^2$$

   (b) Find the length that results in the largest area $A(\ell)$ for your field.

$$\ell = \boxed{} \text{ m}$$

   (c) Use your answer in part (b) to find the maximum area for your field.

$$A_{\max} = \boxed{} \text{ m}^2$$