Mathematics 122 Test #3 Name: _____

You are to use your own calculator, no sharing.

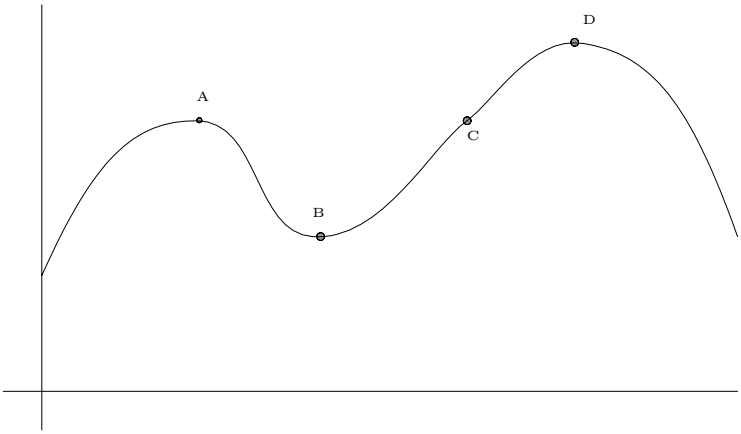
Show your work to get credit. **A blank page is attached for scratch work.**

(1) (10 points) Use your calculator to compute the following

(a) $\int_{-1}^{2} xe^{x+2}\,dx =$ _____

(b) $\int_{0}^{3} \frac{1-p^2}{1+p^2}\,dp =$ _____

(2) (8 points) For the points labeled in the figure answer the following.



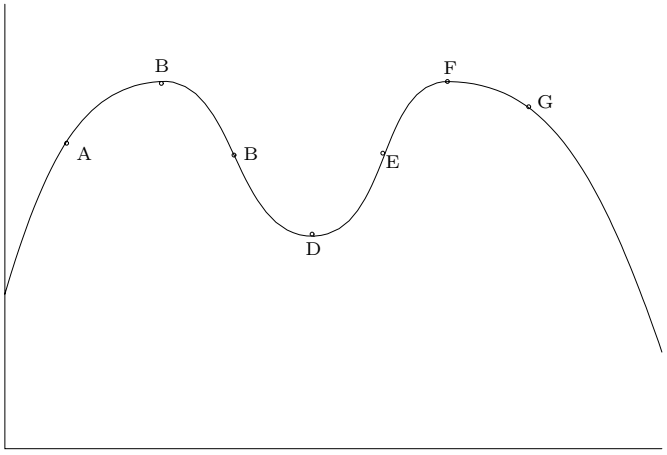
(a) Which of the labeled points are local maximums? _____

(b) Which of the labeled points are local minimums? _____

(c) Which of the labeled points are critical points? _____

(d) Which of the labeled points are a global maximum? _____

(3) (7 points) For the points labeled in the figure answer the following.



(a) Which of the labeled points has $f''(x) > 0$? _____

(b) Which of the labeled points is $f(x)$ concave down? _____

(c) Which of the labeled points are critical points? _____

(4) (10 points) Find the inflection points of $y = -2x^3 + 24x^2 - 9x + 7$.

_____

(5) (10 points) When you cough, your wind pipe contracts. The velocity with which air comes out is depends on the radius r of your wind pipe. If R is the normal (i.e. rest) radius of our wind pipe, then for $0 \leq r \leq R$ the velocity is given by

$$v = a(R - r)r^3 \qquad \text{where } a \text{ is a positive constant.}$$

What value of r maximizes the velocity? $r =$ _____

(6) (10 points) A car starts moving at time $t = 0$. Its velocity is shown in the following table. Give an upper, lower and best estimate of the distance the car has traveled during the 20 seconds.

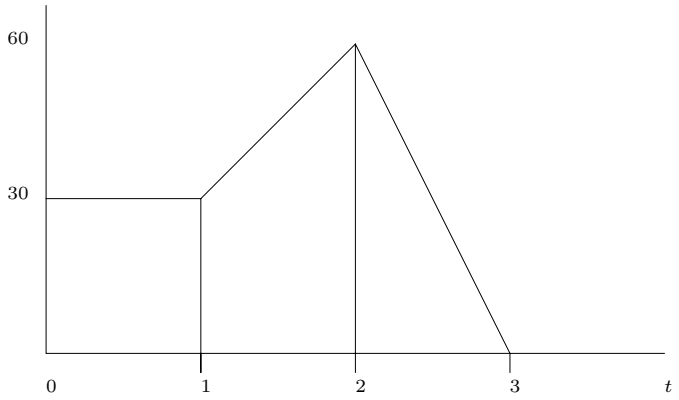
t (seconds)	0	5	10	15	20
Velocity (ft/sec)	0	8	20	35	50

Upper estimate _____

Lower estimate _____

Best estimate _____

(7) (10 points) The velocity, v in miles per hour, of a car as a function of time, t in hours, is given by the following graph.



(a) How far does the car travel in the first two hours? _____

(b) If the car starts 100 miles form Columbia, and moves directly away from Columbia, then how is it from Columbia after 3 hours?

_____

(8) (15 points) Consider the graphs of $y = 3x^2$ and $y = -9x$.

(a) Find where these graphs intersect (give both the x and y coordinates of the point so intersection.) _____

(b) Graph them on the same axis.

(c) Find the area between the two graphs. Area = _____

(9) (10 points) A tanks with 300 gallons of water springs a leak. After t hours the water is leaking at $r(t) = \dfrac{10}{1+t}$ gallons/hour. How much water is left in the tank after 24 hours?

_____

(10) (5 points) Let $f(x) = 2x^3 + 6x^2 - 18x + 3$.

(a) Compute the derivative $f'(x)$ and explain why $x = 1$ is a critical point.

(b) Compute the second derivate $f''(x)$ and use this to explain why $f(x)$ has a local minimum at $x = 1$.

(11) (5 points) Draw a graph of a function on $[0, 10]$ that has two local maximums one local minimum and no other critical points.

(12) (5 points) One form of the fundamental theorem of calculus is that the integral of a rate of change is the total change. Use this to complete the following equation:

$$\int_a^b F'(t)\,dt = \underline{\qquad\qquad}$$

Have a nice Thanksgiving.