Name: **Exam 1 (Version A)**

Instructions: This exam is closed book, closed note, and an individual effort. Electronic devices other than approved calculators are not allowed on your person (e.g., no cell phones or calculators with CAS). Remove any smartwatches and non-religious head-wear. Cheating of any kind will not be tolerated and will result in a grade of zero.**You must clear the memory on your calculator before beginning the exam.** Answer each question. **Show all work to receive full credit.** Unless the question specifies, you may provide either an exact answer or round to two decimal places. Write your answers on the test. You have **1 hour 40 minutes** to finish the exam. Answer all questions to the best of your ability. Unless otherwise specified, you are required to **SHOW ALL YOUR WORK** to receive full credit. The exam has 110 possible points. You will be graded out of 100 points. Each question is worth 12 pts.

Questions	Score		Score
Question 1		Question 5	
Question 2		Question 6	
Question 3		Question 7	
Question 4		Question 8	
Extra Credit		Question 9	
		Total	

1. For this problem you need only give your solution unless otherwise stated by the question. Parts (b) and (j) are worth 2 points. All others are worth 1 point.

   (a) Let $f(x)$ be a function with respect to x. Then if $f(x)$ gets smaller as x gets greater we say $f(x)$ is ______.

   (b) In the function, $f(x) = \frac{3}{2}x - 7$, determine the slope, x-intercept, and y-intercept (write the intercepts as points!).

   (c) If a function is linear, it is of the form ______.

   (d) (T/F) The average rate of change of a linear function is the slope. ______¡

   (e) If a function is concave up on the interval $(1, 3)$, concave down on the interval $(3, \infty)$, and increasing on $(1, \infty)$, what are/is the inflection point(s) of the function? ______(only need x value(s))

   (f) (T/F) Average velocity is the change in speed over time. ______

   (g) (T/F) Let $(10, 500)$ be the break-even point for a given cost and revenue function with quantity 10 and dollar amount \$500. Then at a quantity of 11, the company is making a profit. ______

   (h) (T/F) If an exponential function $f(t)$ in terms of t has a constant percent increase r and intitial value 500, then $f(t) = 500r^t$. ______

   (i) Write the expression as one logarithm $\frac{1}{2}\ln(x^2) - \frac{1}{2}\ln(y) + 3\ln(x) - 4\ln(1)$. ______

   (j) If an objects weight, w, is inversely proportional to the cube of its distance ,r, from earth's center, then what is a formula, given constant of proportionality k, for the relationship?

2. Aunt Marjie doesn't like going outside in the cold. Seriously...she's a big baby about it. If it's -10 F she'll only stay outside for 2 minutes, but if it's 70 F she'll stay out for 2 hours. Even at 70 though, she's still complaining.

   (a) Find the average rate of change for temperature in degrees Fahrenheit with respect to time in minutes. Interpret the meaning of this.

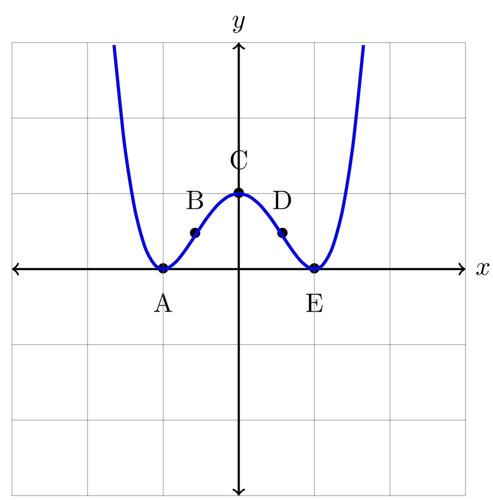
   (b) Find a linear function for the temperature, T, in degrees Fahrenheit with respect to time, t, in minutes.

3. Given the graph below where $A = (-1, 0)$, $B = (-\sqrt{3}/3, 38/81)$, $C = (0, 1)$, $D = (\sqrt{3}/3, 38/81)$, and $E = (1, 0)$, find the following:

   (a) Find the intervals for which the function is increasing and the intervals for which the function is decreasing and label which are increasing and which are decreasing (Note: Use open brackets for these intervals).

   (b) Find the intervals for which the function is concave up and the intervals for which the function is concave down and label which are concave up and which are concave down (Note: Use open brackets for these intervals).

   (c) Find all inflection points on the graph.



4. Carrie, a marine biologist, is performing experiments along the continental slope off of the coast of baja California where the biodiversity is very dynamic. Scientists have proven that biodiversity is closely linked to the temperature of the water. Carrie wants to monitor the temperature of the ocean at different depths along the continental slope, to help record the changes in biodiversity due to changes in the temperature of the water. At the same time she does not want the robot to crash into the continental slope, so she needs to take into effects the speed of the currents.

   Earlier scientists have found that the speed of ocean current as a function of depth. The speed, S, depends on depth, d, according to the following formula.

$$S(d) = 3d + 1$$

   Where S is measured in meters per second and d is measured in meters. Suppose that the depth of a research robot depends on time, t, according to the formula:

$$d(t) = (1/9)t^2$$

   (a) Write a function that models the speed, S, of the current at the depth of the robot in terms time, t.

   (b) Graph the function found in (a) along with the graph of $S'(t) = t^2$. Plot the effect on three integer (whole number) points from $S'(t)$ to $S(t)$. (LABEL YOUR AXES!)

5. Provide your answer for each of the below next to the table and label your answers by which part they associate to.

   (a) Determine if the tables below can be modeled by an exponential function, linear function, or neither. Justify your answer.

   (b) If linear or exponential, give a function representing the values in the table.

   (c) If linear, interpret the slope. If exponential, determine the percent rate.

(a) Table 1.

x	0	2	3	5
$f(x)$	20	26	29	35

(b) Table 2.

x	0	1	2	3
$f(x)$	7	2.24	.7168	.229376

6. A company produces a good, incurring a fixed cost of \$1000. Producing each unit of the good costs the company an addition \$20. Suppose the company sells each unit of the good for \$5.

   (a) Find the cost, revenue and profit functions for the above company in terms of quantity, q.

   (b) Find the marginal cost (MC), marginal revenue (MR), and marginal profit (MP) for the functions found in (a).

   (c) At what point, (q, p), does the company break even?

7. Let Matt Barnes invest \$2000 in an account compounded quarterly at a rate of 4% and let John Noble invest \$2000 in an account compounded continuously at a rate of 4%.

   (a) Find an function for the amount in the account, P, in terms of years, t, for each account.

   (b) Find the amount in each account at the end of 5 years (**Show how you got your answer**).

   (c) Find the time at which the value of each account doubles (**Show how you got your answer**).

   (d) Explain the difference between compounded quarterly and compound continuously. (Hint: compound means to apply the rate to the account)

8. Let the surface area of the leaves of a tree, S, satisfy the function, $S = kN^{1/5}$ where N is the number of leaves a tree has at a given time and k is the constant of proportionality. An oak tree has on average 3,200,000 leaves and a leaf surface area of 3000 inches squared.

   (a) Find the constant of proportionality, k (**Show how you got your answer**).

   (b) Given the function with k, find the surface area when a tree has 24,300,000 leaves (**Show how you got your answer**).

9. (a) Let the demand curve be $q = D(p) = -3p + 20$ and supply curve be $q = S(p) = 7$. Find the equilibrium $(p*, q*)$. Then graph the two curves. Label axes, equilibrium and the q-intercept (or the y-intercept).

(b) Let Woody have a budget of \$1000. Woody spends all his money on guns, at \$150 each, and butter, at \$6 each. Find a budget constraint for Woody and then graph the function. (Hint for graphing: Find intercepts)

10. Extra Credit (2 points): Draw a picture of a dinosaur eating broccoli.