EXAM 2 - MATH 111 Friday, February 18

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Read each problem **very carefully** before starting to solve it. Each problem is worth 10 points. It is necessary to show **all** your work. Correct answers without explanations are worth 0 points. GOOD LUCK!!

1. If an average sized man jumps from an airplane with an open parachute, his downward velocity t seconds into the fall is $v(t) = 20(1 - 0.2^t)$ feet per second.

   (a) Use functional notation to express the velocity 2 seconds into the fall and then calculate its value.

   (b) Describe how the velocity increases with time. In the explanation include the average rate of change from the beginning to the end of the first second and from the fifth second to the sixth second of the fall.

   (c) Find the terminal velocity of the man.

   (d) How long will it take for the man to reach 99% of its terminal velocity?

2. The circulation C of a certain magazine as a function of time t is given by the formula $C = \frac{5.2}{0.1+0.3^t}$, where C is measured in thousands and t in years since the beginning of 1992, when the magazine was launched.

   (a) Make a graph of C vs. t covering the first 6 years of the magazine's existence.

   (b) Express using functional notation the circulation of the magazine 18 months after it was launched and, then, find its value.

   (c) Over what time interval is the graph of C concave up? Explain your answer in practical terms.

   (d) At what time was the circulation increasing the fastest?

   (e) Determine the limiting value for C? What does it mean in practical terms?

3. The temperature C of a fresh cup of coffee t minutes after it is poured is given by $C = 125e^{-0.03t} + 75$ degrees Fahrenheit.

   (a) Make a graph of C vs. t.

   (b) The coffee is cool enough to drink when its temperature is 150 degrees. When will the coffee be cool enough to drink?

   (c) What is the temperature of the coffee in the pot?

   (d) What is the temperature of the room where the coffee is drunk?

4. The number of newly infected individuals N t days after the outbreak of an epidemic is given by

$$N = \frac{75150e^{0.3t}}{(500 + e^{0.3t})^2}.$$

(a) Make a graph of the number of new cases vs. days since the outbreak; include times up to 30 days.

(b) What is the greatest number of new cases we expect to see in 1 day and when does that occur?

(c) The local medical facilities can handle no more than 25 new cases per day. During what time period will it be necessary to recruit help from outside sources?

5. Solve the inequality $x^3 - 4x^2 + 3x \leq 0$ using the sign table method.