Name _____

Math 111 Section 4 **Instructor: Paul Konichek**

Quiz 9 (sections 5.6 – 6.1) **(the Last Quiz)**

1. **Exponential Growth: Given that a quantity Q(t) is described by the exponential growth function**

$$Q(t) = 300\, e^{0.02\, t}$$

Where t is measured in minutes, answer the following questions:

a. **What quantity is present initially? _____ (½ pt.)**
b. **What is the growth constant? _____ (½ pt.)**
c. **Complete the following table of values: (1 pt.)**

t	0	10	30	50	70
Q					

***Choose either one of the following two problems 2 or 3: Please cross out the ungraded one.**

2. (3 pts.) Atmospheric Pressure: If the temperature is constant, then the atmospheric pressure P (in pounds per square inch) varies with the altitude above sea level h in accordance with the law

$$P(h) = p_0\, e^{-k\, h}$$

where p_0 is the atmospheric pressure at sea level and k is a constant.

a. ***If the atmospheric pressure is 15 lb/in^2 at sea level and 12.5 lb/in^2 at 4000 ft*, find k**

k = _____

b. **Find the atmospheric pressure at an altitude of 14,000 ft.**

P(14,000) = _____

c. **Find how fast is the atmospheric pressure changing with respect to altitude t at an altitude of 14,000 ft? (show all work here)**

P'(14,000) = _____

Quiz 9 cont. You are doing either 2 or 3 and crossing out the one NOT to grade.

3. **(or 3 pts.) Growth of Bacteria: The growth rate of the bacterium *Escherichia coli*, a common bacterium found in the human intestine, is proportional to its size. Under ideal laboratory conditions, when this bacterium is grown in a nutrient broth medium, the *number of cells in a culture doubles approximately every 20 min*. Given that Growth of Bacteria under these conditions grows in accordance with the law $Q(t) = Q_0 e^{kt}$ where Q_0 denotes the number of bacteria initially present in the culture, k is a constant determined by the strain of bacteria under consideration and other factors, and t is the elapsed time measure in minutes. (show all work here)**

a). If the initial cell population at t=0 is 100 and *number of cells in a culture doubles approximately every 20 min* , find k for the bacterium *Escherichia coli* under the above conditions:

k = _____

b). How long will it take for a colony of 100 cells to increase to a population of 500,000 cells?

t = _____ (round up to the nearest minute)

c). What is the rate of growth of the population at the end of 246 minutes knowing Q(246) = 500,000?

Q'(246) = _____

The remaining five problems are 1 point each.

Verify directly that F is an antiderivative of f(x).

4. $F(x) = \frac{1}{3}x^3 + 2x^2 - x + 2$; $f(x) = x^2 + 4x - 1$

Answer: _____

In 5-8, find the indefinite integral.

5. $\int x^{-4}\,dx$

Answer: _____

6. $\int \frac{2}{x^3}\,dx$

Answer: _____

7. $\int 5e^x\,dx$

Answer: _____

8. $\int (2t+1)(t-2)\,dt$

Answer: _____