Exam #1 · Wednesday, September 17, 2008

MATH 124 · Calculus I · Section 26 · Fall 2008 Name _____

Problem 1. Let

$$f(y) = 3y + 7$$

and

$$g(y) = y^2 e^{-2y}.$$

Part (a). Find $g(f(y))$.

Part (b). Find $g(y)f(y)$.

Problem 2. Solve for z exactly:

$$6 \cdot 3^z = 7 \cdot 2^z.$$

Problem 3. An unknown brownish substance weighing 1.5 pounds was placed in your roommate's refrigerator. It was then observed to increase in weight by 7 percent per day. Find the number of days (to the nearest tenth of a day) it will take for the substance to weigh 6 pounds.

Problem 4. The following data represent profit P (in dollars) versus quantity q of wristwatches sold at a nearby store.

q	P
140	45
180	75
220	105
260	135

Part (a). Write down a linear equation for P as a function of q. Simplify your work as much as possible. Then use the equation to find $P(90)$.

Part (b). Verbally describe the significance of the horizontal intercept, from a business point of view.

Part (c). Find the horizontal intercept.

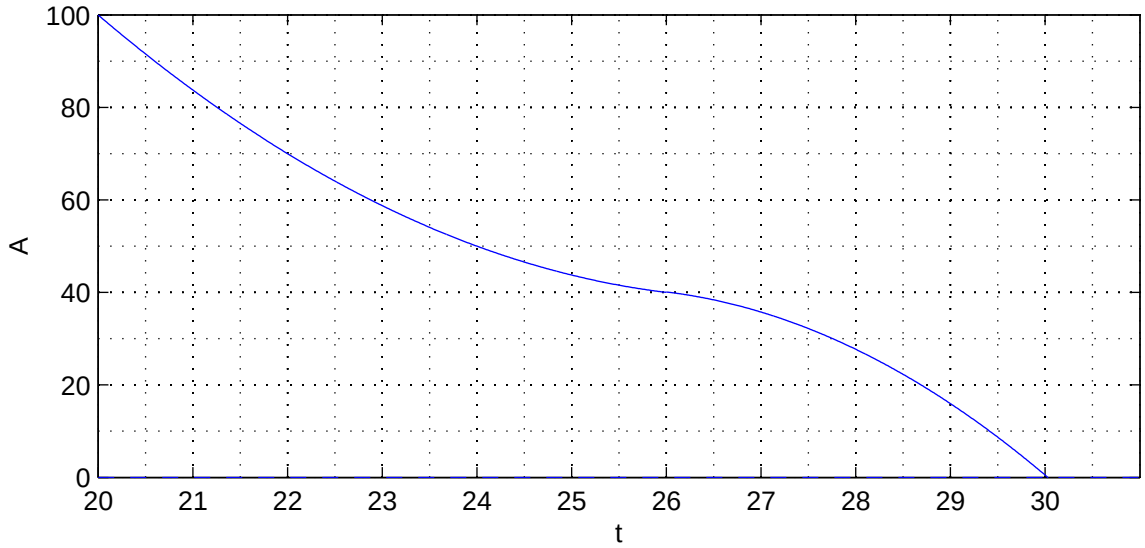
Part (d). Verbally describe the significance of the vertical intercept, from a business point of view.

Problem 5. Let

$$f(x) = \frac{x^2 - kx + 3}{x - 3}.$$

Find k such that $\lim_{x \to 3} f(x)$ exists.

Problem 6. On December 9, 1999 the Mars Polar Lander entered the Martian atmosphere. The following is a reconstruction of its altitude $A(t)$ versus time t in seconds, measured in seconds from the start of the final landing phase. At an altitude of 40 meters, the landing rockets switched off prematurely, letting the lander free-fall to the Martian surface — after which time the lander was never heard from again.



Part (a). Using the graph, estimate $A(24)$. Describe verbally what this quantity means.

Part (b). Using the graph, estimate $A^{-1}(20)$. Describe verbally what this quantity means.

Part (c). Using the graph, estimate the time of impact.

Part (d). Using the graph, estimate the lander's speed at time of impact.

Problem 7. Invert the following function:

$$f(x) = Ca^x.$$

(You may assume $C > 0$ and $a > 0$.)

Problem 8. Evaluate the following limit, using algebraic properties of limits:

$$\lim_{h \to 0} \frac{(x+h)^2 + 2(x+h) - x^2 - 2x}{h}.$$

Problem 9. Numerically estimate the following limit to 3 decimal places:

$$\lim_{\theta \to 0} \frac{2\theta}{\sin(3\theta)}.$$