Math 116 Post-Test

1. A manufacturer buys $20,000 worth of machinery that depreciates linearly so that its trade-in value after 10 years will be $1,000.

a) Express the value of the machinery V, as a function of its age a.

b) When does the machinery become worthless?

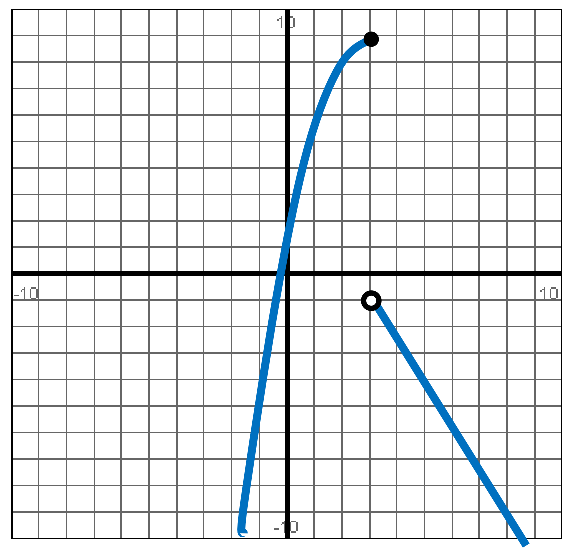
2. Find $\lim_{x \to 6} \frac{x-6}{x^2-2x-24}$

3. Use the graph to find the limit (if it exists).

a) $\lim_{x \to 3^+} f(x) =$

b) $\lim_{x \to 3} f(x) =$

c) $\lim_{x \to -1} f(x) =$



4. Use the limit definition, $f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$**, to find the derivative of** $f(x) = 6x^2 - 5$.

5. Find the derivatives of the following functions. Make sure to use the correct notation for the derivative. All final answers must be simplified and written with positive exponents.

a) $y = \frac{3}{(2x-1)^5}$

b) $y = \sqrt{7x^5 - 2}$

c) $g(x) = \ln\left(\frac{x+2}{x-2}\right)$

d) $f(x) = (9 - x^2)(5x - 2)$

6. Find the equation of the tangent line to the function $\boxed{f(x) = x^3 e^{2-x}}$ **at** $x = 2$.

7. **For the function** $\boxed{f(x) = x^4 + 8x^3 + 70}$

a) Find the intervals of increase and decrease.

b) Find all relative extrema of this function. Give the ordered pair (x, y) for the extrema. Determine if each extremum is a relative minimum or relative maximum.

c) Find the intervals of concavity.

d) Find the inflection points (if any).

8. **During a recession, Congress decides to stimulate the economy by providing funds to hire unemployed workers for government projects. Suppose that *t* months after the stimulus program begins, there are** $N(t)$ **thousand people unemployed, where**

$\boxed{N(t) = -t^3 + 45t^2 + 408t + 3078}$ **.**

In order to avoid overstimulating the economy (and inducing inflation), a decision is made to terminate the stimulus program as soon as the *rate* of unemployment begins to decline. When does this occur? At this time, how many people are unemployed?

9. **For the given cost function (in dollars)** $\boxed{C(q) = 3q^2 + 5q + 75}$

a) Find the average cost and the marginal cost. Sketch these functions on the same axes.

b) Determine the level of production that will minimize the average cost. What is the minimum average cost?

10. **A carpenter has been asked to build an open box with a square base. The sides of the box will cost \$3 per square meter, and the base will cost \$4 per square meter. What are the dimensions of the box of *greatest volume* that can be constructed for \$48?**

11. **A real estate office handles a 50-unit apartment complex. When the rent is \$580 per month, all units are occupied. For each \$40 increase in rent, however, an average of one unit becomes vacant. Each occupied unit requires an average of \$45 per month for service and repairs. What rent should be charged to obtain a maximum profit?**

12. **In 1960, the total enrollment in public universities and colleges in the United States was 2.3 million students. By 2000, enrollment had risen to 12 million students. Assume enrollment can be modeled by** $A = Pe^{kt}$ **exponential growth.**

a) Find the population continuous growth rate during that period.

b) How many years until the enrollment doubles from the 2000 figure?

13. **Find the following indefinite integrals.**

a) $\displaystyle\int \frac{8}{2x-1}\,dx$

b) $\displaystyle\int \frac{9+6x-x^2}{x}\,dx$

14. **A manufacturer estimates that the marginal revenue from producing** x **units of a certain commodity is** $R'(x) = \frac{100}{\sqrt{x}}$ **dollars per unit. If the revenue derived from producing 400 units is $30,000, how much revenue should be expected from producing 700 units?**

15. **The demand and supply functions for a product are modeled by the given two functions:**

Demand: $\boxed{p = -0.40x + 12}$ **Supply:** $\boxed{p = 0.30x + 5}$

where x **is the number of units in millions.**

Sketch the supply and demand functions on the same axes and use your sketch to:

a) Find the consumer surplus. b) Find the producer surplus.