Complete the following problems in preparation for your first exam.

1. Suppose you would like to save $25,000$. If you deposit $20,000$ into an account paying 2.24% interest compounded continuously. How much time does the money need to stay in the account in order to reach your goal. Use logarithms to solve.

2. Use properties of logarithms to expand the following expression into the sum, difference, or constant multiples of logarithms.
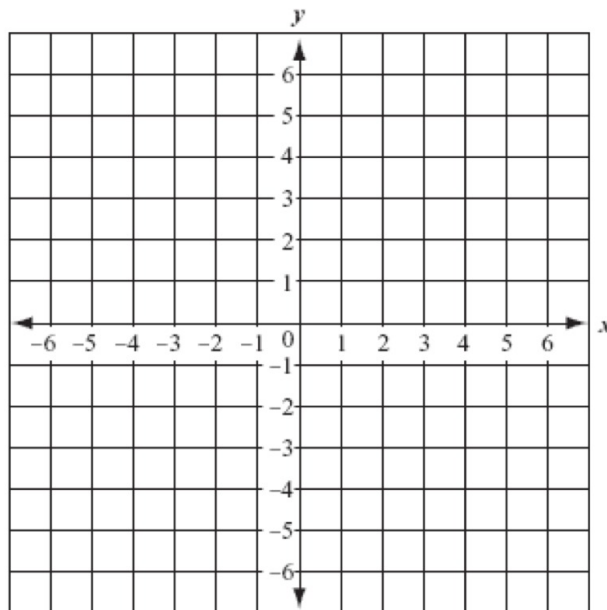$$\log_6\left(\frac{\sqrt{x}(y-1)}{x^5 y}\right)$$

3. Let f be given by:

$$f(x) = \begin{cases} -2x - 3 & \text{if } x \leq -1 \\ x^3 + 1 & \text{if } x > -1 \end{cases}$$

(a) Evaluate $f(-1)$.

(b) Sketch a graph of the function f. **Label the (x, y)-coordinates of at least one point on each piece on the graph.**

(c) Write the interval(s) for which f is decreasing. **Use interval notation.**

(d) Is $f(x)$ a continuous function? Explain.

4. The following function represents the profit function for "soda" sold at the Rent on a given game day.
$$P(x) = x^2 - 200x + 2.$$

(a) Using the limit definition of the derivative, calculate $P'(x)$.

(b) Evaluate $P'(101)$ and explain what it means in context of the question.

5. On the given plot, graph a function $f(x)$, that satisfies the following properties (be sure to include labels to make your picture clear):

- $f(x)$ is increasing on $(-\infty, -3) \cup (0, 2)$ and decreasing on $(-3, 0) \cup (2, \infty)$.
- $\lim_{x \to 2} f(x) = 3$, $f(x)$ is continuous at $x = 2$, but $f'(x)$ is **undefined** at $x = 2$.
- $\lim_{x \to (-1)^-} f(x) = 2$.
- $\lim_{x \to (-1)^+} f(x) = 1$.
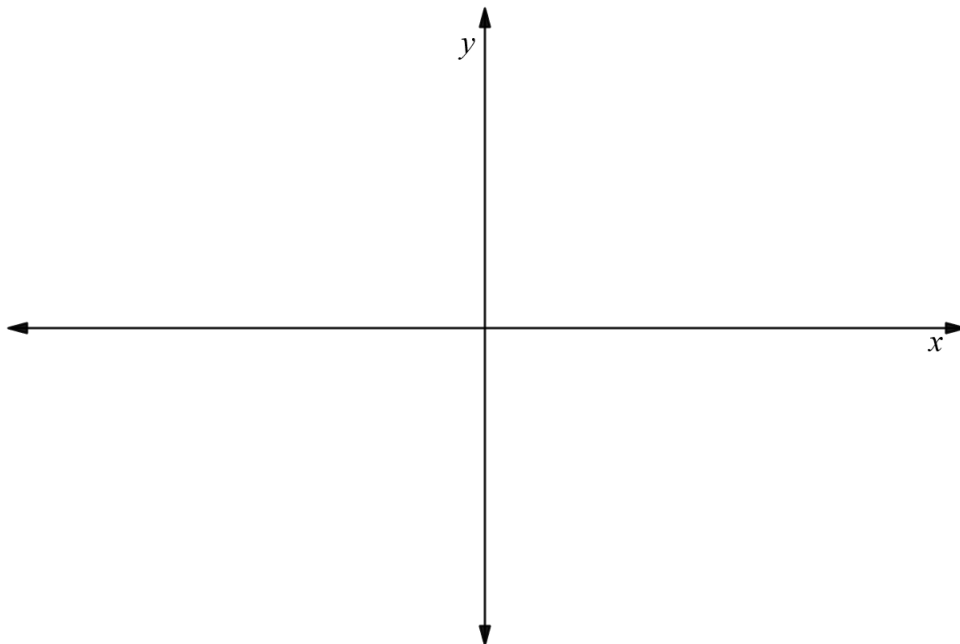
6. Suppose a Tax Advisor makes \$40 per hour. In addition, if she works more than 40 hours in one week she will be paid time and a half. That is, any time over 40 hours the advisor will be paid \$60 per hour. Write a piecewise function that describes her pay if she works t number of hours.