Name: _____

Please show all work and justify your answers.

1. (10 pts.) Suppose $f(x) = \begin{cases} 2 & \text{for } x < 5 \\ 3 & \text{for } x \geq 5 \end{cases}$. Explain why $\lim_{x \to 5} f(x)$ does not exist.

2. (10 pts.) Evaluate $\lim_{t \to \infty} \dfrac{3t^3 - t^2}{t^3 + 3t^4}$.

3. (10 pts.) Assuming a yearly inflation rate of 2% the price of a gallon of gas is given by $P(t) = 1.02^t$ where t is in years. How fast will the price of a gallon be rising in 3 years?

4. (10 pts.) Let $f(x) = \sqrt{x}$.
   (a) Use the definition of derivative to find f' and show that it satisfies the power rule.
   (b) Find an equation for the tangent line to f at $x = 16$ and use it to approximate $\sqrt{15}$.

5. (10 pts.) Find dy/dx, if $x \ln(y) + y^3 = \cos(x - y) + 1$.

6. (10 pts.) A martini glass is a cone of height 5 cm and radius 5 cm (at the top). Boris the bartender fills the glass at the rate of 10 cm^3/s. How fast will the level of martini be rising at the moment when the glass is filled half way up?

1	2	3	4	5	6	total (60)	(%)