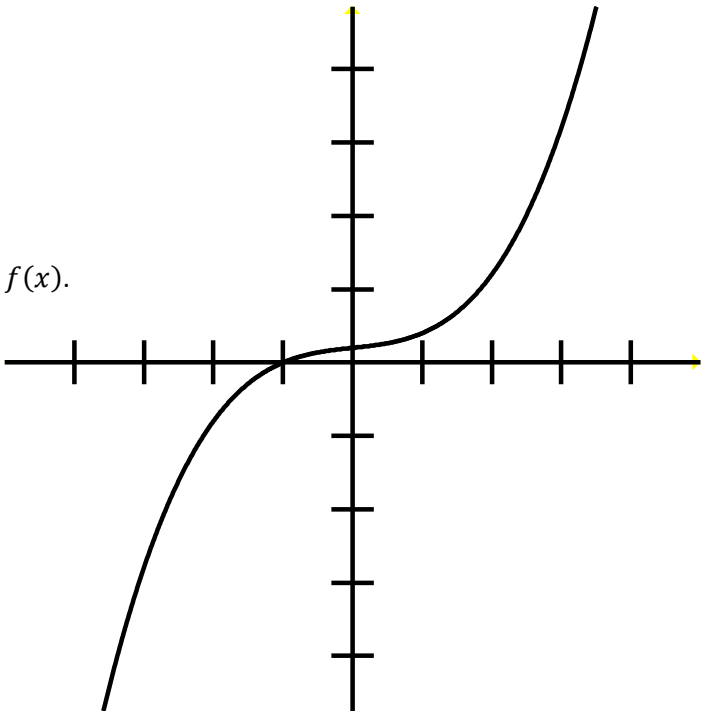
Name _____ Calculus I, Test 1, Fall 2016

**Non-calculator portion. Please show all your work and circle your answer when appropriate. You do not need to simplify answers unless the problem specifies to do so.**

1) Estimate the instantaneous rate of change of the function graphed below at $x = -2$. (4 points)

2) Using the function graphed to the right, find $\lim_{x \to -1} f(x)$. (4 points)



3) Suppose $f(x)$ and $g(x)$ are polynomials with $f(0) = 4$ and $\lim_{x \to 0} \frac{f(x)}{g(x)} = 10$. Find $g(0)$. (4 points)

4) Find each of the following limits. (5 points each)

a) $\lim_{x\to 5^+} \frac{x^2-16}{x-5}$

b) $\lim_{x\to 2} \frac{2x^2-2x-4}{x-2}$

c) $\lim_{x\to \infty} \frac{x^2-25}{x-5}$

d) $\lim_{x \to 3} \tan(x)\cos(x)$

e) $\lim_{x \to 3} \frac{x^2-x-2}{x^2-4}$

f) $\lim_{x \to -\infty} \frac{x^6+3x^3+x^2+1}{x^4+3^x+2^x+1}$

g) $\lim_{x \to 9} \frac{\sqrt{x}-3}{x-9}$

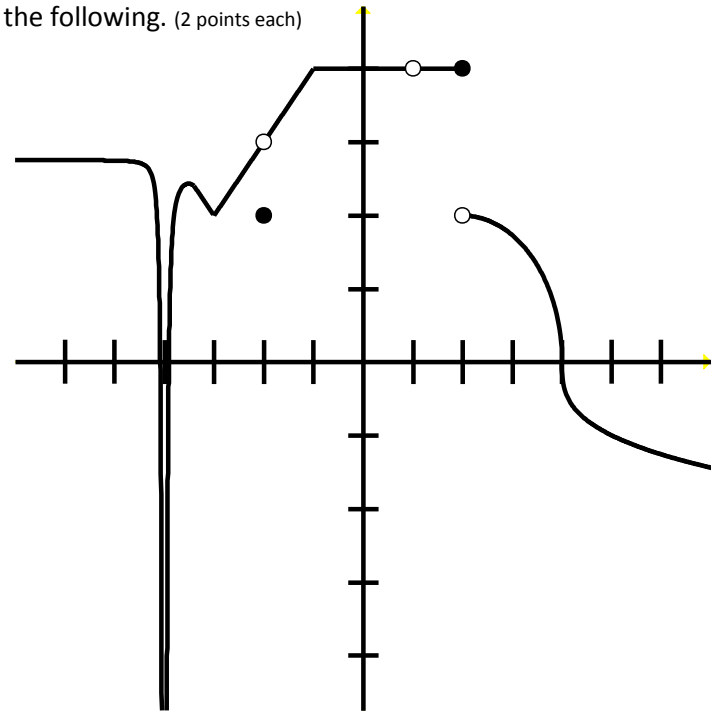
h) $\lim_{x \to 2^-} \frac{x^2+ax}{bx+1}$

i) $\lim_{x \to a} \frac{x^4+2x}{5}$

j) $\lim_{x\to-\infty} \frac{x^2+\sin(x)}{x^2-\cos(x)}$

k) $\lim_{x\to\infty} \sqrt{x} - \sqrt{x-1}$

5) Use the graph of $y = f(x)$ below to find each of the following. (2 points each)



l) $\lim_{x \to -4^+} f(x)$

m) $\lim_{x \to -3^-} f(x)$

n) $\lim_{x \to -2} f(x)$

o) $\lim_{x \to 1} f(x)$

p) $\lim_{x \to 2} f(x)$

q) $\lim_{x \to 2^-} f(x)$

r) A vertical asymptote

s) A horizontal asymptote

t) An $x$-value where $f(x)$ is not continuous.

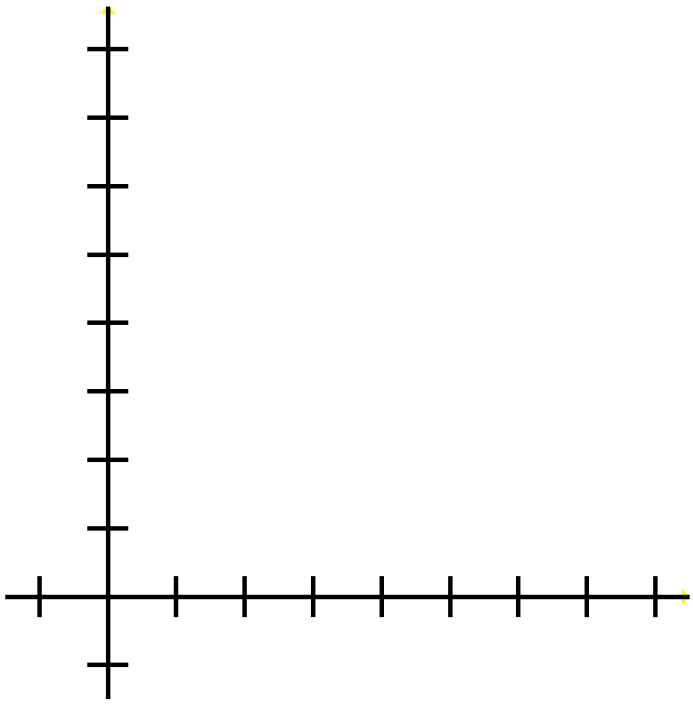
**Technology portion: After you tear off and turn in the non-calculator portion, you may take out your technology and finish this portion. Again, please circle your answer.**

6) Find $\lim_{x\to\infty} \frac{e^{2x}}{3^x}$
(5 points)

7) A projectile is shot out of a bunker. Its distance from the bunker is given by $y = 1000\ln(1 + 10^6 x)$ where $x$ is the time since the shot was fired, measured in seconds and $y$ is measured in feet. Estimate the instantaneous velocity of the projectile after 5 seconds. (5 points)

8) Assume that postage for sending a first-class letter is $\$0.40$ for the first ounce, plus $\$0.25$ for each additional ounce. Postage is not prorated, meaning for instance a 1.5 ounce letter requires the same postage as a 2 ounce letter.

a) Graph the function $p = f(w)$ that gives the postage $p$ for sending a letter that weighs $w$ ounces, for $0 < w \leq 5$. (3 points)



b) Find $\lim_{w \to 3.3} f(w)$

(1 point)

c) Find $\lim_{w \to 4} f(w)$

(1 point)