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) \( \lim_{x \to -\infty} \frac{x^6 + 3x^3 + x^2 + 1}{x^4 + 3x^2 + 2x + 1} \)
g) \[ \lim_{x \to 9} \frac{\sqrt{x-3}}{x-9} \]

h) \[ \lim_{x \to 2} \frac{x^2 + ax}{bx+1} \]

i) \[ \lim_{x \to \alpha} \frac{x^4 + 2x}{5} \]
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)