1. Below is the graph of $y = f(x)$. Determine the values of the following from looking at the graph. Answers may be numbers, $+\infty$, $-\infty$, or DNE (for ‘does not exist’).

(a) $\lim_{x \to -1^-} f(x) =$ __________

(b) $\lim_{x \to -1^+} f(x) =$ __________

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

(d) $f(-1) =$ __________

(e) $\lim_{x \to 5^-} f(x) =$ __________

(f) $\lim_{x \to 5^+} f(x) =$ __________

(g) $\lim_{x \to 5} f(x) =$ __________

(h) $f(5) =$ __________

(i) List all points where $f(x)$ is not continuous. $x =$ __________

(j) True or False? $f'(1) > 0$. _____

(k) True or False? $f(x)$ is differentiable at $x = 2$, but not continuous at $x = 2$. _____

(l) True or False? $f(x)$ has a horizontal tangent line at $x = 0$. _____
2. Evaluate the following limits that involve trig functions. Answers may be numbers, +∞, or −∞.

(a) \[ \lim_{x \to 0} \frac{\sin^2 x + 1}{\cos x} \]

Answer: 

(b) \[ \lim_{x \to 0} \frac{\sin (4x) \cos x}{x} \]

Answer: 

(c) \[ \lim_{x \to 0} \frac{1 - \cos x}{\sin x} \]

Answer: 

(d) \[ \lim_{x \to 0} \frac{\sin (5x)}{\sin (2x)} \]

Answer:
3. Consider the function

\[ f(x) = \frac{x^2 + 1}{(x - 1)^2} \]

Compute the following. Answers may be numbers, +∞, or −∞.

(a) \( \lim_{x \to \infty} f(x) = \) 

Answer: ____________

(b) \( \lim_{x \to -\infty} f(x) = \) 

Answer: ____________

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

Answer: ____________

(d) \( \lim_{x \to 1^+} f(x) = \) 

Answer: ____________

(e) Use the information you found above to determine which graph below is the graph of \( y = f(x) \). Circle your answer.

![Graphs of f(x)]
4. For the following given functions \( f(x) \), compute \( f'(x) \) using the limit definition. That is, compute

\[
\lim_{h \to 0} \frac{f(x + h) - f(x)}{h}
\]

(a) \( f(x) = x^2 + 5 \)

(b) \( f(x) = \frac{2}{x+1} \)

(c) \( f(x) = x^{1/3} \) \textbf{Hint:} Use that

\[ h = ((x + h)^{1/3} - x^{1/3})((x + h)^{2/3} + (x + h)^{1/3}x^{1/3} + x^{2/3}). \]
5. Show that the equation $x^2 - \sin(x) = 0$ has a solution in the interval $(\frac{\pi}{6}, \frac{\pi}{2})$.

Answer: 

6. A trough 10 ft long has a cross section that is an isosceles triangle having a base of 4 ft and height 3 ft. If the water pours into the trough at 6 ft$^3$/min, how fast is the depth of the water changing when the depth is 1 ft?

Answer: 

7. A baseball player runs from home plate to first base at a rate of 25 ft/sec. At what rate is his distance from third base changing when he is 40 ft from first base? The bases on a baseball field form a square with side-length 90 ft. How would your method of solution change if the bases instead formed a diamond, with the angle at home plate formed by the baselines equal to 60°?
8. Find the equation of the tangent line to the graph of \( \sin(x) + \sin(y) = xy \) at the point \((0, 0)\).

9. For each of the following graphs, sketch the derivative:

   (a)
   (b)

10. Use linear approximation to estimate \( \sqrt[3]{8.1} \).

   Answer: _______________