

1. (10 points) Evaluate the following limit. Show your work.

$$\lim_{x \rightarrow 2} \frac{-x + 2}{3x^2 + 9x - 30}$$

2. (10 points) Evaluate the following limit. Show your work.

$$\lim_{x \rightarrow 0} \frac{\sqrt{x^3 + 49} - 7}{x^3}$$

3. (12 points) Evaluate the following limit. Show your work and name any theorems you use.

$$\lim_{x \rightarrow 0} x^2 \cos\left(\frac{1}{x}\right)$$

4. Multiple Choice: Evaluate the following limits. Circle the correct answer. You do **not** need to show work.

(a) (3 points) $\lim_{x \rightarrow 0} x + e^{2x}$

I) 1

II) 0

III) ∞

IV) Does not exist

(b) (3 points) $\lim_{x \rightarrow \infty} \frac{-6x^3 + 2x^2 - 5}{3x^3 - x + 7}$

I) -1

II) -6

III) -2

IV) ∞

(c) (3 points) $\lim_{x \rightarrow -\infty} \frac{x^2 + x - 6}{x^4 - 2x^3 + 7x - 14}$

I) 0

II) -1

III) $-\infty$

IV) ∞

(d) (3 points) $\lim_{x \rightarrow 3^+} \frac{4 - x}{9 - x^2}$

I) 0

II) ∞

III) $-\infty$

IV) Does not exist

5. (a) (5 points) Complete the formal definition of continuity:

A function $f(x)$ is continuous at $x = a$ if _____.

(b) (5 points) Let $f(x) = \begin{cases} \frac{(x-3)(x+1)}{2x(x-3)} & \text{if } x \neq 3 \\ 1 & \text{if } x = 3. \end{cases}$

Is $f(x)$ continuous at $x = 3$? Explain using the definition of continuity.

6. A soccer player kicks a ball down the field. The function $s(t)$ gives the distance in feet the ball has rolled after t seconds.

t in seconds	0	1	2	3	4	5	6
$s(t)$ in feet	0	20	30	38	44	46	47

- (a) (5 points) What is the average velocity of the soccer ball between $t = 1$ and $t = 5$ seconds? Include units.

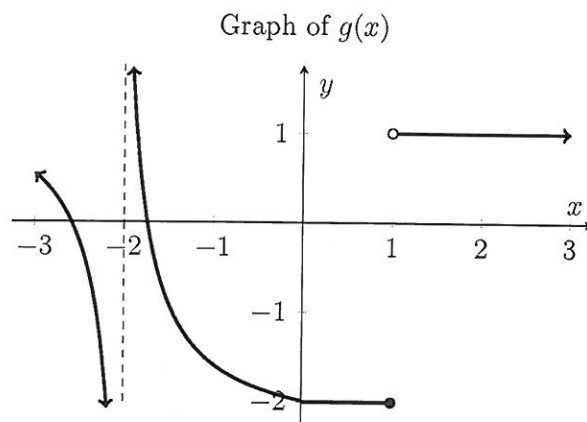
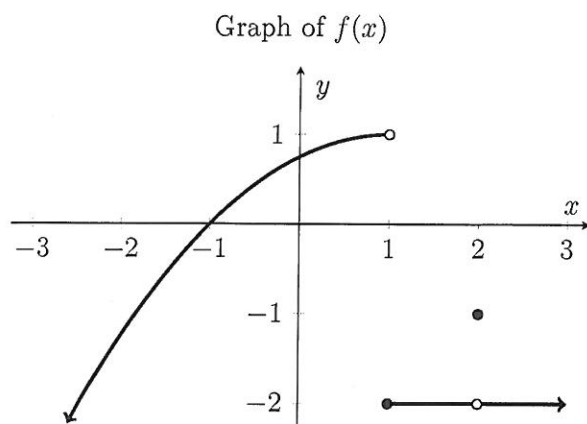
- (b) (4 points) Write an equation for the secant line between the points at $t = 1$ and $t = 5$.

- (c) (3 points) Given that $s'(3) = 7.5$, what does the value 7.5 represent in the context of the problem? Include units.

7. (a) (8 points) Let $f(x) = \frac{1}{x^2}$. Using the limit definition of the derivative, compute $f'(-3)$. Show your work.

(b) (4 points) Write an equation for the tangent line of $f(x)$ at $x = -3$.

8. Use the following graphs to compute the limits below. Write ∞ or $-\infty$ when appropriate, or DNE if the limit does not exist. You do **not** need to show your work.



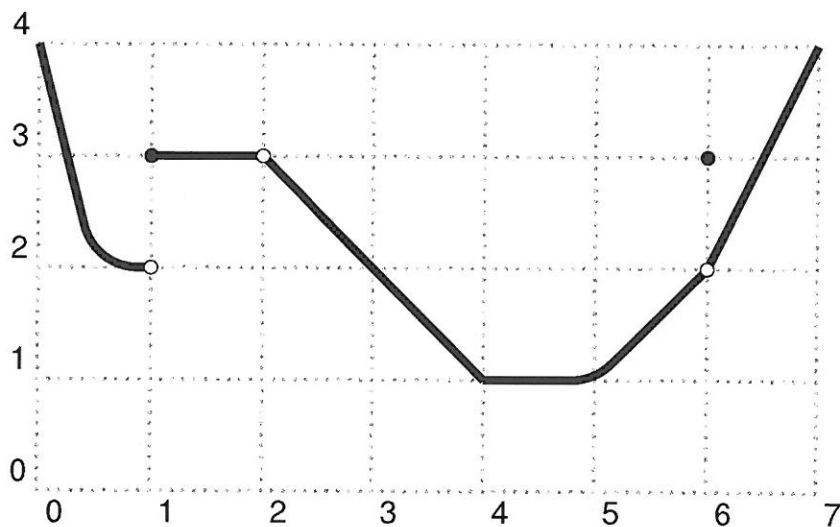
(a) (3 points) $\lim_{x \rightarrow 2} f(x)$

(b) (3 points) $\lim_{x \rightarrow 1} g(x)$

(c) (3 points) $\lim_{x \rightarrow -2^+} g(x)$

(d) (3 points) $\lim_{x \rightarrow 1} (f(x) + g(x))^2$

- (20 pts) 5. Consider the function f whose graph appears below, and answer the following questions. **You must justify all answers.**



- (a) (i) Is $f(1)$ defined? If so, what is it?
 (ii) Does $\lim_{x \rightarrow 1} f(x)$ exist? If so, what is it?
 (iii) Is f continuous at 1?
- (b) (i) Is $f(2)$ defined? If so, what is it?
 (ii) Does $\lim_{x \rightarrow 2} f(x)$ exist? If so, what is it?
 (iii) Is f continuous at 2?
- (c) (i) Is $f(4)$ defined? If so, what is it?
 (ii) Does $\lim_{x \rightarrow 4} f(x)$ exist? If so, what is it?
 (iii) Is f continuous at 4?
- (d) (i) Is $f(6)$ defined? If so, what is it?
 (ii) Does $\lim_{x \rightarrow 6} f(x)$ exist? If so, what is it?
 (iii) Is f continuous at 6?