1. If \( f(x) = \frac{2 - 2x}{x - 4} \), evaluate \( \lim_{x \to 4} f(x) \).
   
   (a) 1
   (b) 1/8
   (c) 1/2
   (d) 0
   (e) The limit does not exist.

2. Let \( f(x) = \frac{3x + 6}{4 - x^2} \). Which of the following statement(s) is/are true?
   
   - P. \( \lim_{x \to 2^-} f(x) = \infty \)
   - Q. \( f(x) \) can be made continuous at \( x = -2 \) by defining, \( f(-2) = 3/4 \).
   - R. \( f(x) \) has horizontal asymptote \( y = 0 \).
   - S. \( f(x) \) has vertical asymptote \( x = -2 \) and \( x = 2 \).

   (a) P, Q, and R.
   (b) R and S only
   (c) Q and R only
   (d) P and R only
   (e) P, Q, and S

3. Let \( f(x) = \begin{cases} e^{x-3} & x < 2 \\ r - 2x & x \geq 2 \end{cases} \). Find the value of \( r \) which will make \( f(x) \) continuous for all real numbers, \( r = \ldots \).
   
   (a) 2+e
   (b) 4/e
   (c) 2-1/e
   (d) 4-e
   (e) 4+1/e
4. Let \( p = \lim_{x \to -\infty} \frac{|2x + 4|}{x - 1} \) and \( q = \lim_{x \to \infty} \frac{3}{2 + e^x} \), then

(a) \( p = -\infty \) and \( q = \infty \)
(b) \( p = -2 \) and \( q = 0 \)
(c) \( p = 2 \) and \( q = 3/2 \)
(d) \( p = -2 \) and \( q = 3/2 \)
(e) \( p = 2 \) and \( q = 0 \)

5. Let \( f(x) = x^2 \cos \left( \frac{1}{x} \right) \), evaluate \( \lim_{x \to 0} f(x) \).

(a) \( \infty \)
(b) \( -\infty \)
(c) 0
(d) 1
(e) The limit does not exist.

6. Evaluate \( \lim_{x \to 0^+} \frac{1 - \cos x}{\sin^2 x} \) (Hint: use a trigonometric identity to rewrite the function)

(a) \( \infty \)
(b) 0
(c) 1
(d) \( -\infty \)
(e) 1/2

7. Evaluate \( \lim_{x \to -\infty} e^{\frac{x^2}{x+1}} \). Note that \( \frac{x^2}{x+1} \) is in the exponent

(a) 0
(b) \( -\infty \)
(c) \( 1/e \)
(d) \( \infty \)
(e) 1

8. Let \( f(x) = \begin{cases} \frac{2}{x + 2} & x \leq 0 \\ (x - 1)^2 & 0 < x < 1 \\ 1 + 2\sqrt{x} & x \geq 1 \end{cases} \) Which of the following is/are true?

P. \( \lim_{x \to 2^+} f(x) = \infty \)
Q. \( f(x) \) is continuous from the left at \( x = 1 \).
R. \( f(x) \) has both an infinite and a jump discontinuity.
S. \( f(x) \) is continuous at \( x = 0 \).
9. Let \( f(x) = \begin{cases} \frac{\sqrt{x+5} - 3}{x-4} & x \neq 4 \\ 3 & x = 4 \end{cases} \).

Find \( \lim_{x \to 4} f(x) \).

(a) 3  
(b) 1  
(c) 1/6  
(d) 1/2  
(e) The limit does not exist

10. According to the intermediate value theorem, the graph of 
\( f(x) = 1 - 4x + \frac{4}{x + 2} \)

must have at least one zero on which of the following intervals?

(a) (-1,0)  
(b) (2,3)  
(c) (1,2)  
(d) (0,1)  
(e) None of the above

11. Evaluate \( \lim_{x \to -\infty} \frac{x}{2x - \sqrt{x^2 + 4}} \).

(a) 1/2  
(b) 1  
(c) 0  
(d) 1/3  
(e) The limit does not exist.

12. Evaluate the limit below involving absolute value \( \lim_{x \to 1^+} \frac{x^2 + 4x - 5}{|x - x^2|} \).

(a) -6  
(b) 6
13. Find the limit for the given function
\[ \lim_{x \to 1} \frac{\sin (x - 1)}{x^2 + 6x - 7} \]
(a) 1/8
(b) 0
(c) -1/4
(d) 9
(e) \infty

14. Evaluate the limit \[ \lim_{x \to \infty} \ln \left( \sqrt{\frac{x^2}{9} + 3} \right) - \ln x. \]
(a) \infty
(b) 0
(c) \ln 3
(d) -\ln 3
(e) \frac{1}{\ln 3}

15. Evaluate the limit \[ \lim_{x \to 0} \frac{1 + e^x}{1 - e^{x^2}} \]
(a) -\infty
(b) 0
(c) 1
(d) \infty
(e) The limit does not exist

16. A ball is tossed into the air from a bridge so that its height in feet above the water after \( t \) seconds is given by the position function
\[ h(t) = -16t^2 + 80t + 100. \]

Find the average velocity of the ball during the first two seconds after it is thrown.
(a) 96 ft/sec
(b) 120 ft/sec
(c) 48 ft/sec
17. The intermediate value theorem guarantees that \( f(x) = \frac{-2x-7}{x+2} \) must have at least one zero on which of the following intervals?

(a) \((-3, 1)\)
(b) \((-3, 2.1)\)
(c) \((0, 1)\)
(d) \((-9, -4)\)
(e) \((-4, -3)\)
Free Response

1. Suppose Dwight Shrute and Michael Scott toss a watermelon off of the roof of Dunder Mifflin with an initial velocity of 32 feet per second. Its height in feet above the ground after $t$ seconds is given by $s(t) = -16t^2 + 32t + 48$.

(a) Use the limit definition of derivative to find a formula for the velocity of the watermelon at any time $t$.

(b) Find the velocity of the watermelon when it hits the ground.
2. (a) Suppose that \(2^{-x} \leq f(x) \leq \frac{x-1}{x-1} \) on \((0,1) \cup (1,\infty)\). Evaluate \(\lim_{x \to 1} f(x)\). Show your work in finding the limit, and state the name of the theorem use.

(b) Let \(f(x) = \frac{x^2 - |2x|}{x}\). Find

i. \(\lim_{x \to 0^+} f(x)\)

ii. \(\lim_{x \to 0^-} f(x)\)

iii. sketch the graph of \(f(x)\).
3. Let \( f(x) = \frac{2x - x^2}{x^3 + x^2 - 6x} \).

(a) Find each limit if possible

i. \( \lim_{x \to 0^+} f(x) \)

ii. \( \lim_{x \to -3^+} f(x) \)

iii. \( \lim_{x \to 2^-} f(x) \)

iv. \( \lim_{x \to \infty} f(x) \)

(b) Find each vertical and horizontal asymptote \( f(x) \).

(c) Sketch the graph of \( f(x) \).

(d) List all discontinuities of \( f(x) \) and state whether they are jump, infinite or removable.
4. (a) Use the limit definition of derivative to find $f'(x)$ if $f(x) = \frac{x+3}{x}$.

(b) What's the slope of the tangent line to $f(x)$ at $x = 3$?

(c) Write the equation of the tangent line at $x = 3$. 