1. Simplify the following:
   a. \((x^2)^7\)
   b. \(x^2(x^3 - 3x) - 4x^5 + 9x^3\)
   c. \(\frac{x^{15}}{x^3}\)
   d. \(\sqrt[3]{x^{15}}\)

2. Solve for \(y\):
   \[8x^3y + 2xy - 5 = 6x^2\]

3. Plot these points in the \(xy\) plane:
   A \((0, 0)\)  B \((5, 0)\)  C \((0, -4)\)  D \((-3, 5)\)

4. Without using a calculator, sketch a graph of each of these in the \(xy\) plane:
   A \(y = x\)  B \(y = 3\)  C \(x = 3\)  D \(y = x^2\)  E \(y = \frac{1}{x}\)

5. A line \(L\) goes through the points \((-3, 7)\) and \((1, -5)\).
   a. Find the slope of \(L\).
   b. Find the equation of \(L\) using the point-slope form.
   c. Find the slope of a line perpendicular to \(L\).
1. Consider the function

\[ f(x) = \begin{cases} 
2x + 1 & x < 1 \\
-x^2 - 1 & x \geq 1 
\end{cases} \]

a. Evaluate \( f(0) \), \( f(1) \) and \( f(2) \).

b. Sketch a graph of \( y = f(x) \).

2. Find the points of intersection between the graphs of \( 2x^2 + 3y^2 = 66 \) and \( y = 4 \).

3. Let \( f(x) = \sqrt{4x - 3} \).

a. Evaluate \( f(7) \), \( f(1) \), \( f(10) \) and \( f(0) \).

b. Find the domain of \( f(x) \).

c. Find the range of \( f(x) \).

d. Find \( f(x + h) \).

e. Find the inverse of \( f(x) \).
1. A train leaves city A at 10:00 a.m. and arrives at city B at 12:15 p.m. The train leaves city B at 2:00 p.m. and arrives at city C three hours later. The average velocity of the train while traveling from A to B was 45 miles per hour. The distance between city B and city C is 240 miles. What is the average velocity of the train from city A to city C (including the stop)?

2. A train leaves city A at 8:00 a.m. and arrives at city B at 10:00 a.m. The average velocity of the train from A to B was 60 miles per hour. The train leaves city B at 10:00 a.m. and arrives at city C at 1:00 p.m. Find the average velocity of the train from city B to C, given that the average velocity from A to C was 50 miles per hour.

3. Let \( f(x) = \frac{3}{x^2 + 1} \).
   a. Find the average rate of change of \( f(x) \) from \( x = 0 \) to \( x = 2 \).
   b. Draw the graph of \( y = f(x) \) (a graphing calculator can help). Show how to represent your answer to part (a) on the graph.

4. Find a positive number \( A \) so that the average rate of change of \( g(x) = 3x^2 - 1 \) from \( x = 2 \) to \( x = A \) is equal to 33.
1. Let \( g(x) = x^2 - 4x \).
   a. Find the value of \( x \) for which the tangent line to \( y = g(x) \) has slope equal to 6.
   b. Find the value of \( g(x) \) at the point where the tangent line to \( y = g(x) \) is parallel to \( y = 2x + 5 \).
   c. Find a value of \( x \) so that the instantaneous rate of change of \( g \) at \( x \) is equal to the average rate of change of \( g \) from \( x = -1 \) to \( x = 3 \).

2. An object is launched up in the air. The height of the object after \( t \) seconds is \( P(t) \) feet, where \( P(t) = -16t^2 + 256t + 64 \).
   a. When is the object at its greatest height? (Hint: What must be true about the velocity of the object when it is at the greatest height?)
   b. What is the maximum height of the object?

3. Suppose \( q(x) = 3x^2 - 12x + 8 \) and \( p(x) = 3x^2 - 12x + 5 \).
   a. Find \( q'(x) \) and \( q'(1) \).
   b. Find the equation of the tangent line to \( y = q(x) \) at \( x = 1 \).
   c. Find \( p'(x) \) and \( p'(1) \).
   d. Find the equation of the tangent line to \( y = p(x) \) at \( x = 1 \).
   e. What do you notice when you compare your answers? Draw the graphs of \( y = p(x) \) and \( y = q(x) \) and explain what you’ve found.
1. Find each of the following limits.
   a. \( \lim_{t \to 3} (4t + 7) \)  
   b. \( \lim_{x \to 1} \frac{x^2 - 5x + 6}{x^2 - 3x + 1} \)

2. Let \( f(x) = \begin{cases} 
    x^2 + 2 & \text{if } x \leq 1 \\
    -3x + 1 & \text{if } x > 1 
  \end{cases} \)

Sketch the graph of \( y = f(x) \) and use it to find the following:
   a. \( f(1) \)  
   b. \( \lim_{x \to 1} f(x) \)
   c. \( \lim_{x \to 1^-} f(x) \)  
   d. \( \lim_{x \to 1^+} f(x) \)
   e. \( f(2) \)  
   f. \( \lim_{x \to 2} f(x) \)
   g. \( \lim_{x \to 2^-} f(x) \)  
   h. \( \lim_{x \to 2^+} f(x) \)

3. Sketch a graph of \( y = |x| \) and use it to find \( \lim_{x \to 0^-} f(x) \), \( \lim_{x \to 0^+} f(x) \) and \( \lim_{x \to 0} f(x) \).

4. Sketch a graph of \( y = \frac{|x|}{x} \) and use it to find \( \lim_{x \to 0^-} f(x) \), \( \lim_{x \to 0^+} f(x) \) and \( \lim_{x \to 0} f(x) \).
1. Compute each of the following limits.
   a. \( \lim_{x \to 2} \frac{x^2 - 5x + 6}{x^2 - 3x + 2} \)
   b. \( \lim_{x \to 2} \frac{x^2 - 4x + 4}{x^2 - 4} \)
   c. \( \lim_{h \to 0} \frac{(5 + 2h)^2 - 25}{h} \)
   d. \( \lim_{t \to 0} \frac{\frac{2}{t} + \frac{7t - 4}{2t}}{} \)
   e. \( \lim_{h \to 0} \frac{(x + h)^2 - x^2}{h} \)
   f. \( \lim_{x \to 0} \frac{x^2 - 3x}{x^2 - 6x} \)
   g. \( \lim_{x \to 5} \frac{x^2 + 1}{x - 5} \)
   h. \( \lim_{x \to 0^+} \frac{27x}{\sqrt{x}} \)

2. Refer to Recitation Worksheet 3A problem 2.
   a. Is \( f(x) \) continuous at \( x = 1 \)?
   b. Is \( f(x) \) continuous at \( x = 2 \)?

3. Refer to Recitation Worksheet 3A problem 3. Is \( y = |x| \) continuous at \( x = 0 \)?

4. Let \( g(x) = \begin{cases} 
   x - 1 & \text{if } x < 2 \\
   x^2 - A^2 & \text{if } x \geq 2 
\end{cases} \)
   a. Sketch the graph of \( y = g(x) \) using \( A = 0 \). Is \( g(x) \) continuous?
   b. Sketch the graph of \( y = g(x) \) using \( A = 1 \). Is \( g(x) \) continuous?
   c. Sketch the graph of \( y = g(x) \) using \( A = 2 \). Is \( g(x) \) continuous?
   d. Do you think there is a real value of \( A \) which makes \( g(x) \) continuous?
      If so, what is \( A \)? If not, why not?
1. The graph of \( y = f(x) \) is shown below, and the tangent line at \( x = 7 \) is indicated.

   a. Find \( f'(-2), f'(0), \) and \( f'(7). \)
   
   b. For which values of \( x \) is \( f(x) \) not continuous?
   
   c. For which values of \( x \) is \( f(x) \) not differentiable?

2. Let \( g(x) = |x^2 + 2x - 15| \). Find all points where \( g(x) \) is not differentiable.
On these problems you will use the **limit definition of the derivative**, 
\[ f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}, \]
to compute each of the following derivatives.

For each function do the following steps:

(a) Find the difference quotient \( \frac{f(x+h) - f(x)}{h} \)

(b) Simplify your answer to part (a) using algebra

(c) Take the limit as \( h \to 0 \) to compute \( f'(x) \).

1. \( f(x) = x^2 + 5x \)
2. \( f(x) = \sqrt{x+5} \)
3. \( f(x) = \frac{1}{x+3} \)
4. \( f(x) = \sqrt{3x-2} \)
5. \( f(x) = \frac{7}{x-4} \)