1. Graph the line by making a table of values or by using the slope and the y-intercept (your choice). Then write the coordinates of the y-intercept. 

\[
y = \frac{2}{3}x - 3
\]

2. Find the slope of the line that contains the given points. State whether the line is increasing, decreasing, horizontal or vertical.
   a. \((-5, 2)\) and \((3, -4)\)
   b. \((2, -1)\) and \((2, 5)\)
   c. \((-4, -1)\) and \((2, 4)\)
   d. \((-5, 4)\) and \((1, 4)\)

3. Graph \(y = -\frac{3}{2}x + 3\) on a set of axes by using the slope and y-intercept.

4. Determine whether the pair of lines is parallel, perpendicular, or neither.
   a. \(y = \frac{3}{7}x + 5\) and \(y = \frac{7}{3}x - 4\)
   b. \(y = \frac{5}{2}x - 7\) and \(y = -\frac{2}{5}x + 2\)
   c. \(y = -\frac{4}{3}x - 1\) and \(y = -\frac{1}{3}x - 5\)

5. The number of states with ethanol plants was 22 states in 2007 and has increased by about 2 states per year. Let \(n\) be the number of states with ethanol plants at \(t\) years since 2007.
   a. Find the slope of the linear model. What does it mean in this situation?
   b. What is the \(n\)-intercept of the model? What does it mean in this situation?
   c. Write an equation that models the situation.

   a. \(-\frac{2}{3}(6x - 9)\)
   b. \(9.36 - 2.4(1.7x + 3.5)\)
   c. \(-5(2w - 7) + 3(4w - 6)\)

7. Solve.
   a. \(6x - 3 = 19\)
   b. \(\frac{3}{5}x = 6\)
   c. \(9a - 5 = 8a + 2\)
   d. \(3(2x - 5) - 2(7x + 9) = 47\)
   e. \(\frac{7}{8}x + \frac{3}{10} = \frac{1}{4}x - \frac{1}{2}\)

8. Solve the equation \(A = \frac{a + b}{2}\) for the variable \(a\)
9. The number of US patent applications was 456 thousand in 2007 and increased by about 23 thousand per year. Let \( n \) be the number of patent applications (in thousands) during the year that is \( t \) years since 2007.
   a. Find an equation of a model.
   b. Predict the number of patent applications in 2014.
   c. Predict when there will be 640 thousand patent applications. Use an equation.

10. Given the linear equation \( 2x - 5y = 10 \)
   a. Write the line in \( y = mx + b \) form.
   b. Use the slope and y-intercept to graph the line.

11. Given the line \( 6x - 3y = 18 \)
   a. Find the x-intercept and the y-intercept of the line.
   b. Use the two intercepts to graph the line.

12. State (yes or no) if the following represent functions. Explain your answer.
   a. [picture of graph]
   b. [table of data]

13. Determine the domain and range of #3a above.

14. Let \( f(x) = -4x + 7 \)
   a. Find \( f(-3) \)
   b. Find \( x \) when \( f(x) = 2 \)

15. Write an equation of the line that has the given slope and contains the given point.
   a. \( m = 7; \quad (-2, -4) \)
   b. \( m = -\frac{2}{3}; \quad (6, -1) \)

16. Write an equation of the line that passes through the given points:
   a. (\(-4, 6\)) and (2, 3)
   b. (\(-2, -4\)) and (\(-2, 5\))

17. Given the line \( 3x - 5y = 20 \).
   a. Write the line in the form \( y = mx + b \)
   b. Write the equation of the line \( \ell \) through the point (4, -1) that is parallel to the line in part a.
   c. Write the equation of the line \( \ell \) through the point (4, -1) that is perpendicular to the line in part a.
18. The percentages of Fortune 100 companies that offer a pension declined from 68% in 1998 to 28% in 2007. Let \( p = f(t) \) be the percent of Fortune 100 companies that offer a pension at \( t \) years since 1990.
   a. Find an equation of \( f \).
   b. What is the slope? What does it mean in this situation?
   c. What is the \( p \)-intercept? What does it mean in this situation?
   d. What is the \( t \)-intercept? What does it mean in this situation?
   e. When did all Fortune 100 companies offer a pension?
   f. In what year will no Fortune 100 companies offer a pension?

19. Solve the inequality and graph the solution.
   a. \( 3(2x+1) \leq 4(x+2)-1 \)
   b. \( \frac{2b-4}{3} < \frac{3b-4}{4} \)

20. Find the solution of the following linear systems. You may use either substitution or elimination. If the system is inconsistent or dependent, say so.
   a. \[ \begin{align*}
      5x - 3y &= 21 \\
      y &= 4 - 2x 
   \end{align*} \]
   b. \[ \begin{align*}
      2x - 3y &= 4 \\
      -4x + 6y &= -8 
   \end{align*} \]

21. A person plans to invest a total of $7000, part of it in an account at 3% annual interest and the rest in an account at 7% annual interest. How much should the person invest in each account so that the total interest in one year will be $410?

22. How many gallons of 10% antifreeze solution and a 20% antifreeze solution must be mixed to make 10 gallons of a 16% antifreeze solution?

23. Graph the solution on a set of axes
   a. \( y > \frac{2}{3}x - 5 \)
   b. \( 2x + 4y \geq 4 \)
   c. \( y \leq \frac{4}{3}x - 2 \)
   \( y > -x + 4 \)

Add or subtract:
24. \( (-7a^3 + 5a^2 - 9) + (2a^3 - 8a^2 + 3a) \)
25. \( (5x^3y - 2x^2y^2 + 9xy^3) - (8x^3y + 4x^2y^2 - xy^3) \)

Multiply.
26. \( (4p + 9)(2p - 5) \)
27. \( (3x + 7y)^2 \)
28. \( -2xy^2(7x^3 - 3xy + 6y^2) \)
29. \( (4x^2 + 9y^2)(4x^2 - 9y^2) \)
Simplify the following monomials.

30. \( \frac{6x^2y^4}{8x^3y^9} \)
31. \( (4a^3b^5)^3 \cdot a^6b \)
32. \( \left( \frac{2x^3}{3y^4} \right)^3 \)
33. \( (7x^3)^2 \)
34. \( \left( \frac{-9x^5}{5y^7} \right)^0 \)

Factor, if possible. Make sure you factor out the GCF first, if needed.

35. \( x^2 - 14x + 49 \)
36. \( p^2 - 3pq - 54q^2 \)
37. \( 2a^4 - 28a^3b + 80a^2b^2 \)
38. \( 25p^2 - 36q^2 \)
39. \( 3x^2 - x - 4 \)
40. \( 8x^3 + 20x^2 - 18x - 45 \)
41. \( 9x^2 + 49 \)
42. \( -16x^2 - 26x + 12 \)

Solve the following quadratic equations:

43. \( x^2 - 13x + 36 = 0 \)
44. \( 49x^2 - 9 = 0 \)
45. A batter hits a baseball into the air. The height (in feet) of the baseball after \( t \) seconds is given by
\[
h = f(t) = -16t^2 + 80t + 4
\]
After how many seconds is the baseball at a height of 68 feet?

46. Graph the function \( f(x) = -2(x + 5)^2 - 1 \) by hand.

47. Given \( y = -2x^2 - 4x + 3 \)
   a. Find x-coordinate of the vertex
   b. Graph the parabola by hand.

48. Simplify:
   a. \( \sqrt{32} \)
   b. \( \sqrt{-75} \)

49. Solve. You may factor or use the quadratic formula.
   a. \( x^2 - 3x - 10 = 0 \)
   b. \( 4(x - 3)^2 + 1 = 7 \)
   c. \( 3x^2 - 6x + 5 = 0 \)
50. The table below shows the U.S. revenues of DVD sales for various years. Let $R = f(t)$ be the U.S. revenues of DVD sales (in millions of dollars) for $t$ years since 2000.

<table>
<thead>
<tr>
<th>Year</th>
<th>$t = \text{years since 2000}$</th>
<th>DVD revenue (millions of dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td></td>
<td>15.1</td>
</tr>
<tr>
<td>2005</td>
<td></td>
<td>16.0</td>
</tr>
<tr>
<td>2006</td>
<td></td>
<td>16.3</td>
</tr>
<tr>
<td>2007</td>
<td></td>
<td>15.8</td>
</tr>
<tr>
<td>2008</td>
<td></td>
<td>15.2</td>
</tr>
</tbody>
</table>

a. Find an equation for $R = f(t)$ in vertex form. Use $y = a(x-h)^2 + k$. Round $a$ to three decimal places.

b. What is the vertex of your equation? What does it mean in this situation?

c. Use your equation to estimate the U.S. DVD revenue in 2010. Round your answer to 1 decimal place and write units with your answer.

d. Predict the years when DVD sales are $14$ million.
Selected Answers:
2a. \( m = -\frac{3}{4} \) decreasing  b. undefined vertical  c. \( m = \frac{5}{6} \) increasing  d. 0 horizontal
4a. neither  b. perpendicular  c. parallel
5a. m=2  the number of states with ethanol plants increased by 2 states per year  
     b. (0,22)  In 2007, 22 states had ethanol plants 
     c. \( n = 22 + 2t \)
6a. \( 4x - 6 \)  b. 0.96 - 4.08x  c. 2w + 17
7a. \( x = \frac{11}{4} \)  b. \( x = 10 \)  c. \( a = 7 \)  d. \( x = -10 \)  e. \( x = -\frac{32}{5} \)
8. \( a = 2A - b \)
9a. \( y = 456 + 23t \)  b. 617 thousand patents  c. in 2015
10a. \( y = \frac{2}{5}x - 2 \)  b. x-int (3, 0)  y-int (0, -6)  
     c.  yes  d. no
13. Domain: all real numbers  Range: \(-3 \leq y \) or \( y \geq -3 \)
15a. \( y = 7x + 10 \)  b. \( y = -\frac{2}{3}x + 3 \)  c. \( y = -\frac{1}{2}x + 4 \)  d. \( x = -2 \)
17a. \( y = \frac{2}{3}x - 4 \)  b. \( y = \frac{3}{5}x - \frac{17}{5} \)  c. \( y = -\frac{5}{3}x + \frac{17}{5} \)
18a. \( p = f(t) = -4.44t + 103.5 \)  
     b. \( m=-4.44 \) the percent of Fortune 100 companies that offer a pension decreased by 4.44% per year.
     c. (0, 103.5) In 1990, the percent was 103.5%.  (Model Breakdown)
     d. (23.3, 0) in 2013, 0% will offer a pension.  e. in 1991  f. in 2013

19a. \( x \leq 2 \)  b. \( b > -4 \)
20a. (3, -2)  b. Inf many solutions (dependent)
21. Invest $5000 at 10% and $2000 at 20%
22. Mix 4 gallons of 10% antifreeze and 6 gallons of 20% antifreeze
24. \(-5a^3 - 3a^2 + 3a - 9 \)
25. \(-3x^3 y - 6x^2 y^2 + 10xy^3 \)
26. \(8p^2 - 2p - 45 \)
27. \(9x^2 + 42xy + 49y^2 \)
28. \(-14x^3 y^2 + 6x^2 y^3 - 12xy^4 \)
29. \(16x^4 - 81y^4 \)
30. \(\frac{3}{4}x^4 y^5 \)
31. \(64a^{15}b^{16} \)
32. \(\frac{8x^9}{27y^{12}} \)
33. \(49x^6 \)
34. 1
35. \((x - 7)^2 \)
36. \((p-9q)(p+6q) \)
37. \(2a^2 (a-4b)(a-10b) \)
38. \((5p-6q)(5p+6q) \)
39. \((3x-4)(x+1) \)
40. \((2x+5)(2x+3)(2x-3) \)
41. prime 42. \(-2(x+2)(8x-3) \)
43. \(x = 4, x = 9 \)
44. \(x = \frac{3}{7}, x = -\frac{3}{7} \)
45. at \( t = 1 \) seconds (going up) and \( t = 4 \) seconds (going down)
47. \( a = -2 \)  b. \( 4\sqrt{2} \)
49. \( a = 5; \ x = -2 \)  b. \( x = 4.2 \)  c. \( x = \frac{6 \pm 2i\sqrt{6}}{6} \)
50a. \( y = -0.3(x-6)^2 + 16.3 \)
50b. (6, 16.3) in 2006, DVD sales were $16.3 million and that was the highest sales
50c. $11.5 million  50d. In about 2003 and 2009