Chapter 5 Notes

Writing Linear Equations

[Diagram of a coordinate plane]
5.1 Write Linear Equations in Slope-Intercept Form

Use slope and $y$-intercept to write an equation.

1. Write an equation of the line with a slope of -4 and a $y$-intercept of 6.

2. Slope is 8; $y$-intercept is -5.

3. Slope is $\frac{2}{3}$; $y$-intercept is -2.

4. Slope is -3; $y$-intercept is 7.

5. Slope is $-\frac{5}{2}$; $y$-intercept is 9.

Write an equation of a line given two points.

6.   

   \[
   \begin{array}{|c|c|c|}
   \hline
   x & y \\
   \hline
   1 & 3 \\
   \hline
   \end{array}
   \]
Write an equation of a line given two points.

7. 

8. 

Write a linear function.

9. Write an equation for the linear function \( f \) with the values \( f(0) = 4 \) and \( f(2) = 12 \).

10. Write an equation for the linear function with the values \( f(0) = 3 \) and \( f(3) = 15 \).

11. Write an equation for the linear function with the values \( f(3) = 1 \) and \( f(0) = 7 \).
5.2 Use Linear Equations in Slope-Intercept Form

Writing an Equation of a Line in Slope-Intercept Form

1. Identify the slope ___. You can use the slope formula to calculate the slope if you know two points on the line.
2. Find the y-intercept ___. You can substitute the slope and the coordinates of a point \((x, y)\) on the line into \(y = mx + b\). Then solve for \(b\).
3. Write an equation using _____________________.

Write an Equation given the Slope and a Point

1. Write an equation of the line that passes through the point \((1, 2)\) and has a slope of 3.
2. Write an equation of the line that passes through the point \((2, 2)\) and has a slope of 4.

Write an Equation given Two Points

3. Write an equation of the line that passes through \((2, -3)\) and \((-2, 1)\).
Write an Equation given Two Points
4. Write an equation of the line that passes through (-3, 4) and (1, 2).

5. Write an equation of the line that passes through (-8, -13) and (4, 2).

Solve a multi-step Problem
6. From 1990 to 2001, the number of airports in the United States increased at a relatively constant rate of 175 airports per year. There were 19,306 airports in the United States in 2001.
   a. How many U.S. airports were there in 1990?
   b. Write an equation that gives the number of U.S. airports as a function of the number of years since 1990.
   c. Find the year in which the number of U.S. airports reached 19,500.

7. Your gym membership costs $33 per month after an initial membership fee. You paid a total of $228 after 6 months. Write an equation that gives the cost as a function of the length of your gym membership (in months). Find the total cost after 9 months.
5.3 Write Linear Equations in Point-Slope Form

The point-slope form of the equation of the nonvertical line through a given point \((x_1, y_1)\) with a slope of \(m\) is:

Write an equation in point-slope form

1. Write an equation in point-slope form on the line that passes through the point \((3, 2)\) and has a slope of 2.

2. Write an equation in point-slope form on the line that passes through the point \((-3, 5)\) and has a slope of 4.

Graph an equation in point-slope form

3. \(y-2=\frac{1}{2}(x-2)\)
Graph an equation in point-slope form

4. \( y + 1 = 2(x - 1) \)

Use point-slope form to write an equation

5. Write an equation in point-slope form of the line shown.

6. Write an equation in point-slope form of the line shown.
Solve a multi-step problem.

7. You are designing a sticker to advertise your band. A company charges $225 for the first 1000 stickers and $80 for each additional 1000 stickers. Write an equation that gives the total cost (in dollars) of stickers as a function of the number (in thousands) of stickers ordered. Find the cost of 9000 stickers.

Write a real-world linear model from a table.

8. The table shows the cost of visiting a working ranch for one day and night for different numbers of people. Can the situation be modeled by a linear equation? Explain. If possible, write an equation that gives the cost as a function of the number of people in the group.

<table>
<thead>
<tr>
<th>Number of people</th>
<th>4</th>
<th>6</th>
<th>8</th>
<th>10</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost (dollars)</td>
<td>250</td>
<td>350</td>
<td>450</td>
<td>550</td>
<td>650</td>
</tr>
</tbody>
</table>
5.4 Write Linear Equations in Standard Form

Write equivalent equations in standard form

Write an equation from a graph

a. Write an equation in standard form of the line shown.
b. Write an equation in standard form of the line shown.

Write an equation from two points.

  c. Write an equation in standard form of the line through (3, -1) and (2, -4)

Write an equation of a line.

d. Line A  

e. Line B
Complete an equation in standard form

f. Find the missing coefficient in the equation of the line shown. Write the completed equation.

\[ Ax + 5y = -3 \]

\[ (2, 1) \]

\[ 6x + By = 4 \]
5.5 Write Equations of Parallel and Perpendicular Lines

Parallel lines have the ________ slope.

Graph the two lines: \( y = 3x + 2 \)
\[ y = 3x - 4 \]

Write the slope of a line that is parallel to each line.

1. \( y = \frac{-1}{4}x + 2 \) ___________ 2. \( 2x - 3y = 9 \) ___________

Perpendicular lines have ____________________________ slopes.

Here are a couple examples:

Graph the two lines: \( y = 3x - 4 \)
\[ y = \frac{-1}{3}x + 2 \]

Write the slope of a line that is perpendicular to each line.

3. \( y = 3x + 5 \) ___________ 4. \( -x + 4y = 20 \) ___________
<table>
<thead>
<tr>
<th>Slope:</th>
<th>Parallel</th>
<th>Perpendicular</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. $y = 5x + 2$</td>
<td>________</td>
<td>________</td>
</tr>
<tr>
<td>6. $y = -2x - 3$</td>
<td>________</td>
<td>________</td>
</tr>
<tr>
<td>7. $y = \frac{-2}{3}x + 2$</td>
<td>________</td>
<td>________</td>
</tr>
<tr>
<td>8. $4x + 3y = 8$</td>
<td>________</td>
<td>________</td>
</tr>
<tr>
<td>9. $6x - y = 4$</td>
<td>________</td>
<td>________</td>
</tr>
</tbody>
</table>

Write an equation for the line containing the point (2, 3) and...

7. parallel to the line $y = 2x + 3$. _____________________

8. perpendicular to the line $y = 2x + 3$. _____________________
Write an equation for the line containing the point (1, -3) and...

9. parallel to the line $y = x - 6$. ______________________

10. perpendicular to the line $y = x - 6$ _________________

Write an equation for the line containing the point (-5, 3) and...

11. parallel to the line $y = -4$. _________________

12. perpendicular to the line $y = -4$ _________________
Write an equation for the line containing the point (______) and...

13. parallel to the line ______________ . ______________________

14. perpendicular to the line ______________. _____________________

Write an equation for the line containing the point (______) and...

15. parallel to the line ______________ . ______________________

16. perpendicular to the line ______________. _____________________
5.6 Fit a Line of Data

Scatter Plot: ________________________________________________________________
__________________________________________________________________________

Correlation: ________________________________________________________________

Line of fit: __________________________________________________________________

If $y$ tends to increase as $x$ increases, the paired data are said to have a _______ correlation.

If $y$ tends to decrease as $x$ increases, the paired data are said to have a _______ correlation.

If $x$ and $y$ have no apparent relationship, the paired data are said to have _______ correlation.

Describe the correlation of data graphed in the scatter plot.
For example, the fitted line on the scatter plot at the right can be used to predict that about 25 trees will be sold at $125 each.

Using the same scatter plot,
1. How much will 15 trees be sold for?
2. How many trees will be sold for about $25?

Make a Scatter Plot

a. Make a scatter plot of the data in the table.

<table>
<thead>
<tr>
<th>X</th>
<th>1</th>
<th>1.5</th>
<th>2</th>
<th>2</th>
<th>3</th>
<th>3.5</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>-0.5</td>
<td>-1</td>
<td>-0.5</td>
<td>-2</td>
</tr>
</tbody>
</table>

b. Describe the correlation of the data:

Using a Line of Fit to Model Data

Step 1: Make a _________________ of the data.

Step 2: Decide whether the data can be modeled by a __________.

Step 3: Draw a line that appears to _____ the data closely. There should be approximately as many points _________ the line as below it.

Step 4. Write an equation using ______ points on the line. The points do not have to represent actual data pairs, but they must lie on the line of fit.
Write an equation to model data.

Game attendance: The table shows the average attendance at a school’s varsity basketball games for various years. Write an equation that models the average attendance at varsity basketball games as a function of the number of years since 2000.

<table>
<thead>
<tr>
<th>Year</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avg. Game attendance</td>
<td>488</td>
<td>497</td>
<td>525</td>
<td>567</td>
<td>583</td>
<td>621</td>
<td>688</td>
</tr>
</tbody>
</table>

Game Attendance

![Graph showing years and average game attendance]

Years since 2000

1. Make a scatter plot.
2. Can you make a line?
3. Draw the line.
4. Write an equation.
   Calculate the slope of the line.
Write an equation to model data.

Make a scatter plot of the data in the table. Describe the correlation and write an equation of the line.

<table>
<thead>
<tr>
<th>x</th>
<th>1</th>
<th>2</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td>5</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>8</td>
</tr>
</tbody>
</table>

1. Make a scatter plot.
2. Can you make a line?
3. Draw the line.
4. Write an equation.
   Calculate the slope of the line.
5.7 Predict with Linear Models

Best-fitting line: __________________________________________________________
___________________________________________________ ____________________

Zero of a function: _________________________________________________________
___________________________________________________ ____________________

Make a scatter plot of the data. Find the equation of the best-fitting line. Approximate the value of $y$ for $x = 5$.

1.

<table>
<thead>
<tr>
<th>$X$</th>
<th>0</th>
<th>2</th>
<th>4</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>$Y$</td>
<td>2</td>
<td>7</td>
<td>14</td>
<td>17</td>
<td>20</td>
</tr>
</tbody>
</table>


Make a scatter plot of the data. Find the equation of the best-fitting line. Approximate the value of $y$ for $x = 10$.

2. 

<table>
<thead>
<tr>
<th>$X$</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>$Y$</td>
<td>20</td>
<td>32</td>
<td>39</td>
<td>53</td>
<td>63</td>
</tr>
</tbody>
</table>

Zero of a Function

a. $f(x) = 7.5x + 20$

b. $f(x) = -x + 7$

c. $f(x) = 17x - 68$

d. $f(x) = -0.5x + 0.75$

e. $f(x) = 5x - 7$

f. $f(x) = -2x + 4$