PreCalculus Chapter 2

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Due October 3rd, 2021

Solutions are in blue and explanations for each problem are directly below them

Section 2.1: Linear Functions

Two from 1-6 pg. 110

1.) A town's population has been growing linearly. In 2003, the population was 45,000, and the population has been growing by 1700 people each year. Write an equation, P(t), for the population t years after 2003.

- P(t) = 45,000 + 1700t

Explanation: The population starts at 45,000 and every year it increases (ADDS) by 1700, and it multiplies (TIMES t) every year that passes. I found this pretty easy, and didn't have to look up the solution.

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2.) A town's population has been growing linearly. In 2005, the population was 69,000, and the population has been growing by 2500 people each year. Write an equation, P(t), for the population t years after 2005.

- P(t) = 69,000 + 2500t

Explanation: This is the exact same problem as the last with different numbers. The population starts at 69,000 and every year it increases (ADDS) by 2500, and it multiplies (TIMES t) every year that passes. I found this pretty easy, and didn't have to look up the solution.

Two from 7-16 pg. 110

Determine if each function is increasing or decreasing.

7.) $f(x) = 4x + 3$

- INCREASING

Explanation: 4x isn't a negative number, so it will always increase with a positive slope. The y-intercept 3, doesn't affect whether or not it is increasing. I found this problem easy, and didn't need to look at the solution manual.

8.) $g(x) = 5x + 6$

- INCREASING

Explanation: Much like the last problem 5x is a positive number meaning that it will increase positively. The y-intercept of 6 doesn't affect this. I found this problem easy, and didn't need to look at the solution manual.

One from 17-22 pg. 110

Find the slope of the line that passes through the two given points.

17.) (2 , 4) and (4 , 10)

- $m = \frac{10-4}{4-2} = \frac{6}{2} = 3$

Explanation: I used the formula, $\frac{y2-y1}{x2-x1}$, to find the slope of the equation. I substituted in the numbers and got a solution of 3. I found this problem easy, and didn't need the solution manual.

One from 25-31 pg. 111

25.) Sonya is walking home from a friend's house. After 2 minutes she is 1.4 miles from home. Twelve minutes after leaving, she is 0.9 miles from home. What is her rate?

- $m = \frac{1.4-0.9}{12-2} = \frac{0.5miles}{10minutes} = \frac{0.005miles}{1minute}$

Explanation: The equation is asking for "rate" which is the same as slope. So, I used the formula, $\frac{y2-y1}{x2-x1}$, to find the slope of the equation. The x-axis is time (minutes), and the y-axis is distance (miles). x1 is 2 minutes, x2 is 12 minutes, y1 is 0.9, y2 is 1.4. I substituted the given numbers in and solved the equation for 1 minute, which is a rate of 0.005 miles. I found this problem easy, and didn't need the solution manual.

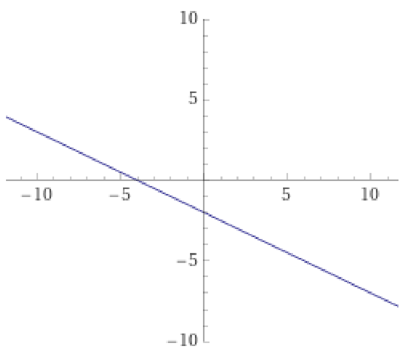
Section 2.2: Graphs of Linear Functions

One from 7-8 pg. 125

Sketch a line with the given features.

7.) An x-intercept of (-4, 0) and y-intercept of (0, -2)

- $f(x) = -\frac{1}{2}x - 2$

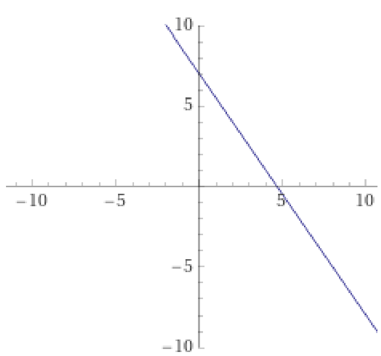


One from 9-10 pg. 125

Sketch a line with the given features.

9.) A vertical intercept of (0,7) and a slope of $-\frac{3}{2}$

- $f(x) = -\frac{3}{2}x + 7$

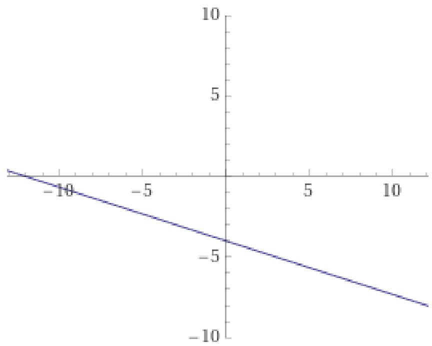


One from 11-12 pg. 125

Sketch a line with the given features.

11.) Passing through the points (-6,-2) and (6,-6)

- $f(x) = -\frac{1}{2}x - 4$

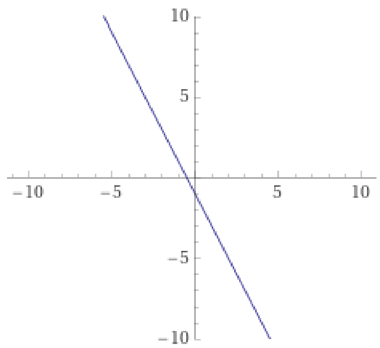


Explanation:

One from 13-22 pg. 125

Sketch the graph of each equation.

13.) $f(x) = -2x - 1$



Explanation: In this example a formula is already given. With -2x being the slope and -1 as the y intercept I plugged these numbers into mathematica and got this graph. It was pretty simple and I didn't need the solution manual.

One from 23-24 pg. 126

23. If g(x) is the transformation of f(x) = after a vertical compression by 3/4, a shift left by 2, and a shift down by 4.

a. Write an equation for g(x)

- $g(x) = \frac{3}{4}(x+2) - 4 \quad = \quad g(x) = \frac{3}{4}x - \frac{5}{2}$

Explanation: The equation for g(x) starts with a vertical compression of 3/4, which makes g(x) = 3/4. Then, with a left shift of 2 I got an equation of g(x) = 3/4 (x + 2). Finally with a downward shift of 4, I ended the equation with g(x) = 3/4 (x + 2) -4.
This equation can be simplified into g(x) = 3/4x - 5/2 after using the distributive property. I found this question easy and didn't need the solution manual.

b. What is the slope of this line?

- slope $= \frac{3}{4}$

Explanation: The equation I was left from the last problem was g(x) = 3/4x - 5/2. This equation is in point slope form (y = mx + b) where m represents the slope. This means that the slope is 3/4 as that is the m value of the equation.

c. Find the vertical intercept of this line.

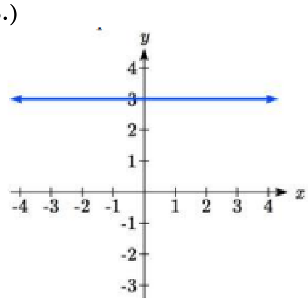
- vertical intercept $= -\frac{5}{2}$

Explanation: The vertical intercept is the same as the y - intercept. Once again, the solution to problem a is g(x) = 3/4x - 5/2. The equation is in y = mx + b form where b represents the y - intercept. In this case the b value is - 5/2, so the vertical intercept is - 5/2.

One from 25-34 pg. 126

Write an equation of the line shown.

25.)



- $f(x) = 3$

Explanation: The line is straight (no slope) and has a y intercept of 3 (b). Since it has no slope, the equation is f(x) = 0x + 3, which is the same as the answer f(x) = 3.

One from 35-40 pg. 127

Given below are descriptions of two lines. Find the slopes of Line 1 and Line 2. Is each pair of lines parallel, perpendicular or neither?

35.) Line 1: Passes through (0 , 6) and (3 , -24)

Line 2: Passes through (-1 , 19) and (8 , -71)

- m of line 1 $= -\frac{1}{2}$ AND m of line 2 $= 1$

  They are neither perpendicular or parallel.

Explanation: line 1 has a negative slope and line 2 has a positive one. These lines intersect but not directly perpendicular to each other, obviously meaning that they are not parallel either. They also pass through far away points.

I found this problem rather difficult but I didn't need the solution manual.

One from 41-46 pg. 127

41. Write an equation for a line parallel to $f(x) = -5x - 3$ and passing through the point (2 , -12).

- $y = -5x - 2$ is parallel to the line.

Explanation: In order for two lines to be parallel, they must have the same slope so they don't intersect. Meaning that both equations will have a slope of -5. From here using the point (2, -12) and plugging into the original equation I got b = -2. This gives us the solution of y = -5x -2, which is parallel to y = -5x -3.

I found this problem easy and didn't need the solution manual.

Section 2.3: Modeling with Linear Functions

Two from 1-12 pg. 137 - 139

1.) In 2004, a school population was 1001. By 2008 the population had grown to 1697. Assume the population is changing linearly.

a. How much did the population grow between the year 2004 and 2008?

- 696

Explanation: The difference between the year 2004 and 2008 can be represented as 1697 - 1001. This equals 696, which is the growth from 2004 to 2008.

b. How long did it take the population to grow from 1001 students to 1697 students?

- 4 years

Explanation: In question a, we found the difference in population between 2004 and 2008. 2004 has 1001 and 2008 has 1697. This is the same thing the question is asking, and the difference between these years is 4.

c. What is the average population growth per year?

- 696/4 = 174 students per year

Explanation: The yearly difference between 2004 and 2008 is 4 years. The growth between these years was 696, so we can use the equation 696/4 (growth/time). This gives us an answer of 174 students per year.

d. What was the population in the year 2000?

- 1001 - 4(174) = 305

Explanation: The population in 2004 was 1001, and there is a 4 year difference between 2000 and 2004. I also know that the average growth is 174 students every year. So, we can get the equation of 1001 - 4(174). This equals my final answer of 305.

e. Find an equation for the population, P, of the school t years after 2000.

- P(t) = 174t + 305

Explanation: The average growth of students between 2004 and 2008 is 174. Multiply this number by the function of t (time), and we get P(t) = 174t. Then we add 305 (students for the year 2000) to the equation to end with P(t) = 174t + 350. Where t can be substituted by any given year.

f. Using your equation, predict the population of the school in 2011.

- P(11) = 174(11) + 305 = 2219 people

Explanation: The average growth every year is 174, and since the year 2000, there have been 11 years... So I subbed 11 in for the t (time) value. The population in the year 2000 was 305 students so I got an equation of 174(11) + 305. This gave me an answer of 2219 people.

I found most of these problems easy and didn't need the solution manual for any of them.

3.) A phone company has a monthly cellular plan where a customer pays a flat monthly fee and then a certain amount of money per minute used on the phone. If a customer uses 410 minutes, the monthly cost will be $71.50. If the customer uses 720 minutes, the monthly cost will be $118.

a. Find a linear equation for the monthly cost of the cell plan as a function of x, the number of monthly minutes used.

- f(x) = 0.15x + 10

Explanation: With the given information I got the ordered pairs (410 , 71.50) and (720 , 118). using the slope formula, I got $\frac{118-71.50}{720-410}$. So, the equation is f(x) = 0.15x + b. I then subbed in the number 10 for b, which gives the solution of f(x) = 0.15x + 10.

b. Interpret the slope and vertical intercept of the equation.

- m = 0.15 and the y - intercept is 10.

Explanation: The slope is the number 0.15.. which is the price per minute of 15 cents, and the y-intercept (10) is the flat monthly fee of ten dollars.

c. Use your equation to find the total monthly cost if 687 minutes are used.

- f(687) = 0.15(687) + 10 = 113.05

Explanation: I simply used the equation from question a and subbed in the given number (687) for x. This gave me a solution of 113.05 for the total monthly cost.

Two from 13-18 pg. 139

13.) Find the area of the triangle bounded by the y-axis, the line $f(x) = 9 - \frac{6}{7}x$, and the line perpendicular to $f(x)$ that passes through the origin.

- A = $\frac{1}{2}9(4.44) = 19.98$

Explanation: The area of the triangle is A = 1/2bh. I know that the base of the triangle is also 9, and the height is the point where the two lines intersect. The equation for this the perpendicular lines is g(x) = $\frac{7}{6}x$ as it is the reciprocal of 6/7. When I solved for x by setting the two equations equal to each other I got 4.44. So, the area of the triangle is A = $\frac{1}{2}9(4.44)$, which is equal to 19.98.
I found this problem easy and didn't need the solution manual

14.) Find the area of the triangle bounded by the x-axis, the line $f(x) = 12 - \frac{1}{3}x$, and the line perpendicular to $f(x)$ that passes through the origin.

- A = $\frac{1}{2}12(0.75) = 4.5$

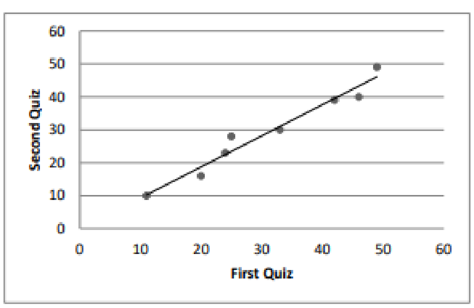
Explanation: Once again, the area of the triangle is A = 1/2bh. The base of the triangle is given, which is 12, the height is where the lines intersect. The perpendicular equation is g(x) = 3x as 3/1 is the reciprocal of 1/3 from f(x). After solving for x by setting the two equations equal to each other I got 0.75. Meaning that the area is A = 1/2(12)(0.75) = 4.5
I found this problem difficult but didn't need the solution manual.

Section 2.4: Fitting Linear Models to Data

One from 1-2 pg. 147

1.) The following is data for the first and second quiz scores for 8 students in a class. Plot the points, then sketch a line that fits the data.

First Quiz	11	20	24	25	33	42	46	49
Second Quiz	10	16	23	28	30	39	40	49



Explanation: I figured out this problem on my own. However, I don't know how to make a line plot in mathematica, so I needed the solution manual to get sketch the line plot.

One from 5-6 pg. 147

5.) Based on each set of data given, calculate the regression line using your calculator or other technology tool, and determine the correlation coefficient.

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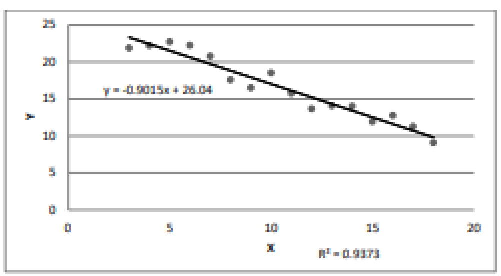
x	*y*
3	21.9
4	22.22
5	22.74
6	22.26
7	20.78
8	17.6
9	16.52
10	18.54
11	15.76
12	13.68
13	14.1
14	14.02
15	11.94
16	12.76
17	11.28
18	9.1



Explanation: Once again, I had a hard time figuring out how to make a line plot in mathematica so I needed the solution manual. However, I know what the points are and how to plot them... just don't know the command in mathematica.

One from 7-8 pg. 148

7. A regression was run to determine if there is a relationship between hours of TV watched per day (x) and number of sit ups a person can do (y). The results of the regression are given below. Use this to predict the number of sit ups a person who watches 11 hours of TV can do.

$y = ax + b$

$a = -1.341$

$b = 32.234$

$r^2 = 0.803$

$r = -0.896$

- $y = -1.341(11) + 32.234 = 17483/1000 \to 17.483$

Explanation: With the equation of a line is the equation y = ax + b. I was given a = 1.341 and b = 32.234, and I used the line, y = 1.341x + 32.234. Because the correlation coefficient is close to negative one (r = -0.896) I know that the line will be good for the data and will give me a good prediction. Since x is the number of hours someone watches TV and y is the amount of sit-ups someone can do, I plugged in 11 for x in our equation to get the predicted amount of sit-ups that person can do. Which is

$y = -1.341(11) + 32.234 = 17483/1000 \to 17.483$

I found this problem easy and didn't need the solution manual.

One from 13-14 pg. 148

13. The US census tracks the percentage of persons 25 years or older who are college graduates. That data for several years is given below. Determine if the trend appears linear. If so and the trend continues, in what year will the percentage exceed 35% ?

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Year	1990	1992	1994	1996	1998	2000	2002	2004	2006	2008
Percent Graduates	21.3	21.4	22.2	23.6	24.4	25.6	26.7	27.7	28	29.4

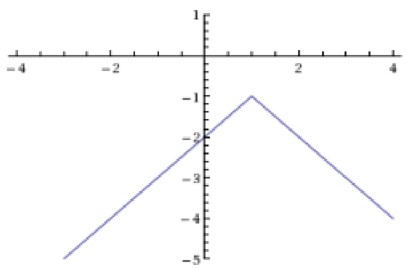
Section 2.5: Absolute Value Functions

Two from 5-10 pg. 156

Sketch a graph of each function.

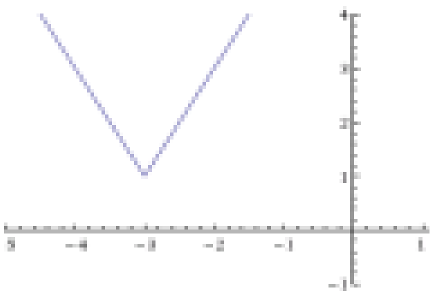
5.) $f(x) = -|x - 1| - 1$

- x - 2 or - x + 2



Explanation: Since this is an absolute value, there are two lines. The two lines are reflected along the x-axis depending if they are positive or negative. The slope can be either negative or positive. The the y - intercept can be either 2 or -2.

6.) $f(x) = -|x + 3| + 4$



I found this problem difficult and I needed the solution manual to figure it out.

Two from 11-16 pg. 156

Solve each equation.

11.) $|5x - 2| = 11$

- 5x - 2 = 11 OR 5x - 2 = -11

  5x = 13 OR 5x = -9

  x = $\frac{13}{5}$ OR x = $-\frac{9}{5}$

Explanation: There are two values for 11, they are: 11 and -11.

- For 11 I added the number 2 to the other side of the equation, making 5x = 13. Then I divided both sides of the equation by 5, giving me the answer of x = $\frac{13}{5}$.

- For -11 I added the number 2 to the -11 on the other side of the equation, making 5x = -9. Then I divided both sides of the equation by 5, giving me the answer of x = $-\frac{9}{5}$.

I found both of these solutions pretty easily, and didn't need the solution manual for it.

13.) $2|4-x|=7$

- $|4-x|=\frac{7}{2}$

  $4-x=\frac{7}{2}$ OR $4-x=-\frac{7}{2}$

  $-x=-\frac{1}{2}$ OR $-x=-\frac{15}{2}$

  $x=\frac{1}{2}$ OR $x=\frac{15}{2}$

Explanation: To make the equation easier I divided 2 on both sides of the equation, to make —4 - x— = 7/2. From here the two values are: 7/2 and -7/2.
For 7/2 I subtracted 4 on both sides of the equation, resulting in - x = - 1/2. Then I divided both sides by negative one... as -x is equal to -1x. Giving me an answer of x = 1/2.
For -7/2 I subtracted 4 on both sides of the equation, resulting in - x = - 15/2. Then I divided both sides by negative one... as -x is equal to -1x. Giving me an answer of x = 15/2.

I found both of these solutions easily, I didn't need the solution manual for them.

Two from 17-20 pg. 157

Find the horizontal and vertical intercepts of each function.

17.) $f(x)=2|x+1|-10$

- $0=2|x+1|-10 \rightarrow\ 5=|x+1|$

  $5=x+1$ OR $-5=x+1$

  x = 4 OR x = - 6

  x intercepts are (4 , 0) and (-6 , 0)

  y intercept occurs when the $f(x)$ is equal to zero.

  $f(0)=2|0+1|-10\ \rightarrow\ f(0)=2(1)-10\ \rightarrow\ f(0)=2-10=8$

  The y intercept is (0 , 8)

Explanation: For the x intercepts, I set the equation equal to zero. I made the equation simpler by adding 10 on both sides of the equation, then dividing by 2. This creates $5 = |x + 1|$, from here the two values can be 5 or -5.

For 5, I simply subtracted 1 on the other side to make x = 4. For -5, I subtracted 1 on the other side to make x = -6. These two answers give me the x intercepts of (4 , 0) and (-6 , 0) as they correspond with x = 4 and x = -6.

For the y intercept, I made the function of x equal to zero (different from setting the whole equation to zero). This is how you can find the y intercept for a given function. I ended up with a solution of 8, meaning that the y intercept is (0 , 8). I found this problem tedious and long, but I didn't need the solution manual to solve it.

19.) $f(x) = -3|x - 2| - 1$

- $0 = -3|x - 2| - 1 \rightarrow \ -\frac{1}{3} = |x - 2|$

  $-\frac{1}{3} = |x - 2|$, an absolute value cannot omit a negative value, in which this one does. So the are no x-intercepts and no solutions.

  y intercept occurs when the $f(x)$ is equal to zero.

  $f(0) = -3|0 - 2| - 1 \ \rightarrow \ f(0) = -3(2) - 1 \ \rightarrow \ f(0) = -6 - 1 = -7$

  The y intercept is (0 , -7)

Explanation: For the x intercepts, I set the equation equal to zero. I made the equation simpler by adding 1 on both sides of the equation, then dividing by negative 3. This creates $-\frac{1}{3} = |x - 2|$, and since the absolute value results in a negative solution, there are **no x intercepts or solutions.**

Similar to the last equation, the y intercept is found by making the function of x equal to zero. I ended up with a solution of -7, meaning the y intercept is (0 , -7). I found this problem long like the last one, but I didn't need the solution manual for it.

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Two from 21-26 pg. 157

Solve each inequality.

21.) $|x + 5| < 6$

- $|x + 5| = 6$ OR -6

Explanation: Since the absolute value can result in either a negative or positive value, 6 will be positive or negative. The x + 5 will remain the same. I found this problem easy and didn't need the solution manual.

22.) $|x - 3| < 7$

- $|x - 3| = 7$ OR - 7

Explanation: Since the absolute value can result in either a negative or positive value, 7 will be positive or negative. The x - 3 will remain the same. I found this problem easy and didn't need the solution manual.

END
