## SECTION 1.1 PROBLEM SET: GRAPHING A LINEAR EQUATION

Work the following problems.

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| 1) Is the point (2, 3) on the line 5x – 2y = 4? | 2) Is the point (1, – 2) on the line 6x – y = 4? |
| 3) For the line 3x - y = 12, complete the following ordered pairs.  (2, ) ( , 6)  (0, ) ( , 0) | 4) For the line 4x + 3y = 24, complete the following ordered pairs.  (3, ) ( , 4)  (0, ) ( , 0) |
| 5) Graph y = 2x + 3 | 6) Graph y = – 3x + 5 |
| 7) Graph y = 4x – 3 | 8) Graph x – 2y = 8 |
| 9) Graph 2x + y = 4 | 10) Graph 2x – 3y = 6 |

***SECTION 1.1 PROBLEM SET: GRAPHING A LINEAR EQUATION***

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| --- | --- |
| 11) Graph 2x + 4 = 0 | 12) Graph 2y - 6 = 0 |
| 13) Graph the following three equations on the same set of coordinate axes.  y = x +1 y = 2x + 1 y = -x + 1 | 14) Graph the following three equations on the same set of coordinate axes.  y = 2x +1 y = 2x y = 2x - 1 |
| 15) Graph the line using the parametric equations  x = 1 + 2t, y = 3 + t | 16) Graph the line using the parametric equations  x = 2 – 3t, y = 1 + 2t |

## SECTION 1.2 PROBLEM SET: SLOPE OF A LINE

Find the slope of the line passing through the following pair of points.

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| --- | --- |
| 1) (2, 3) and (5, 9) | 2) (4, 1) and (2, 5) |
| 3) (– 1, 1) and (1, 3) | 4) (4, 3) and (– 1, 3) |
| 5) (6, – 5) and (4, – 1) | 6) (5, 3) and (– 1, – 4) |
| 7) (3, 4) and (3, 7) | 8) (– 2, 4) and (– 3, – 2) |
| 9) (– 3, – 5) and (– 1, – 7) | 10) (0, 4) and (3, 0) |

***SECTION 1.2 PROBLEM SET: SLOPE OF A LINE***

Determine the slope of the line from the given equation of the line.

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| 11) y = – 2x + 1 | 12) y = 3x – 2 |
| 13) 2x – y = 6 | 14) x + 3y = 6 |
| 15) 3x – 4y = 12 | 16) What is the slope of the x-axis?    What is the slope of the y-axis? |

Graph the line that passes through the given point and has the given slope.

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| 17) (1, 2) and m = – 3/4 | 18) (2, ­– 1) and m = 2/3 |
| 19) (0, 2) and m = – 2 | 20) (2, 3) and m = 0 |

## SECTION 1.3 PROBLEM SET: DETERMINING THE EQUATION OF A LINE

Write an equation of the line satisfying the following conditions.   
Write the equation in the form y = mx + b.

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| --- | --- |
| 1) It passes through the point (3, 10) and has  slope = 2. | 2) It passes through point (4,5) and has m = 0. |
| 3) It passes through (3, 5) and (2, – 1). | 4) It has slope 3, and its y-intercept equals 2. |
| 5) It passes through (5, – 2) and m = 2/5. | 6) It passes through (– 5, – 3) and (10, 0). |
| 7) It passes through (4, – 4) and (5, 3). | 8) It passes through (7, – 2) ; its y-intercept is 5. |
| 9) It passes through (2, – 5) and its x-intercept  is 4. | 10) Its a horizontal line through the point (2, – 1). |

***SECTION 1.3 PROBLEM SET: DETERMINING THE EQUATION OF A LINE***

Write an equation of the line satisfying the following conditions.   
Write the equation in the form y = mx + b.

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| --- | --- |
| 11) It passes through (5, – 4) and (1, – 4). | 12) It is a vertical line through the point (3, – 2). |
| 13) It passes through (3, – 4) and (3, 4). | 14) It has x-intercept = 3 and y-intercept = 4. |

Write an equation of the line satisfying the following conditions.   
Write the equation in the form Ax + By = C.

|  |  |
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| 15) It passes through (3, – 1) and m = 2. | 16) It passes through (– 2, 1) and m = – 3/2. |
| 17) It passes through (– 4, – 2) and m = 3/4. | 18) Its x-intercept equals 3, and m = – 5/3. |

***SECTION 1.3 PROBLEM SET: DETERMINING THE EQUATION OF A LINE***

Write an equation of the line satisfying the following conditions.   
Write the equation in the form Ax + By = C.

|  |  |
| --- | --- |
| 19) It passes through (2, – 3) and (5, 1). | 20) It passes through (1, – 3) and (– 5, 5). |

Write an equation of the line satisfying the following conditions.   
Write the equation in point slope form y−y1 = m (x−x1)

|  |  |
| --- | --- |
| 21) It passes through (2, – 3) and (5, 1). | 22) It passes through (1, – 3) and (– 5, 2). |
| 23) It passes through (6, −2) and (0, 2). | 24) It passes through (8, 2) and (−7, −4). |
| 25) It passes through (–12, 7) and has slope = –1/3. | 26) It passes through (8, – 7) and has slope 3/4. |

## SECTION 1.4 PROBLEM SET: APPLICATIONS

In the following application problems, assume a linear relationship holds.

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| 1) The variable cost to manufacture a product is $25 per item, and the fixed costs are $1200.  If x is the number of items manufactured and y is the cost, write the cost function. | 2) It costs $90 to rent a car driven 100 miles and $140 for one driven 200 miles. If x is the number of miles driven and y the total cost of the rental, write the cost function. |
| 3) The variable cost to manufacture an item is  $20 per item, and it costs a total of $750 to produce 20 items. If x represents the number  of items manufactured and y is the cost, write the cost function. | 4) To manufacture 30 items, it costs $2700, and to manufacture 50 items, it costs $3200. If x represents the number of items manufactured and y the cost, write the cost function. |
| 5) To manufacture 100 items, it costs $32,000, and to manufacture 200 items, it costs $40,000. If x is the number of items manufactured and  y is the cost, write the cost function. | 6) It costs $1900 to manufacture 60 items, and the fixed costs are $700. If x represents the number of items manufactured and y the cost, write the cost function. |

***SECTION 1.4 PROBLEM SET: APPLICATIONS***

In the following application problems, assume a linear relationship holds.

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| --- | --- |
| 7) A person who weighs 150 pounds has 60 pounds of muscles; a person that weighs 180 pounds has 72 pounds of muscles. If x represents body weight and y is muscle weight, write an equation describing their relationship. Use this relationship to determine the muscle weight of a person that weighs 170 pounds. | 8) A spring on a door stretches 6 inches if a force of 30 pounds is applied. It stretches 10 inches  if a 50 pound force is applied. If x represents the number of inches stretched, and y is the force, write a linear equation describing the relationship. Use it to determine the amount of force required to stretch the spring 12 inches. |
| 9). A male college student who is 64 inches tall weighs 110 pounds. Another student who is 74 inches tall weighs 180 pounds. Assuming the relationship between male students' heights (x), and weights (y) is linear, write a function to express weights in terms of heights, and use this function to predict the weight of a student who is 68 inches tall. | 10) EZ Clean company has determined that if it spends $30,000 on advertising, it can hope to sell 12,000 of its Minivacs a year, but if it spends $50,000, it can sell 16,000. Write an equation that gives a relationship between the number of dollars spent on advertising (x) and the number of minivacs sold(y). |
| 11) The freezing temperatures for water for Celsius and Fahrenheit scales are 0ºC and 32ºF. The boiling temperatures for water are 100 ºC and 212 ºF. Let C denote the temperature in Celsius and F in Fahrenheit. Write the conversion function from Celsius to Fahrenheit. Use the function to convert 25 ºC into ºF. | 12) By reversing the coordinates in the previous problem, find a conversion function that converts Fahrenheit into Celsius, and use this conversion function to convert 72 ºF into an equivalent Celsius measure. |

***SECTION 1.4 PROBLEM SET: APPLICATIONS***

In the following application problems, assume a linear relationship holds.

|  |  |
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| 13) California’s population was 29.8 million in the year 1990, and 37.3 million in 2010. Assume that the population trend was and continues to be linear, write the population function. Use this function to predict the population in 2025. *Hint: Use 1990 as the base year (year 0); then 2010 and 2025 are years 20, and 35, respectively.)* | 14) Use the population function for California in the previous problem to find the year in which the population will be 40 million people. |
| 15) A college’s enrollment was 13,200 students in the year 2000, and 15,000 students in 2015. Enrollment has followed a linear pattern.  Write the function that models enrollment as a function of time. Use the function to find the college’s enrollment in the year 2010.  *Hint: Use year 2000 as the base year.* | 16) If the college’s enrollment continues to follow this pattern, in what year will the college have 16,000 students enrolled. |
| 17) The cost of electricity in residential homes is a linear function of the amount of energy used. In Grove City, a home using 250 kilowatt hours (kwh) of electricity per month pays $55.  A home using 600 kwh per month pays $118. Write the cost of electricity as a function of the amount used. Use the function to find the cost for a home using 400 kwh of electricity per month. | 18) Find the level of electricity use that would correspond to a monthly cost of $100. |

***SECTION 1.4 PROBLEM SET: APPLICATIONS***

In the following application problems, assume a linear relationship holds.

|  |  |
| --- | --- |
| 19) At ABC Co., sales revenue is $170,000 when  it spends $5000 on advertising.  Sales revenue is $254,000 when $12,000 is spent on advertising.  a) Find a linear function for  y = amount of sales revenue as a function of  x = amount spent on advertising.  b) Find revenue if $10,000 is spent on advertising.  c) Find the amount that should be spent on advertising to achieve $200,000 in revenue. | 20) For problem 19, explain the following: a. Explain what the slope of the line tells us about the effect on sales revenue of money spent on advertising. Be specific, explaining both the number and the sign of the slope in the context of this problem. b. Explain what the y intercept of the line tells us about the sales revenue in the context of this problem |
| 21) Mugs Café sells 1000 cups of coffee per week if it does not advertise. For every $50 spent in advertising per week, it sells an additional 150 cups of coffee.  a) Find a linear function that gives  y = number of cups of coffee sold per week  x = amount spent on advertising per week.  b) How many cups of coffee does Mugs Café expect to sell if $100 per week is spent on advertising? | 22) Party Sweets makes baked goods that can be ordered for special occasions. The price is $24 to order one dozen (12 cupcakes) and $9 for each additional 6 cupcakes.  a) Find a linear function that gives the total price of a cupcake order as a function of the number of cupcakes ordered  b) Find the price for an order of 5 dozen (60) cupcakes |

## SECTION 1.5 PROBLEM SET: MORE APPLICATIONS

Solve the following problems.

|  |  |
| --- | --- |
| 1) Solve for x and y. y = 3x + 4  y = 5x – 2 | 2) Solve for x and y. 2x – 3y = 4  3x – 4y = 5 |
| 3) The supply and demand curves for a product are: Supply y = 2000x – 6500  Demand y = – 1000x + 28000,  where x is price and y is the number of items.  At what price will supply equal demand and how many items will be produced at that price? | 4) The supply and demand curves for a product are  Supply y = 300x – 18000 and   Demand y = – 100x + 14000,  where x is price and y is the number of items.  At what price will supply equal demand, and how many items will be produced at that price? |
| 5) A car rental company offers two plans for one way rentals.  Plan I charges $36 per day and 17 cents per mile. Plan II charges $24 per day and 25 cents per mile.  a. If you were to drive 300 miles in a day, which plan is better?  b. For what mileage are both rates equal? | |

***SECTION 1.5 PROBLEM SET: MORE APPLICATIONS***

Solve the following problems.

|  |  |
| --- | --- |
| 6) A demand curve for a product is the number of items the consumer will buy at different prices. At a price of $2 a store can sell 2400 of a particular type of toy truck. At a price of $8 the store can sell 600 such trucks. If x represents the price of trucks and y the number of items sold, write an equation for the demand curve. | 7) A supply curve for a product is the number of items that can be made available at different prices. A manufacturer of toy trucks can supply 2000 trucks if they are sold for $8 each; it can supply only 400 trucks if they are sold for $4 each. If x is the price and y the number of items, write an equation for the supply curve. |
| 8) The equilibrium price is the price where the supply equals the demand. From the demand and supply curves obtained in the previous two problems, find the equilibrium price, and determine the number of items that can be sold at that price. | 9) A break-even point is the intersection of the cost function and the revenue function, that is, where total cost equals revenue, and profit is zero. Mrs. Jones Cookies Store's cost and revenue, in dollars, for x number of cookies is given by C = .05x + 3000 and R = .80x. Find the number of cookies that must be sold to break even. |

***SECTION 1.5 PROBLEM SET: MORE APPLICATIONS***

Solve the following problems.

|  |  |
| --- | --- |
| 10) A company's revenue and cost in dollars are given by R = 225x and C = 75x + 6000, where x is the number of items. Find the number of items that must be produced to break-even. | 11) A firm producing socks has a fixed cost of  $20,000 and variable cost of $2 per pair of socks. Let x = the number of pairs of socks. Find the break-even point if the socks sell for $4.50 per pair. |
| 12) Whackemhard Sports is planning to introduce a new line of tennis rackets. The fixed costs for the new line are $25,000 and the variable cost of producing each racket is $60.  x is the number of rackets; y is in dollars. If the racket sells for $80, how many rackets must be sold in order to break even? | 13) It costs $1,200 to produce 50 pounds of a chemical and it costs $2,200 to produce 150 pounds. The chemical sells for $15 per pound x is the amount of chemical; y is in dollars.  a. Find the cost function.  b. What is the fixed cost?  c. How many pounds must be sold to break even?  d. Find the cost and revenue at the break-even point. |

## SECTION 1.6 PROBLEM SET: CHAPTER REVIEW

1) Find an equation of the x-axis.

2) Find the slope of the line whose equation is 2x + 3y = 6.

3) Find the slope of the line whose equation is y = – 3x + 5.

4) Find both the x and y intercepts of the line 3x – 2y = 12.

5) Find an equation of the line whose slope is 3 and y-intercept 5.

6) Find an equation of the line whose x-intercept is 2 and y-intercept 3.

7) Find an equation of the line that has slope 3 and passes through the point (2, 15).

8) Find an equation of the line that has slope –3/2 and passes through the point (4, 3).

9) Find an equation of the line that passes through the points (0, 32) and (100, 212).

10) Find an equation of the line that passes through the point (2, 5) and is parallel to the line y = 3x + 4.

11) Find the point of intersection of the lines 2x – 3y = 9 and 3x + 4y = 5.

12) Is the point (3, – 2) on the line 5x – 2y = 11?

13) Find two points on the line given by the parametric equations, x = 2 + 3t, y = 1 – 2t.

14) Find two points on the line 2x – 6 = 0.

15) Graph the line 2x – 3y + 6 = 0.

16) Graph the line y = – 2x + 3.

17) A female college student who is 60 inches tall weighs 100 pounds. Another female student who is 66 inches tall weighs 124 pounds. Assume the relationship between the female students' weights and heights is linear. Find an equation for weight as a function of height. Use this relationship to predict the weight of a female student who is 70 inches tall.

18) In deep-sea diving, the pressure exerted by water plays a great role in designing underwater equipment. If at a depth of 10 feet there is a pressure of 21 lb/in2, and at a depth of 50 ft there is a pressure of 75 lb/in2, write a linear equation giving a relationship between depth and pressure. Use this relationship to predict pressure at a depth of 100 ft.

19) The variable cost to manufacture an item is $30 per item; the fixed costs are $2750. Find the cost function.

20) The variable cost to manufacture an item is $10 per item, and it costs $2,500 to produce 100 items. Write the cost function, and use this function to estimate the cost of manufacturing 300 items.

21) It costs $2,700 to manufacture 100 items of a product, and $4,200 to manufacture 200 items.   
x= the number of items; y= cost. Find the cost function; use it to predict the cost to produce 1000 items.

22) In 1990, the average house in Emerald City cost $280,000 and in 2007 the same house cost $365,000. Assuming a linear relationship, write an equation that will give the price of the house in any year, and use this equation to predict the price of a similar house in the year 2020.

23) The population of Mexico in 1995 was 95.4 million and in 2010 it was 117.9 million. Assuming a linear relationship, write an equation that will give the population of Mexico in any year, and use this equation to predict the population of Mexico in the year 2025.

***SECTION 1.6 PROBLEM SET: CHAPTER REVIEW***

24) At Nuts for Soup Lunch Bar, they sell 150 bowls of soup if the high temperature for the day is 40 ºF. For every 5 ºF increase in high temperature for the day, they sell 10 fewer bowls of soup.

a. Assuming a linear relationship, write an equation that will give y = the number of bowls of soup sold as a function of x = the daily high temperature.

b. How many bowls of soup are sold when the temperature is 75 ºF?

c. What is the temperature when 100 bowls of soup are sold?

25) Two-hundred items are demanded at a price of $5, and 300 items are demanded at a price of $3. If x represents the price, and y the number of items, write the demand function.

26) A supply curve for a product is the number of items of the product that can be made available at different prices. A doll manufacturer can supply 2000 dolls if the dolls are sold for $30 each, but he can supply only 400 dolls if the dolls are sold for $10 each. If x represents the price of dolls and y the number of items, write an equation for the supply curve.

27) Suppose you are trying to decide on a price for your latest creation - a coffee mug that never tips. Through a survey, you have determined that at a price of $2, you can sell 2100 mugs, but at a price of $12 you can only sell 100 mugs. Furthermore, your supplier can supply you 3100 mugs if you charge your customers $12, but only 100 mugs if you charge $2. What price should you charge so that the supply equals demand, and at that price how many coffee mugs will you be able to sell?

28) A car rental company offers two plans. Plan I charges $16 a day and 25 cents a mile, while Plan II charges $45 a day but no charge for miles. If you were to drive 200 miles in a day, which plan is better? For what mileage are both rates the same?

29) The supply curve for a product is y = 250x – 1000. The demand curve for the same product is   
y = – 350x + 8,000, where x is the price and y the number of items produced. Find the following.

a) At a price of $10, how many items will be in demand?

b) At what price will 4,000 items be supplied?

c) What is the equilibrium price for this product?

d) How many items will be manufactured at the equilibrium price?

30) The supply curve for a product is y = 625x – 600 and the demand curve for the same product is   
y = – 125x + 8,400, where x is the price and y the number of items produced.   
Find the equilibrium price and determine the number of items that will be produced at that price.

31) Both Jenny and Masur work in the sales department for Sports Supply. Jenny gets paid $120 per day plus 4% commission on the sales. Masur gets paid $132 per day plus 8% commission on the sales in excess of $1,000. For what sales amount would they both earn the same dailyamounts?

32) A company's revenue and cost in dollars are given by R = 25x and C = 10x + 9,000, where x represents the number of items. Find the number of items that must be produced to break-even.

33) A firm producing a certain type of CFL lightbulb has fixed costs of $6,800, and a variable cost of $2.30 per bulb. The bulbs sell for $4 each. How many bulbs must be produced to break-even?

34) A company producing tire pressure gauges has fixed costs of $7,500, and variable cost of $1.50 cents per item. If the gauges sell for $4.50, how many must be produced to break-even?

35) A company is introducing a new cordless travel shaver before the Christmas holidays. It hopes to sell 15,000 of these shavers in December. The variable cost is $11 per item and the fixed costs $100,000. If the shavers sell for $19 each, how many must be produced and sold to break-even?