## Section 1.3

## Linear Function

A linear function is one that can be written in the form

$$
f(x)=m x+b \quad \text { or } \quad y=m x+b
$$

where $m$ is the slope and $b$ is the $y$-intercept (when $x=0$ ) of the linear function.

## The Slope $m$

The slope of a line between two points $\left(x_{1}, y_{1}\right)$ and $\left(x_{2}, y_{2}\right)$ is given by the following formula:

$$
m=\frac{\text { change in } y}{\text { change in } x}=\frac{\text { rise }}{\text { run }}=\frac{\Delta y}{\Delta x}=\frac{y_{2}-y_{1}}{x_{2}-x_{1}}
$$

## Finding the Intercepts

The $x$-intercept of a line is where it crosses the $x$-axis. To find it, set $y=0$ and solve for $x$. The $y$ intercept is where it crosses the $y$-axis. To find it, set $x=0$ and solve for $y$. If the equation of the line is $y=m x+b$ then $b$ is the $y$-intercept.

Problem 1. Find $f(0)$, and then find the equation of the given linear function.

| $x$ | 1 | 2 | 3 | 4 |
| :---: | :---: | :---: | :---: | :---: |
| $f(x)$ | 2 | 5 | 8 | 11 |

Problem 2. Decide which of the two given functions is linear.

| $x$ | 0 | 3 | 5 | 6 | 9 |
| :---: | :---: | :---: | :---: | :---: | :---: |
| $f(x)$ | 2 | 6 | 9 | 12 | 15 |
| $g(x)$ | -1 | 8 | 14 | 17 | 26 |

Problem 3. Find the slope of the given line, if it is defined. Graph the equation.
a) $y=\frac{2}{3} x+4$
b) $6 x-3 y=1$
c) $3 x+1=0$
d) $3 y+1=0$

Problem 4. Find a linear equation whose graph is the straight line with the given properties.
a) Through $(1,3)$ with slope 3
b) Through $\left(\frac{1}{2}, 1\right)$ and $\left(-\frac{1}{2}, \frac{3}{4}\right)$
c) Through $\left(\frac{1}{3},-1\right)$ and parallel to the line $3 x-4 y=8$

Problem 5. The RideEm Bicycles factory can produce 100 bicycles in a day at a total cost of $\$ 10,500$ and it can produce 120 bicycles a day at a total cost of $\$ 11,000$. What are the company's daily fixed costs, and what is the marginal cost per bicycle?

Problem 6. The following table shows worldwide sales of Nokia cell phones and their average wholesale process in 2004.

| Quarter | Second | Fourth |
| ---: | :---: | :---: |
| Wholesale Price (\$) | 111 | 105 |
| Sales (millions) | 45.4 | 51.4 |

a) Use the data to obtain a linear demand function for (Nokia) cell phones, and use your demand equation to predict sales if Nokia lowered the price further to $\$ 103$.
b) Fill in the blanks: For every $\qquad$ increase in price, sales of cell phones decrease by $\qquad$ units.

Problem 7. You can sell 90 pet chias per week if they are marked at $\$ 1$ each, but only 30 each week if they are marked at $\$ 2$ per chia. Your chia supplier is prepared to sell you 20 chias each week if they are marked at $\$ 1 /$ chia, and 100 each week if they are marked at $\$ 2$ per chia.
a) Write down the associated linear demand and supply functions.
b) At what price should the chias be marked so that there is neither a surplus nor a shortage of chias?

Problem 8. The position of a model train, in feet along a railroad track, is given by

$$
s(t)=2.5 t+10
$$

after $t$ seconds.
a) How fast is the train moving?
b) Where is the train after 4 seconds?
c) When will it be 25 feet along the track?

Homework for this section: Read the section and watch the videos/tutorials. Then do these problems in preparation for the quiz: \#1, 7, 10, 13, 23, 31, 43, 63, 68, 80, 86, 94

