

Section 1.3

Linear Function

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

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

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 (x_1, y_1) and (x_2, y_2) 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 $y = mx + b$ 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) $6x - 3y = 1$

c) $3x + 1 = 0$

d) $3y + 1 = 0$

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 $(\frac{1}{2}, 1)$ and $(-\frac{1}{2}, \frac{3}{4})$

c) Through $(\frac{1}{3}, -1)$ and parallel to the line $3x - 4y = 8$

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.

| <i>Quarter</i> | <i>Second</i> | <i>Fourth</i> |
|-----------------------------|---------------|---------------|
| 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 _____ increase in price, sales of cell phones decrease by _____ units.

