## 3.2 Graphs of Functions

21. $f(x) = -x^3 + 4x - 2$

Maximum: 1.15

Minimum: -1.15

Interval increasing: $(-1.15, 1.15)$

Interval decreasing: $(-\infty, -1.15) \cup (1.15, \infty)$

Inflection point: 0

Concave up: $(-\infty, 0)$

Concave down: $(0, \infty)$

Constants: —

22. $f(x) = 2x^3 - 6x + 5$

Maximum: $-1$ $-.9999$

Minimum: $1$ $.9999$

Interval increasing: $(-\infty, -1) \cup (1, \infty)$

Interval decreasing: $(-1, 1)$

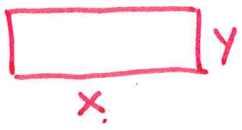
Inflection point: 0

Concave up: $(0, \infty)$

Concave down: $(-\infty, 0)$

Constants: —

**29. a.** A rectangle has a perimeter of 100 inches, and one side has length $x$. Express the area of the rectangle as a function of $x$.




$P = 2x + 2y$

$100 = 2x + 2y$

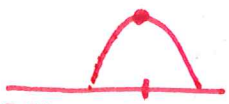
$\frac{100}{2} - \frac{2x}{2} = \frac{2y}{2}$

**b.** Use the function in part a to find the dimensions of the rectangle with perimeter 100 inches and the largest possible area.

$A = xy$

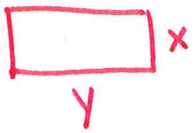
$y = (50 - x)$

a) $A = x(50 - x)$



$x = 25$ $y = 25$ 25

**30. a.** A rectangle has an area of 240 in$^2$, and one side has length $x$. Express the perimeter of the rectangle as a function of $x$.




$A = xy$

$240 = xy$

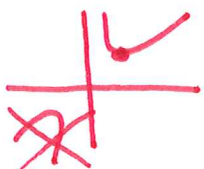
$\left(\frac{240}{x}\right) = y$

$P = 2x + 2y$

$P = 2x + 2\left(\frac{240}{x}\right)$

**b.** Use the function in part a to find the dimensions of the rectangle with area 240 in$^2$ and the smallest possible perimeter.

$x = 15.49$



**31. a.** A box with a square base has a volume of 867 in$^3$. Express the surface area of the box as a function of the length $x$ of a side of the base. (Be sure to include the top of the box.)

$V = x^2 y$

$867 = x^2 y$

$867/x^2 = y$

$SA = 2x^2 + 4xy$

$= 2x^2 + 4x\left(\frac{867}{x^2}\right)$

9.53

**b.** Use the function in part a to find the dimensions of the box with volume 867 in$^3$ and the smallest possible surface area.

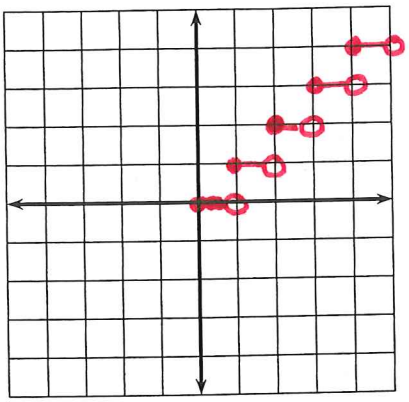
A function whose graph consists of horizontal line segments, such as Figure 3.2-15, is called a **step function.** Step functions can be graphed on a calculator, but some features of their graphs may not be shown.

**Technology Tip**

To change to dot mode, select DOT or DRAW-DOT in the TI-83 MODE menu, the FORMT submenu of the TI-86 GRAPH menu, the STYLE submenu of the TI-89 Y = menu, or the STYLE! submenu of the Sharp 9600 FORMAT menu. In the Casio 9850 SETUP menu, set the DRAWTYPE to PLOT. In the HP-38 PLOT SETUP menu, uncheck CONNECT on the second screen.

**Example 8** The Greatest Integer Function

Graph the greatest integer function $f(x) = [x]$.

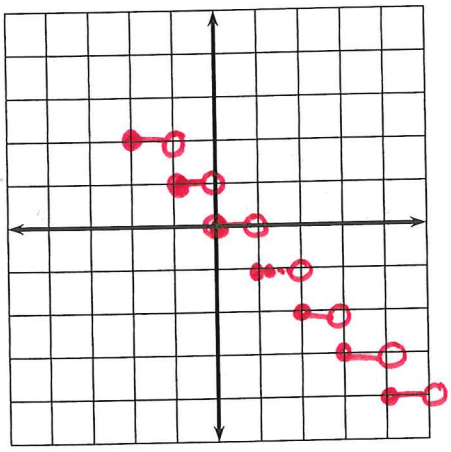


| x | y |
|---|---|
| 0 | 0 |
| .1 | 0 |
| .9 | 0 |
| 1 | 1 |
| 1.1 | 1 |
| 1.9 | 1 |
| 2 | 2 |
| 2.1 | 2 |
| 2.9 | 2 |

**In Exercises 50–53, sketch the graph of the function. Be sure to indicate which endpoints are included and which are excluded.**

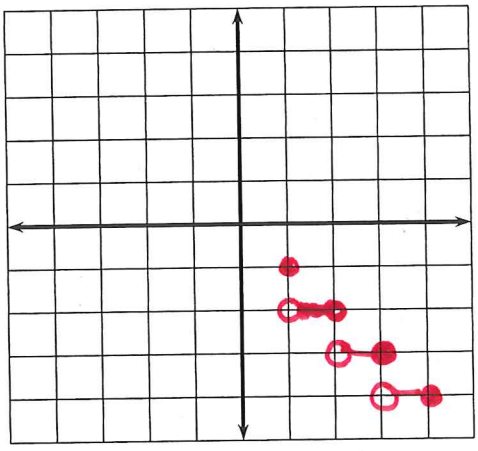
**50.** $f(x) = -[x]$

| x | y |
|---|---|
| 1 | -1 |
| 1.1 | -1 |
| 1.9 | -1 |
| 2 | -2 |
| 2.1 | -2 |
| 2.9 | -2 |
| 3 | -3 |
| 3.1 | -3 |
| 3.9 | -3 |



**51.** $g(x) = [-x]$

| x | y |
|---|---|
| 1 | -1 |
| 1.1 | -2 |
| 1.9 | -2 |
| 2 | -2 |
| 2.1 | -3 |
| 2.9 | -3 |
| 3 | -3 |
| 3.1 | -4 |
| 3.9 | -4 |



**53.** $f(x) = 2[x]$

| x | y |
|---|---|
| 1 | 2 |
| 1.1 | 2 |
| 1.9 | 2 |
| 2 | 4 |
| 2.1 | 4 |
| 2.9 | 4 |
| 3 | 6 |
| 3.1 | 6 |
| 3.9 | 6 |