

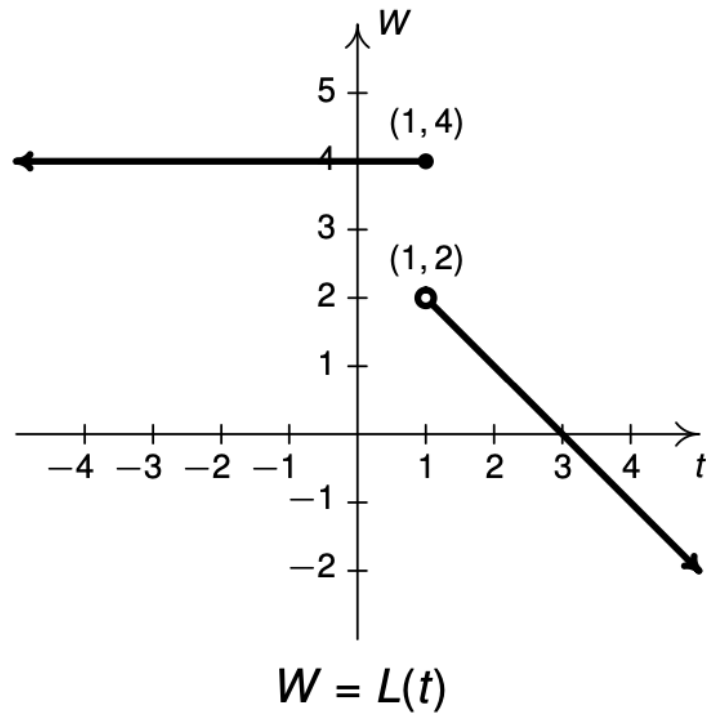
**Example 1.2.3.** The cost, in dollars, to produce  $x$  PortaBoy<sup>11</sup> game systems for a local retailer is given by  $C(x) = 80x + 150$  for  $x \geq 0$ .

1. Find and interpret  $C(0)$  and  $C(5)$  and use these to graph  $y = C(x)$ .
2. Explain the significance of the restriction on the domain,  $x \geq 0$ .
3. Interpret the slope of  $y = C(x)$  geometrically and as a rate of change.
4. How many PortaBoys can be produced for \$15,000?

**Example 1.2.4.** The local retailer in Example 1.2.3 is trying to mathematically model the relationship between the number of PortaBoy systems sold and the price per system. Suppose 20 systems were sold when the price was \$220 per system but when the systems went on sale for \$190 each, sales doubled.

1. Find a formula for a linear function  $p$  which represents the price  $p(x)$  as a function of the number of systems sold,  $x$ . Graph  $y = p(x)$ , find and interpret the intercepts, and determine a reasonable domain for  $p$ .
2. Interpret the slope of  $p(x)$  in terms of price and game system sales.
3. If the retailer wants to sell 150 PortaBoys next week, what should the price be?
4. How many systems would sell if the price per system were set at \$150?

**Example 1.2.5.** Find a formula for the function  $L$  graphed below.



## 1.2.5 Exercises

In Exercises 1 - 6, graph the function. Find the slope and axis intercepts, if any.

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

2.  $g(t) = 3 - t$

3.  $F(w) = 3$

4.  $G(s) = 0$

5.  $h(t) = \frac{2}{3}t + \frac{1}{3}$

6.  $j(w) = \frac{1 - w}{2}$

In Exercises 7 - 10, graph the function. Find the domain, range, and axis intercepts, if any.

7.  $f(x) = \begin{cases} 4 - x & \text{if } x \leq 3 \\ 2 & \text{if } x > 3 \end{cases}$

8.  $g(x) = \begin{cases} 2 - x & \text{if } x < 2 \\ x - 2 & \text{if } x \geq 2 \end{cases}$

9.  $F(t) = \begin{cases} -2t - 4 & \text{if } t < 0 \\ 3t & \text{if } t \geq 0 \end{cases}$

10.  $G(t) = \begin{cases} -3 & \text{if } t < 0 \\ 2t - 3 & \text{if } 0 < t < 3 \\ 3 & \text{if } t > 3 \end{cases}$

17. An on-line comic book retailer charges shipping costs according to the following formula

$$S(n) = \begin{cases} 1.5n + 2.5 & \text{if } 1 \leq n \leq 14 \\ 0 & \text{if } n \geq 15 \end{cases}$$

where  $n$  is the number of comic books purchased and  $S(n)$  is the shipping cost in dollars.

- (a) What is the cost to ship 10 comic books?
- (b) What is the significance of the formula  $S(n) = 0$  for  $n \geq 15$ ?

18. The cost in dollars  $C(m)$  to talk  $m$  minutes a month on a mobile phone plan is modeled by

$$C(m) = \begin{cases} 25 & \text{if } 0 \leq m \leq 1000 \\ 25 + 0.1(m - 1000) & \text{if } m > 1000 \end{cases}$$

- (a) How much does it cost to talk 750 minutes per month with this plan?
- (b) How much does it cost to talk 20 hours a month with this plan?
- (c) Explain the terms of the plan verbally.

19. Jeff can walk comfortably at 3 miles per hour. Find an expression for a linear function  $d(t)$  that represents the total distance Jeff can walk in  $t$  hours, assuming he doesn't take any breaks.

20. Carl can stuff 6 envelopes per *minute*. Find an expression for a linear function  $E(t)$  that represents the total number of envelopes Carl can stuff after  $t$  hours, assuming he doesn't take any breaks.

21. A landscaping company charges \$45 per cubic yard of mulch plus a delivery charge of \$20. Find an expression for a linear function  $C(x)$  which computes the total cost in dollars to deliver  $x$  cubic yards of mulch.

22. A plumber charges \$50 for a service call plus \$80 per hour. If she spends no longer than 8 hours a day at any one site, find an expression for a linear function  $C(t)$  that computes her total daily charges in dollars as a function of the amount of time spent in hours,  $t$  at any one given location.

23. A salesperson is paid \$200 per week plus 5% commission on her weekly sales of  $x$  dollars. Find an expression for a linear function  $W(x)$  which computes her total weekly pay in dollars as a function of  $x$ . What must her weekly sales be in order for her to earn \$475.00 for the week?

29. In response to the economic forces in Exercise 28 above, the local retailer sets the selling price of a PortaBoy at \$250. Remarkably, 30 units were sold each week. When the systems went on sale for \$220, 40 units per week were sold. Rework Example 1.2.4 with this new data.
30. A local pizza store offers medium two-topping pizzas delivered for \$6.00 per pizza plus a \$1.50 delivery charge per order. On weekends, the store runs a 'game day' special: if six or more medium two-topping pizzas are ordered, they are \$5.50 each with no delivery charge. Write a piecewise-defined linear function which calculates the cost in dollars  $C(p)$  of  $p$  medium two-topping pizzas delivered during a weekend.
31. A restaurant offers a buffet which costs \$15 per person. For parties of 10 or more people, a group discount applies, and the cost is \$12.50 per person. Write a piecewise-defined linear function which calculates the total bill  $T(n)$  of a party of  $n$  people who all choose the buffet.
32. A mobile plan charges a base monthly rate of \$10 for the first 500 minutes of air time plus a charge of 15¢ for each additional minute. Write a piecewise-defined linear function which calculates the monthly cost in dollars  $C(m)$  for using  $m$  minutes of air time.

**HINT:** You may wish to refer to number 18 for inspiration.

33. The local pet shop charges 12¢ per cricket up to 100 crickets, and 10¢ per cricket thereafter. Write a piecewise-defined linear function which calculates the price in dollars  $P(c)$  of purchasing  $c$  crickets.