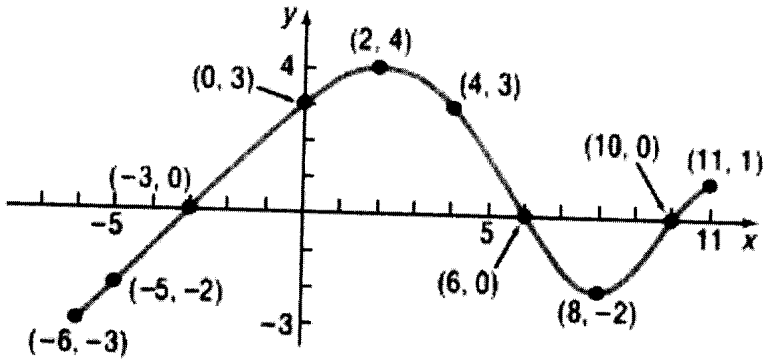
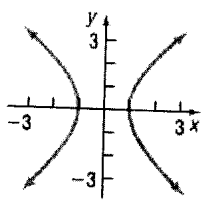
9. Use the given graph of the function f to answer parts (a)–(o).



(a) Find $f(0)$ and $f(-6)$. $f(0) = 3$, $f(-6) = -3$
(b) Find $f(6)$ and $f(11)$. $f(6) = 0$, $f(11) = 1$
(c) Is $f(3)$ positive or negative? $f(3)$ is positive
(d) Is $f(-4)$ positive or negative? $f(-4)$ is negative
(e) For what values of x is $f(x) = 0$? $f(x) = 0$ when $x = -3, 6, 10$
(f) For what values of x is $f(x) > 0$? $f(x) > 0$ for $x \in (-3, 6) \cup (10, 11]$
(g) What is the domain of f? $\mathcal{D}(f) = [-6, 11]$
(h) What is the range of f? $\mathcal{R}(f) = [-3, 4]$
(i) What are the x-intercepts? x-intercepts are $(-3, 0), (6, 0), (10, 0)$
(j) What is the y-intercept? y-intercept is $(0, 3)$
(k) How often does the line $y = \frac{1}{2}$ intersect the graph? Three times
(l) How often does the line $x = 5$ intersect the graph? Once
(m) For what values of x does $f(x) = 3$? $f(x) = 3 \Rightarrow x \in \{0, 4\}$
(n) For what values of x does $f(x) = -2$? $f(x) = -2 \Rightarrow x \in \{-5, 8\}$
(o) What are the zeros of f? Zeros of f are $x = -3, 6, 10$

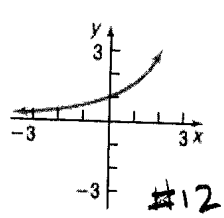
In Problems 11–22, determine whether the graph is that of a function by using the vertical-line test. If it is, use the graph to find:
(a) *The domain and range*
(b) *The intercepts, if any*
(c) *Any symmetry with respect to the x-axis, the y-axis, or the origin*

11.



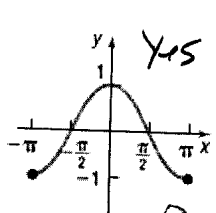
No

12.



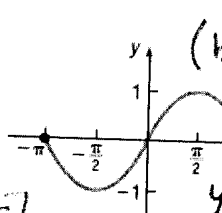
#12
Yes
(a) $\mathcal{D} = \mathbb{R}$
$\mathcal{R} = (0, \infty)$
(b) y-int: $(0, 1)$
(c) No symmetry

13.



Yes
(a) $\mathcal{D} = [-\pi, \pi]$
$\mathcal{R} = [-1, 1]$
(b) x-int: $(-\frac{\pi}{2}, 0), (\frac{\pi}{2}, 0)$
y-int: $(0, 1)$
(c) Symm. w.r.t. y-axis.

14.



(b) x-int: $(-\pi, 0), (0, 0), (\pi, 0)$
y-int: $(0, 0)$
(c) w.r.t. origin

14 Yes
(a) $\mathcal{D} = [-\pi, \pi]$
$\mathcal{R} = [-1, 1]$

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

(a) Is the point $(-1, 2)$ on the graph of f?
(b) If $x = -2$, what is $f(x)$? What point is on the graph of f?
(c) If $f(x) = -1$, what is x? What point(s) are on the graph of f?
(d) What is the domain of f?
(e) List the x-intercepts, if any, of the graph of f.
(f) List the y-intercept, if there is one, of the graph of f.
(g) What are the zeros of f?

(a) $f(-1) = 2(-1)^2 - (-1) - 1$

$= 2 + 1 - 1 = 2 \rightsquigarrow$

$\rightsquigarrow$ $\boxed{(-1, 2) \text{ IS}}$

(b) $x = -2 \Rightarrow f(x) =$

$= f(-2) = 2(-2)^2 - (-2) - 1$

$= 2(4) + 2 - 1$

$= 8 + 1 = \boxed{9 = f(x) \text{ when } x = -2}$

(c) $f(x) = -1 \Rightarrow$

$2x^2 - x - 1 = -1 \Rightarrow$

$2x^2 - x = 0 \Rightarrow$

$x(2x - 1) = 0 \Rightarrow$

$x = 0 \quad \text{OR} \quad 2x - 1 = 0$

$\Rightarrow \boxed{x \in \{0, \tfrac{1}{2}\}}$

(d) $\boxed{\mathcal{D} = \mathbb{R} = (-\infty, \infty)}$

(e) x-intercepts:

Solve $f(x) = 0 \Rightarrow$

$2x^2 - x - 1 = 0 \Rightarrow$

$(2x + 1)(x - 1) = 0 \Rightarrow$

$2x + 1 = 0 \quad \text{OR} \quad x - 1 = 0$

$\Rightarrow x = -\tfrac{1}{2} \quad \text{OR} \quad x = 1 \Rightarrow$

$\boxed{(-\tfrac{1}{2}, 0), (1, 0)}$

(f) y-intercept:

$f(0) = -1 \rightsquigarrow \boxed{(0, -1)}$

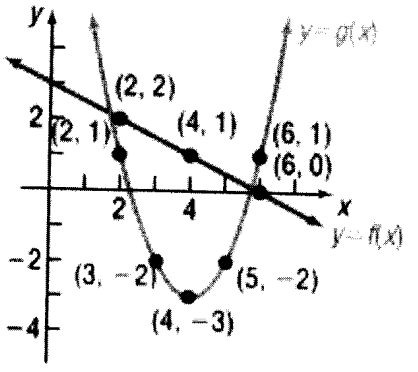
(g) Zeros of f are

$\boxed{x = -\tfrac{1}{2}, 1}$ OR

$x \in \{-\tfrac{1}{2}, 1\}$

(See part (e))

33. The graph of two functions, f and g, is shown below. Use the graph to answer parts (a)–(f).



(a) $(f + g)(2)$

(b) $(f + g)(4)$

(c) $(f - g)(6)$

(d) $(g - f)(6)$

(e) $(f \cdot g)(2)$

(f) $\left(\frac{f}{g}\right)(4)$

(c) $(f-g)(6)$

$= f(6) - g(6)$

$= 0 - 1$

$= -1 = (f-g)(6)$

(d) $(g-f)(6) = +1$ (see (e))

(e) $(f-g)(2)$

$= f(2) \cdot g(2)$

$= (2)(1) = 2 = (f-g)(2)$

(a) $(f+g)(2)$

$= f(2) + g(2)$

$= 2 + 1 =$

$= 3 = (f+g)(2)$

(b) $(f+g)(4)$

$= f(4) + g(4)$

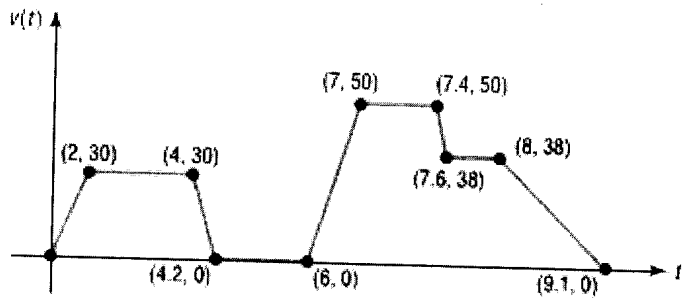
$= 1 + -3$

$= -2 = (f+g)(4)$

$(f)\left(\frac{f}{g}\right)(4) =$

$= \frac{f(4)}{g(4)} = \frac{1}{-3} = -\frac{1}{3} = \left(\frac{f}{g}\right)(4)$

42. The following sketch represents the speed v (in miles per hour) of Michael's car as a function of time t (in minutes).



(a) Over what interval of time is Michael traveling fastest?
(b) Over what interval(s) of time is Michael's speed zero?
(c) What is Michael's speed between 0 and 2 minutes?
(d) What is Michael's speed between 4.2 and 6 minutes?
(e) What is Michael's speed between 7 and 7.4 minutes?
(f) When is Michael's speed constant?

(a) $[7, 7.4]$

(b) $[4.2, 6]$

(c) It's increasing from zero to 30

$(x_1, y_1) = (0, 0)$

$(x_2, y_2) = (2, 30)$

$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{30}{2} = 15$,

$y = m(x - x_1) + y_1$

$= 15(x - 0) + 0$

$= 15x$

$y = 15x$ $(y = 15t)$ is the function that describes V on this interval.

(d) 0 Mph

(e) 50 mph

(f) Speed is constant over $[2, 4]$, $[4.2, 6]$, $[7, 7.4]$, $[7.6, 8]$