1.1

2. (a) The point $(-4,-2)$ is on the graph of f, so $f(-4)=-2$. The point $(3,4)$ is on the graph of g, so $g(3)=4$.

(b) We are looking for the values of x for which the y-values are equal. The y-values for f and g are equal at the points $(-2,1)$ and $(2,2)$, so the desired values of x are -2 and 2.

(c) $f(x)=-1$ is equivalent to $y=-1$. When $y=-1$, we have $x=-3$ and $x=4$.

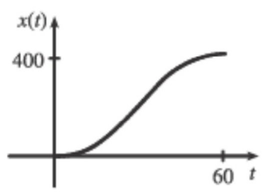
(d) As x increases from 0 to 4, y decreases from 3 to -1. Thus, f is decreasing on the interval $[0,4]$.

(e) The domain of f consists of all x-values on the graph of f. For this function, the domain is $-4\le x\le 4$, or $[-4,4]$. The range of f consists of all y-values on the graph of f. For this function, the range is $-2\le y\le 3$, or $[-2,3]$.

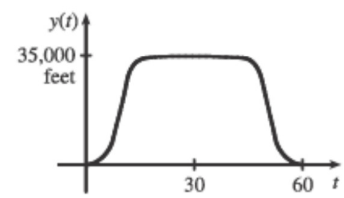
(f) The domain of g is $[-4,3]$ and the range is $[0.5,4]$.

10. The salesman travels away from home from 8 to 9 AM and is then stationary until 10:00. The salesman travels farther away from 10 until noon. There is no change in his distance from home until 1:00, at which time the distance from home decreases until 3:00. Then the distance starts increasing again, reaching the maximum distance away from home at 5:00. There is no change from 5 until 6, and then the distance decreases rapidly until 7:00 PM, at which time the salesman reaches home.

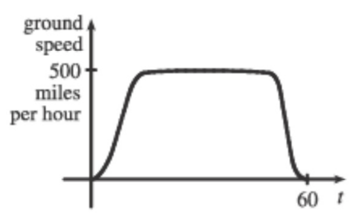
18. (a)



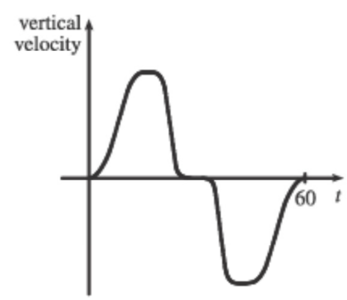
(b)



(c)



(d)



24. $f(x)=x^3$, so $f(a+h)=(a+h)^3=a^3+3a^2h+3ah^2+h^3$,

and $\dfrac{f(a+h)-f(a)}{h}=\dfrac{(a^3+3a^2h+3ah^2+h^3)-a^3}{h}=\dfrac{h(3a^2+3ah+h^2)}{h}=3a^2+3ah+h^2$.

28. $f(x)=(5x+4)/(x^2+3x+2)$ is defined for all x except when $0=x^2+3x+2 \;\Leftrightarrow\; 0=(x+2)(x+1) \;\Leftrightarrow\; x=-2$ or -1, so the domain is $\{x\in\mathbb{R}\mid x\ne -2,-1\}=(-\infty,-2)\cup(-2,-1)\cup(-1,\infty)$.

1.2

4. (a) The graph of $y=3x$ is a line (choice G).

(b) $y=3^x$ is an exponential function (choice f).

(c) $y=x^3$ is an odd polynomial function or power function (choice F).

(d) $y=\sqrt[3]{x}=x^{1/3}$ is a root function (choice g).

8. The vertex of the parabola on the left is $(3, 0)$, so an equation is $y = a(x-3)^2 + 0$. Since the point $(4, 2)$ is on the parabola, we'll substitute 4 for x and 2 for y to find a. $2 = a(4-3)^2 \Rightarrow a = 2$, so an equation is $f(x) = 2(x-3)^2$.

The y-intercept of the parabola on the right is $(0, 1)$, so an equation is $y = ax^2 + bx + 1$. Since the points $(-2, 2)$ and $(1, -2.5)$ are on the parabola, we'll substitute -2 for x and 2 for y as well as 1 for x and -2.5 for y to obtain two equations with the unknowns a and b.

$$(-2, 2): \quad 2 = 4a - 2b + 1 \Rightarrow 4a - 2b = 1 \qquad \textbf{(1)}$$

$$(1, -2.5): \quad -2.5 = a + b + 1 \Rightarrow a + b = -3.5 \qquad \textbf{(2)}$$

$2 \cdot$ **(2)** + **(1)** gives us $6a = -6 \Rightarrow a = -1$. From **(2)**, $-1 + b = -3.5 \Rightarrow b = -2.5$, so an equation is $g(x) = -x^2 - 2.5x + 1$.

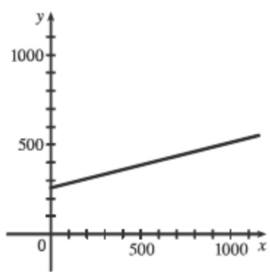
18. (a) Using d in place of x and C in place of y, we find the slope to be $\dfrac{C_2 - C_1}{d_2 - d_1} = \dfrac{460 - 380}{800 - 480} = \dfrac{80}{320} = \dfrac{1}{4}$.

So a linear equation is $C - 460 = \frac{1}{4}(d - 800) \Leftrightarrow C - 460 = \frac{1}{4}d - 200 \Leftrightarrow C = \frac{1}{4}d + 260$.

(b) Letting $d = 1500$ we get $C = \frac{1}{4}(1500) + 260 = 635$.

The cost of driving 1500 miles is \$635.

(c)



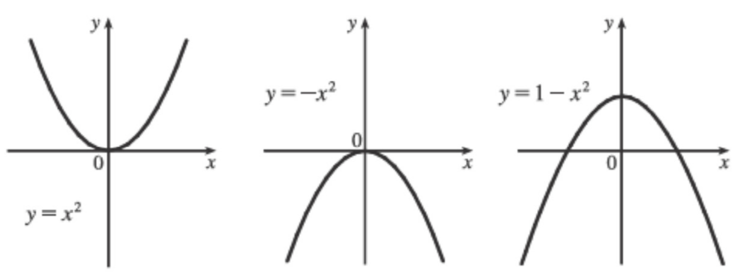
The slope of the line represents the cost per mile, \$0.25.

(d) The y-intercept represents the fixed cost, \$260.

(e) A linear function gives a suitable model in this situation because you have fixed monthly costs such as insurance and car payments, as well as costs that increase as you drive, such as gasoline, oil, and tires, and the cost of these for each additional mile driven is a constant.

1.3

10. $y = 1 - x^2 = -x^2 + 1$: Start with the graph of $y = x^2$, reflect about the x-axis, and then shift 1 unit upward.



50. (a) $f(g(1)) = f(6) = 5$

(b) $g(f(1)) = g(3) = 2$

(c) $f(f(1)) = f(3) = 4$

(d) $g(g(1)) = g(6) = 3$

(e) $(g \circ f)(3) = g(f(3)) = g(4) = 1$

(f) $(f \circ g)(6) = f(g(6)) = f(3) = 4$

54. (a) The radius r of the balloon is increasing at a rate of 2 cm/s, so $r(t) = (2 \text{ cm/s})(t \text{ s}) = 2t$ (in cm).

(b) Using $V = \frac{4}{3}\pi r^3$, we get $(V \circ r)(t) = V(r(t)) = V(2t) = \frac{4}{3}\pi(2t)^3 = \frac{32}{3}\pi t^3$.
The result, $V = \frac{32}{3}\pi t^3$, gives the volume of the balloon (in cm^3) as a function of time (in s).

60. If $A(x) = 1.04x$, then

$(A \circ A)(x) = A(A(x)) = A(1.04x) = 1.04(1.04x) = (1.04)^2 x$,

$(A \circ A \circ A)(x) = A((A \circ A)(x)) = A((1.04)^2 x) = 1.04(1.04)^2 x = (1.04)^3 x$, and

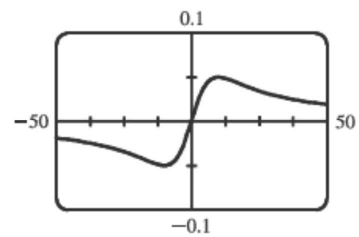
$(A \circ A \circ A \circ A)(x) = A((A \circ A \circ A)(x)) = A((1.04)^3 x) = 1.04(1.04)^3 x, = (1.04)^4 x$.

These compositions represent the amount of the investment after 2, 3, and 4 years.

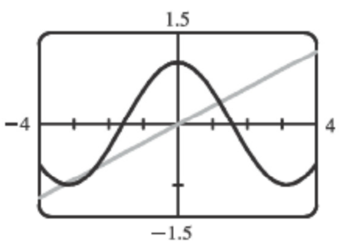
Based on this pattern, when we compose n copies of A, we get the formula $\underbrace{(A \circ A \circ \cdots \circ A)}_{n\ A\text{'s}}(x) = (1.04)^n x$.

1.4

8. The graph of $f(x) = x/(x^2 + 100)$ is symmetric with respect to the origin.



22. (a)



The x-coordinates of the three points of intersection are $x \approx -3.29, -2.36$ and 1.20.

(b) Using trial and error, we find that $m \approx 0.3365$. Note that m could also be negative.

26. $P(x) = 3x^5 - 5x^3 + 2x$, $Q(x) = 3x^5$. These graphs are significantly different only in the region close to the origin. The larger a viewing rectangle one chooses, the more similar the two graphs look.