

Practice 4.1, page 306

1. (a) $2(x^2 - 3x)$ (b) $3\left(x^2 + \frac{2}{3}x\right)$ (c) $-4\left(x^2 - \frac{1}{2}x\right)$
 (d) $\frac{1}{2}(x^2 - 10x)$ (e) $-1.2(x^2 - 5.5x)$ (f) $\frac{2}{3}\left(x^2 + \frac{5}{4}x\right)$
 (g) $-\frac{4}{3}\left(x^2 + \frac{3}{2}x\right)$ (h) $2.7\left(x^2 - \frac{1}{3}x\right)$ (i) $-6\left(x - \frac{1}{10}x\right)$
2. (a) $\frac{9}{4}$ (b) $\frac{49}{4}$ (c) $\frac{1}{9}$
 (d) $\frac{9}{100}$ (e) 1.5625 (f) 0.050 625
 (g) 125.44 (h) $\frac{25}{324}$ (i) $d = 2.5 \times 10^{-5}$
3. (a) $f(x) = \left(x - \frac{3}{2}\right)^2 - \frac{1}{4}$ (b) $f(x) = (x + 3)^2 - 17$
 (c) $f(x) = 3\left(x - \frac{2}{3}\right)^2 - \frac{1}{3}$ (d) $f(x) = \left(x - \frac{1}{2}\right)^2 - \frac{1}{4}$
 (e) $f(x) = \left(x + \frac{3}{2}\right)^2 + \frac{11}{4}$ (f) $f(x) = -\left(x - \frac{5}{2}\right)^2 + \frac{17}{4}$
 (g) $f(x) = (x - 1.3)^2 - 4.39$ (h) $f(x) = (x + 2.7)^2 - 9.09$
 (i) $f(x) = (x - 1.7)^2 - 5.69$
4. $g(x) = 2\left(x + \frac{5}{4}\right)^2 + \frac{7}{8}$
5. (a) $f(x) = \left(x - \frac{3}{2}\right)^2 - \frac{1}{4}$ (b) $f(x) = 2\left(x + \frac{5}{4}\right)^2 - \frac{57}{8}$
 (c) $f(x) = 3\left(x - \frac{2}{3}\right)^2 - \frac{1}{3}$ (d) $f(x) = 5\left(x - \frac{1}{10}\right)^2 - \frac{101}{20}$
 (e) $f(x) = -2\left(x - \frac{3}{4}\right)^2 + \frac{49}{8}$ (f) $f(x) = -4\left(x + \frac{7}{8}\right)^2 + \frac{17}{16}$
 (g) $f(x) = 1.4(x - 1.75)^2 - 6.9875$
 (h) $f(x) = -3.6(x - 0.75)^2 + 0.355$
 (i) $f(x) = \frac{1}{2}(x - 4)^2 - 7$ (j) $f(x) = \frac{2}{3}\left(x - \frac{15}{4}\right)^2 - \frac{91}{8}$
 (k) $f(x) = -\frac{3}{2}\left(x + \frac{7}{24}\right)^2 + \frac{241}{384}$
 (l) $f(x) = -\frac{4}{5}\left(x - \frac{5}{12}\right)^2 - \frac{29}{180}$
6. (a) $f(x) = (x + 5)^2 - 1$; vertex: $(-5, -1)$; $D = \{x \mid x \in \mathbf{R}\}$,
 $R = \{y \mid y \geq -1, y \in \mathbf{R}\}$; parabola, opens up, zeros at $-6, -4$
 (b) $f(x) = 4(x + 1)^2 + 3$; vertex: $(-1, 3)$; $D = \{x \mid x \in \mathbf{R}\}$,
 $R = \{y \mid y \geq 3, y \in \mathbf{R}\}$; parabola, opens up, no zeros;
 y -intercept 7
 (c) $f(x) = -2\left(x - \frac{5}{4}\right)^2 + 3$; vertex: $(5/4, 3)$; $D = \{x \mid x \in \mathbf{R}\}$,
 $R = \{y \mid y \leq 3, y \in \mathbf{R}\}$; parabola, opens down, zeros at 0.025,
 2.47

- (d) $f(x) = \frac{1}{2}(x - 3)^2 - \frac{1}{2}$; vertex: $(3, -1/2)$; $D = \{x \mid x \in \mathbf{R}\}$,
 $R = \{y \mid y \geq -\frac{1}{2}, y \in \mathbf{R}\}$; parabola, opens up, zeros at 2, 4
 (e) $f(x) = -2\left(x - \frac{7}{4}\right)^2 - \frac{47}{8}$; vertex: $\left(\frac{7}{4}, -\frac{47}{8}\right)$;
 $D = \{x \mid x \in \mathbf{R}\}$, $R = \{y \mid y \leq -\frac{47}{8}, y \in \mathbf{R}\}$; parabola, opens
 down, no zeros; y -intercept -12
 (f) $f(x) = -2\left(x - \frac{7}{4}\right)^2 + \frac{49}{2}$; vertex: $\left(\frac{7}{4}, \frac{49}{2}\right)$; $D = \{x \mid x \in \mathbf{R}\}$,
 $R = \{y \mid y \leq \frac{49}{2}, y \in \mathbf{R}\}$; parabola, opens down, zeros at 0,
 3.5
7. (a) $d(x) = 5\left(x - \frac{3}{10}\right)^2 + \frac{11}{20}$ (b) $x = \frac{3}{10}$
 (c) $\left(\frac{3}{10}, \frac{11}{20}\right)$ (d) minimum value: $d = \frac{11}{20}$
 (e) $D = \mathbf{R}$ (f) $R = \{y \mid y \geq \frac{11}{20}, y \in \mathbf{R}\}$
 (g) parabola, opens up, no zeros; y -intercept: 1
8. (a) 31.63 m (b) at 2.5 s
9. (a) $\left(\frac{5}{24}, -\frac{169}{288}\right)$ (b) $\left(-\frac{1}{9}, \frac{85}{108}\right)$
 (c) $(-4, -16)$
10. Vertical compression, factor 2.5; Horizontal translation to the right
 2.5 units; Vertical translation up 3.5 units
11. 3.75 m/ha
12. $2 < t < 10$
13. (a) $D = \mathbf{R}$, $R = \{y \mid y \leq -\frac{25}{4}, y \in \mathbf{R}\}$
 (b) $D = \mathbf{R}$, $R = \{y \mid y \leq \frac{17}{8}, y \in \mathbf{R}\}$
 (c) $D = \mathbf{R}$, $R = \{y \mid y \geq \frac{19}{36}, y \in \mathbf{R}\}$
 (d) $D = \mathbf{R}$, $R = \{y \mid y \geq -0.325, y \in \mathbf{R}\}$
14. You should be able to write the equation of the same quadratic
 function in several different forms to obtain different information
 about the function, as long as the algebra performed does not
 change the question. (1) Factor the coefficient of x^2 from the first
 two terms. (2) Add and subtract the square of half the coefficient
 of x inside the brackets. (3) Group the three terms that form the
 perfect square. Multiply the fourth term by the factor in front of
 the brackets and move it outside the brackets. (4) Factor the
 perfect square.