Answers to Math 102 Final Exam Review

1. a. $2x + h - 4$
b. $\frac{-1}{x(x+h)}$
c. $-6x - 3h - 2$
d. $\frac{1}{\sqrt{x+h}+\sqrt{x}}$

2. a. $\{x|x \neq 0, 3, -3\}$
b. $\{x|x \leq \frac{4}{3}\}$
c. all real numbers
d. $\{x|x \geq 0 \text{ and } x \neq 1\}$

3. a. (i) 3 (ii) -2 (iii) [-2,6] (iv) [-5,3] (v) -1
b. (i) 7 (ii) [5,6] (iii) 3 (iv) $[-5, -1] \cup [3.2, 6]$ (v) $\frac{-8}{7}$

4. a. $\frac{-1}{4}$
b. 10
c. $\frac{1}{2}$
d. -34

5. see graphs.

6. a. $A(x) = -x^2 + 500x$; $\{x|0 < x < 500\}$
b. $A(x) = \frac{4\sqrt{3}+9}{16}x^2 - \frac{15}{2}x + 25$; $\{x|0 \leq x \leq \frac{20}{3}\}$
c. $A(x) = \frac{1}{2}x^3$
d. $d(t) = \sqrt{1709}\ t$

7. a. (i) $m = \frac{-3}{2}$; $b = 2$ (ii) see graph (iii) $\frac{-3}{2}$ (iv) decreasing
b. (i) $m = 0$; $b = -3$ (ii) see graph (iii) 0 (iv) constant
c. (i) $m = 2$; $b = -3$ (ii) see graph (iii) 2 (iv) increasing
d. (i) $m = \frac{1}{2}$; $b = -3$ (ii) see graph (iii) $\frac{1}{2}$ (iv) increasing

8. a. $\{P|P \geq 128\}$ b. \$7.2 million c. \$180 million

9. a. vertex at $(-1, -1)$, y-intercept at $(0, -3)$, no x-intercepts, axis of symmetry is $x = -4$.
b. vertex at $(-2, 4)$, y-intercept at $(0, 0)$, x-intercepts are $(0, 0)$ and $(-4, 0)$, axis of symmetry is $x = -2$.
c. vertex at $(-4, -9)$, y-intercept at $(0, 7)$, x-intercepts are $(-7, 0)$ and

$(-1, 0)$, axis of symmetry is $x = -4$.
d. vertex at $(\frac{1}{3}, \frac{14}{3})$, y-intercept at $(0, 5)$, no x-intercepts, axis of symmetry is $x = \frac{1}{3}$.

10. a. $\$15,000$ b. max. height is 75 feet, and time to ground is 2.5 seconds.

11. a. $500{,}000m^2$ b. width= $\frac{120}{\pi+4}$ feet. length= 8.4 feet.

12. See graphs. End behavior:
a. as $x \to \infty$, $y \to \infty$ and as $x \to -\infty$, $y \to \infty$
b. as $x \to \infty$, $y \to \infty$ and as $x \to -\infty$, $y \to -\infty$
c. as $x \to \infty$, $y \to -\infty$ and as $x \to -\infty$, $y \to -\infty$
d. as $x \to \infty$, $y \to -\infty$ and as $x \to -\infty$, $y \to \infty$

13. a. $P(x) = 3x^2 - 9x - 30$
b. $P(x) = x^3 - 3x^2 + 9x + 13$
c. $P(x) = 2x^4 - 4x^3 + 12x^2 - 16x + 16$
d. $P(x) = 4x^4 - 24x^3 + 72x^2 - 120x + 100$

14. a. (i) $\pm 1, \pm 2, \pm 3, \pm 4, \pm 6, \pm 8, \pm 12, \pm\frac{1}{2}, \pm\frac{3}{2}, \pm\frac{1}{3}, \pm\frac{1}{3}, \pm\frac{2}{3}, \pm\frac{4}{3}, \pm\frac{8}{3}, \pm\frac{1}{6}$
(ii) $-3, 2, \frac{4}{3}, \frac{-1}{2}$
(iii) $P(x) = 4x^4 - 24^3 + 72x^2 - 120x + 100$
b. (i) $\pm 1, \pm 2, \pm 4, \pm\frac{1}{5}, \pm\frac{2}{5}, \pm\frac{4}{5}$
(ii) $\frac{2}{5}, 2 \pm \sqrt{2}$
(iii) $P(x) = 5(x - \frac{2}{5})(x - (2 + \sqrt{2}))(x - (2 - \sqrt{2}))$
c. (i) $\pm 1, \pm\frac{1}{2}$
(ii) $-1, \frac{1}{2}, -1 + \sqrt{2}, -1 - \sqrt{2}$
(iii) $P(x) = 2(x + 1)(x - \frac{1}{2})(x - (-1 + \sqrt{2}))(x - (-1 - \sqrt{2}))$
d. (i) $\pm 1, \pm 2, \pm 3, \pm 4, \pm 6, \pm 8, \pm 12, \pm 24$
(ii) $2, 2i, -2i, \sqrt{3}, -\sqrt{3}$
(iii) $P(x) = (x - 2)(x - 2i)(x + 2i)(x - \sqrt{3})(x + \sqrt{3})$

15. a. (i) x and y: $(0, 0)$. (ii) $x = -1$ (iii) $y = 1$ (iv) see graph
b. (i) x: $(\frac{4}{3}, 0)$, y: $(0, 2)$ (ii) $x = 2$ (iii) $y = 3$ (iv) see graph
c. (i) x and y $(0, 0)$ (ii) $x = 1$ and $x = -1$ (iii) $y = 0$ (iv) see graph
d. (i) x: $(4, 0)$, $(-3, 0)$ and y: $(0, -12)$ (ii) $x = -1$ (iii) oblique: $y = x - 2$ (iv) see graph

16. a. (i) $(f \circ g)(x) = \frac{2x-1}{2x}$ (ii) $\{x | x \neq 0\}$

b. (i) $(f \circ g)(x) = \frac{-1}{x+4}$ (ii) $\{x|x \neq -4, -5\}$
c. (i) $(f \circ g)(x) = \frac{18-15x}{24-19x}$ (ii) $\{x|x \neq \frac{6}{5}, \frac{24}{19}\}$
d. (i) $(f \circ g)(x) = \sqrt{\sqrt{x+3}}$ (ii) $\{x|x \geq -3\}$

17. a. $f^{-1}(x) = \frac{x-5}{3}$
b. $f^{-1}(x) = 3 - x^2$
c. $f^{-1}(x) = \frac{1+2x}{3x}$
d. $f^{-1}(x) = \sqrt[3]{2-x}$

18. a. $(-2, -1] \cup (0, 2]$ b. $[-4, -1)$ c. $(-3, 0) \cup (3, \infty)$ d. $(-\infty, 2] \cup (3, \infty)$

19. a. $y = 0$ is the asymptote, y-intercept $(0, -1)$, see graph
b. $y = -1$ is the asymptote, x-intercept $(3, 0)$, see graph
c. $x = -2$ is the asymptote, x-intercept $(-1, 0)$, see graph
d. $x = 0$ is the asymptote, point $(-1, 3)$, see graph

20. a. 3 b. 3 c. 9 d. 2

21. a. $x = 10$ b. $x = 4$ c. $x = 5$ d. $x = 4$

22. a. $x = \frac{3 \ln 2}{\ln 5 - \ln 2}$
b. $x = \frac{\ln 5}{\ln 5 - \ln 3}$
c. $x = \frac{2}{1 - \ln 3}$
d. $x = -\ln 4$

23. a. 317 b. $A = 100(4)^d$ c. approx. 9901 years d. approx. $\$12,214$

24. a. $(3, 4)$ b. $\{(x, y)|6x + y = y\}$ c. no solution d. $(9, -9)$

25. a. $x = 1$, $y = 3$, $z = -4$
b. $x = 8$, $y = 7$, $z = 3$
c. $x = 7$, $y = 3$, $z = 8$
d. $x = 4$, $y = 2$, $z = 7$

26. a. $(0, -10)$ and $(6, 8)$
b. $(5, 4)$ and $(4, 5)$
c. $(\frac{3}{2}, 6)$ and $(\frac{-1}{3}, \frac{7}{3})$
d. $(4, -3), (3, 4), (-3, 4), (-4, -3)$

27. see graphs.

28. a. max is 230; min is 20
b. min is 22
c. max is 25; min is -90
d. min is 8

29. 800 unbits of model A, 1000 units of model B, $\$85,000$ maximum profit

30. see section of 9.4 of text, examples 1 and 3.