Pre-Calculus 11 Final Exam Review
Answer Section

MULTIPLE CHOICE

1.	ANS: C	PTS: 1	OBJ: Section 2.1
2.	ANS: D	PTS: 1	OBJ: Section 2.1
3.	ANS: C	PTS: 1	OBJ: Section 2.2
4.	ANS: D	PTS: 1	OBJ: Section 2.2
5.	ANS: D	PTS: 1	OBJ: Section 2.2
6.	ANS: B	PTS: 1	OBJ: Section 2.3
7.	ANS: B	PTS: 1	OBJ: Section 2.4
8.	ANS: C	PTS: 1	OBJ: Section 2.4
9.	ANS: A	PTS: 1	OBJ: Section 2.3 | Section 2.4
10.	ANS: B	PTS: 1	OBJ: Section 3.2
11.	ANS: D	PTS: 1	OBJ: Section 3.2
12.	ANS: D	PTS: 1	OBJ: Section 3.3
13.	ANS: A	PTS: 1	OBJ: Section 4.2
14.	ANS: C	PTS: 1	OBJ: Section 4.2
15.	ANS: A	PTS: 1	OBJ: Section 4.2
16.	ANS: B	PTS: 1	OBJ: Section 4.3
17.	ANS: D	PTS: 1	OBJ: Section 4.4
18.	ANS: D	PTS: 1	OBJ: Section 8.2
19.	ANS: D	PTS: 1	OBJ: Section 8.2
20.	ANS: A	PTS: 1	OBJ: Section 8.2
21.	ANS: A	PTS: 1	OBJ: Section 8.2
22.	ANS: D	PTS: 1	OBJ: Section 9.1
23.	ANS: D	PTS: 1	OBJ: Section 9.1
24.	ANS: C	PTS: 1	OBJ: Section 9.1
25.	ANS: A	PTS: 1	OBJ: Section 9.1
26.	ANS: A	PTS: 1	OBJ: Section 9.2
27.	ANS: A	PTS: 1	OBJ: Section 9.2
28.	ANS: D	PTS: 1	OBJ: Section 9.3
29.	ANS: B	PTS: 1	OBJ: Section 9.3
30.	ANS: D	PTS: 1	OBJ: Section 1.1
31.	ANS: C	PTS: 1	OBJ: Section 1.1
32.	ANS: A	PTS: 1	OBJ: Section 1.2
33.	ANS: B	PTS: 1	OBJ: Section 1.2
34.	ANS: C	PTS: 1	OBJ: Section 1.2
35.	ANS: A	PTS: 1	OBJ: Section 1.3
36.	ANS: C	PTS: 1	OBJ: Section 1.3
37.	ANS: C	PTS: 1	OBJ: Section 1.3
38.	ANS: B	PTS: 1	OBJ: Section 1.3
39.	ANS: D	PTS: 1	OBJ: Section 1.3

40.	ANS: D	PTS: 1	OBJ: Section 1.4
41.	ANS: D	PTS: 1	OBJ: Section 1.4
42.	ANS: C	PTS: 1	OBJ: Section 1.5
43.	ANS: D	PTS: 1	OBJ: Section 1.5
44.	ANS: B	PTS: 1	OBJ: Section 1.5
45.	ANS: A	PTS: 1	OBJ: Section 1.5
46.	ANS: C	PTS: 1	OBJ: Section 5.1
47.	ANS: D	PTS: 1	OBJ: Section 5.1
48.	ANS: D	PTS: 1	OBJ: Section 5.2
49.	ANS: C	PTS: 1	OBJ: Section 5.2
50.	ANS: D	PTS: 1	OBJ: Section 5.2
51.	ANS: C	PTS: 1	OBJ: Section 5.2
52.	ANS: C	PTS: 1	OBJ: Section 5.3
53.	ANS: B	PTS: 1	OBJ: Section 5.3
54.	ANS: C	PTS: 1	OBJ: Section 5.3
55.	ANS: A	PTS: 1	OBJ: Section 6.1
56.	ANS: D	PTS: 1	OBJ: Section 6.1
57.	ANS: C	PTS: 1	OBJ: Section 6.1
58.	ANS: A	PTS: 1	OBJ: Section 6.2
59.	ANS: D	PTS: 1	OBJ: Section 6.2
60.	ANS: D	PTS: 1	OBJ: Section 6.2
61.	ANS: B	PTS: 1	OBJ: Section 6.2
62.	ANS: B	PTS: 1	OBJ: Section 6.2
63.	ANS: B	PTS: 1	OBJ: Section 6.2
64.	ANS: B	PTS: 1	OBJ: Section 6.3
65.	ANS: D	PTS: 1	OBJ: Section 6.3
66.	ANS: A	PTS: 1	OBJ: Section 6.4
67.	ANS: D	PTS: 1	OBJ: Section 7.1
68.	ANS: B	PTS: 1	OBJ: Section 7.1
69.	ANS: D	PTS: 1	OBJ: Section 7.2
70.	ANS: D	PTS: 1	OBJ: Section 7.2
71.	ANS: C	PTS: 1	OBJ: Section 7.2
72.	ANS: A	PTS: 1	OBJ: Section 7.3
73.	ANS: C	PTS: 1	OBJ: Section 7.3
74.	ANS: D	PTS: 1	OBJ: Section 7.3
75.	ANS: D	PTS: 1	OBJ: Section 7.3
76.	ANS: D	PTS: 1	OBJ: Section 7.4
77.	ANS: A	PTS: 1	OBJ: Section 7.4
78.	ANS: C	PTS: 1	OBJ: Section 7.4

COMPLETION

1. ANS: 60°

PTS: 1 OBJ: Section 2.1

2. ANS: 47°

PTS: 1 OBJ: Section 2.2

3. ANS: downward

PTS: 1 OBJ: Section 3.2

4. ANS: arithmetic series

PTS: 1 OBJ: Section 1.2

5. ANS: 10

PTS: 1 OBJ: Section 1.3

6. ANS: –8200

PTS: 1 OBJ: Section 1.4

7. ANS: –0.2

PTS: 1 OBJ: Section 1.5

8. ANS: $3x^3(\sqrt[4]{3})$

PTS: 1 OBJ: Section 5.1

9. ANS: $\dfrac{-63\sqrt{11}+77\sqrt{3}}{48}$

PTS: 1 OBJ: Section 5.2

10. ANS: $(-1,1)$ and $(-3,-1)$

PTS: 1 OBJ: Section 7.4

MATCHING

1.	ANS: B	PTS: 1	OBJ: Section 7.2
2.	ANS: A	PTS: 1	OBJ: Section 7.2
3.	ANS: E	PTS: 1	OBJ: Section 7.2
4.	ANS: C	PTS: 1	OBJ: Section 7.4
5.	ANS: D	PTS: 1	OBJ: Section 7.4

SHORT ANSWER

1. ANS:
Use the sine law.

$$\frac{\sin P}{p} = \frac{\sin O}{o}$$

$$\frac{\sin P}{9} = \frac{\sin 50^\circ}{7}$$

$$\sin P = \frac{9 \times \sin 50^\circ}{7}$$

$$\sin P \approx 0.9849$$

$$P \approx \sin^{-1}(0.9849)$$

$$\approx 80.0$$

Since $\angle P = 80^\circ$,

$$\angle N = 180^\circ - (50^\circ + 80^\circ)$$

$$= 50^\circ$$

$$\frac{\sin N}{n} = \frac{\sin O}{o}$$

$$\frac{\sin 50^\circ}{n} = \frac{\sin 50^\circ}{7}$$

$$n = 7$$

ΔNOP is an isosceles triangle.

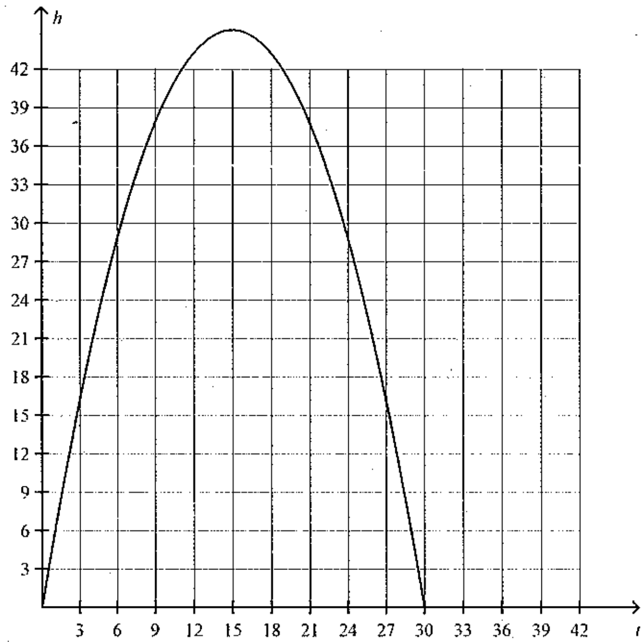
PTS: 1 OBJ: Section 2.3

2. ANS:
a) Answers may vary. Sample answers:
i) 135°
ii) 120°
iii) 240°
b) Sketch the given angle on a Cartesian plane, and identify its reference angle. Then, determine the other quadrant where the trigonometric ratio has the same sign as the given ratio and reflect the reference angle into that quadrant. Any angle co-terminal to the two angles in the diagram will have the same trigonometric ratio as that given.

PTS: 1 OBJ: Section 2.1 | Section 2.2

3. ANS:

a)



b) From the graph, the vertex is (15, 45) and a point on the graph is (0, 0). Write the function in vertex form and then solve for a.

$h = a(t - 15)^2 + 45$

$0 = a(0 - 15)^2 + 45$

$0 = 225a + 45$

$a = -0.2$

The relation that models the situation is $h = -0.2(t - 15)^2 + 45$.

c) $h = -0.2(t - 15)^2 + 45$

$= -0.2(t^2 - 30t + 225) + 45$

$= -0.2t^2 + 6t - 45 + 45$

$= -0.2t^2 + 6t$

PTS: 1 OBJ: Section 3.1 | Section 3.2 | Section 3.3

4. ANS:

$$y = -3x^2 + 12x - 10$$
$$= -3\left(x^2 - 4x\right) - 10$$
$$= -3(x^2 - 4x + 4 - 4) - 10$$
$$= -3((x^2 - 4x + 4) - 4) - 10$$
$$= -3((x-2)^2 - 4) - 10$$
$$= -3(x-2)^2 + 12 - 10$$
$$= -3(x-2)^2 + 2$$

PTS: 1 OBJ: Section 3.3

5. ANS:

Let $P = (x - 5)$ so that the quadratic becomes $6P^2 + 126P + 324$.
Factor the resulting expression:

$$6P^2 + 126P + 324 = 6(P^2 + 21P + 54)$$
$$= 6(P+3)(P+18)$$
$$= 6[(x-5)+3][(x-5)+18]$$
$$= 6(x-2)(x+13)$$

PTS: 1 OBJ: Section 4.2

6. ANS:

To solve the equation, set it equal to 0 and solve for x.

$$5x^2 + 20x - 6 = 0$$
$$x^2 + 4x - 6/5 = 0$$
$$x^2 + 4x = 6/5$$
$$x^2 + 4x + (2)^2 = 6/5 + (2)^2$$
$$(x+2)^2 = 26/5$$
$$x + 2 = \pm\sqrt{26/5}$$
$$x = -2 \pm \sqrt{26/5}$$
$$x \approx 4.28 \text{ and } x \approx -0.28$$

PTS: 1 OBJ: Section 4.3

7. ANS:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-4 \pm \sqrt{4^2 - 4(1)(-21)}}{2(1)}$$

$$= \frac{-4 \pm \sqrt{16 + 84}}{2}$$

$$= \frac{-4 \pm \sqrt{100}}{2}$$

$$= \frac{-4 \pm 10}{2}$$

$$= 3, -7$$

PTS: 1 OBJ: Section 4.4

8. ANS:

Rearrange the equation so all terms are on the same side:

$3x^2 - 8x + 4 = 0$

Calculate the discriminant $b^2 - 4ac$:

$$(-8)^2 - 4(3)(4) = 64 - 48$$
$$= 16$$

Since the discriminant is positive (greater than zero), the equation has 2 real roots.

a) $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$$= \frac{8 \pm \sqrt{16}}{2(3)}$$

$$= \frac{8 \pm 4}{6}$$

$$= 2 \text{ and } \frac{2}{3}$$

b) $3x^2 - 8x + 4 = 0$

$$(3x - 2)(x - 2) = 0$$

$$3x - 2 = 0 \qquad x - 2 = 0$$

$$3x = 2 \qquad x = 2$$

$$x = \frac{2}{3}$$

PTS: 1 OBJ: Section 4.3 | Section 4.4

9. ANS:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$= \frac{10 \pm \sqrt{(-10)^2 - 4(3)(6)}}{2(3)}$$

$$= \frac{10 \pm \sqrt{100 - 72}}{6}$$

$$= \frac{10 \pm \sqrt{28}}{6}$$

$$= \frac{10 \pm 2\sqrt{7}}{6}$$

$$= \frac{5 \pm \sqrt{7}}{3}$$

$$= \frac{5 + \sqrt{7}}{3} \text{ and } \frac{5 - \sqrt{7}}{3}$$

PTS: 1 OBJ: Section 4.4

10. ANS:

The x-intercepts are −2 and 3. These correspond to factors of $(x+2)$ and $(x-3)$. The equation is of the form $y = a(x+2)(x-3)$.

Expand and simplify the right side of the equation:

$$y = a(x+2)(x-3)$$

$$= a(x^2 - x - 6)$$

Substitute the known point on the curve $(0.5, -6.25)$ to determine the value of a:

$$y = a(x^2 - x - 6)$$

$$-6.25 = a[(0.5)^2 - 0.5 - 6]$$

$$-6.25 = a(0.25 - 6.5)$$

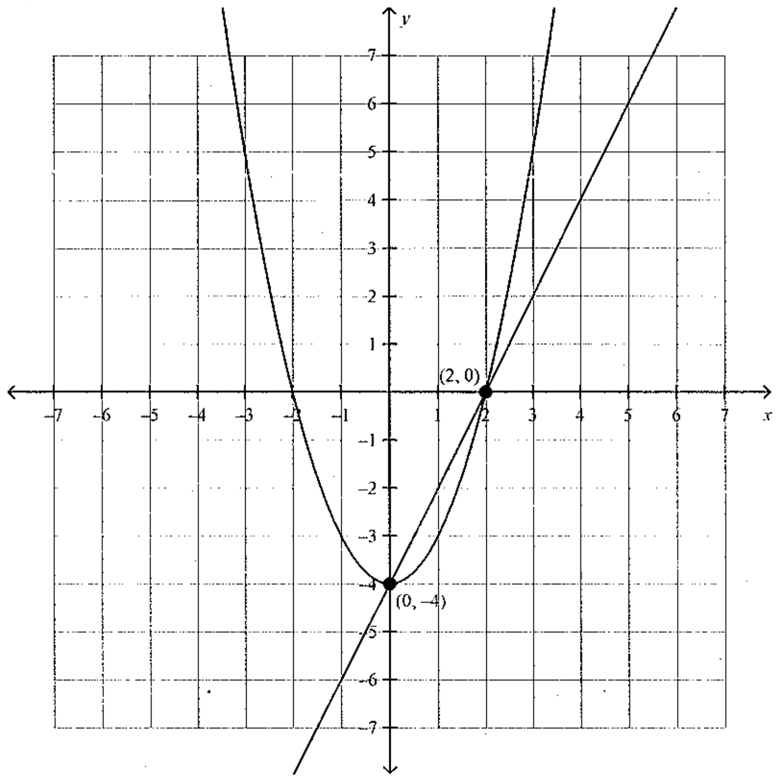
$$-6.25 = a(-6.25)$$

$$a = 1$$

The value of a is 1, so the equation is $y = x^2 - x - 6$.

PTS: 1 OBJ: Section 4.1

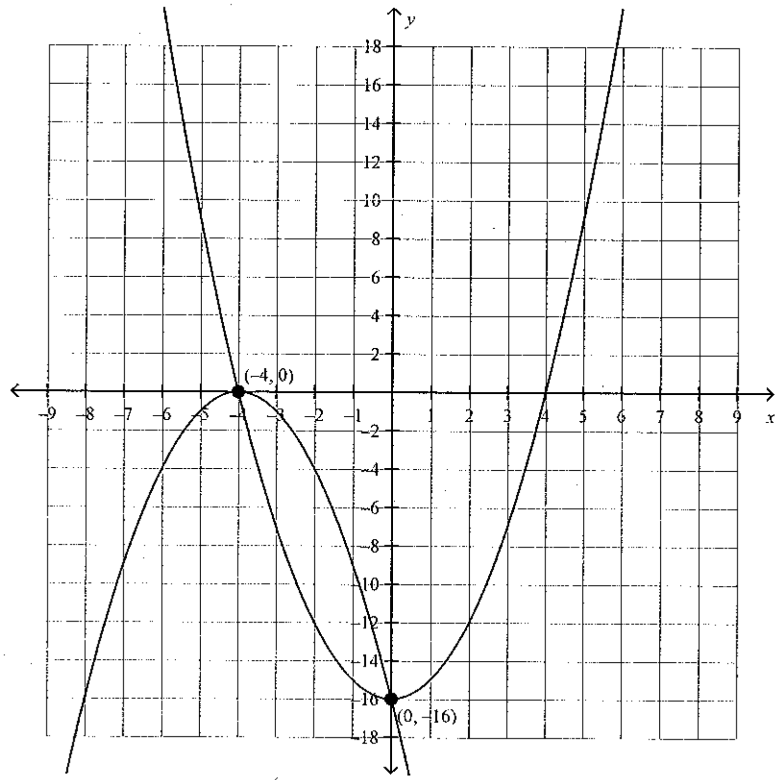
11. ANS:



The solutions are (2, 0) and (0, −4).

PTS: 1 OBJ: Section 8.1

12. ANS:



The solutions are (−4, 0) and (0, −16).

PTS: 1 OBJ: Section 8.1

13. ANS:

Equate the expressions and simplify.

$2x^2 + 4x - 1 = 3x + 5$

$2x^2 + x - 6 = 0$

Use the discriminant $b^2 - 4ac$ to determine the number of solutions to this equation.
Substitute $a = 2$, $b = 1$, and $c = -6$.

$$\begin{aligned} b^2 - 4ac &= (1)^2 - 4(2)(-6) \\ &= 1 + 48 \\ &= 49 \end{aligned}$$

Since $b^2 - 4ac > 0$, there are two solutions to the equation.
The line and the curve have two points of intersection.

PTS: 1 OBJ: Section 8.2

14. ANS:

Subtract the equations:

$$\begin{array}{l} y = 2x^2 - 2x - 3 \\ \underline{y = -x^2 - 2x - 3} \\ 0 = 3x^2 \end{array}$$

Solve for x:

$0 = 3x^2$

$x = 0$

Substitute $x = 0$ into either equation and solve for y:

$$\begin{aligned} y &= -(0)^2 - 2(0) - 3 \\ &= -3 \end{aligned}$$

The single solution is (0, –3).

PTS: 1 OBJ: Section 8.2

15. ANS:

Substitute $y = -6x^2 + 4x + 7$ into the first equation:

$$\begin{aligned} -6x^2 + 4x + 7 &= -3x^2 - 3x + 2 \\ 0 &= 3x^2 - 7x - 5 \end{aligned}$$

Solve for x using the quadratic formula

$$\begin{aligned} x &= \frac{7 \pm \sqrt{(-7)^2 - 4(3)(-5)}}{2(3)} \\ &= \frac{7 \pm \sqrt{109}}{6} \end{aligned}$$

$x \approx 2.91$ and $x \approx -0.57$

Substitute these values into $y = -3x^2 - 3x + 2$:

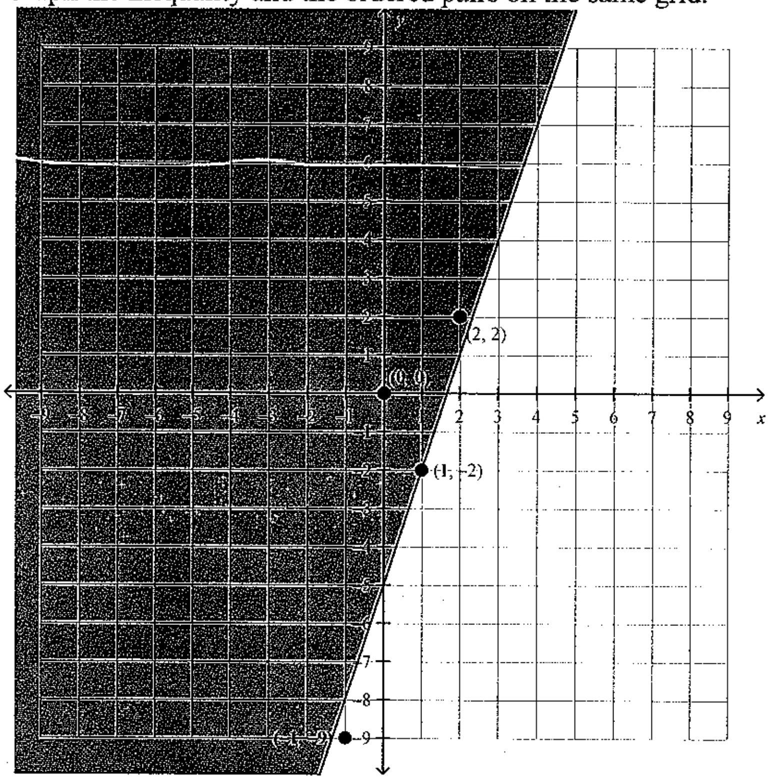
$$\begin{aligned} y &\approx -3(2.91)^2 - 3(2.91) + 2 \\ &\approx -32.13 \end{aligned} \quad \text{and} \quad \begin{aligned} y &\approx -3(-0.57)^2 - 3(-0.57) + 2 \\ &\approx 2.74 \end{aligned}$$

The approximate solutions are (2.91, –32.13) and (–0.57, 2.74).

PTS: 1 OBJ: Section 8.2

16. ANS:

Graph the inequality and the ordered pairs on the same grid.



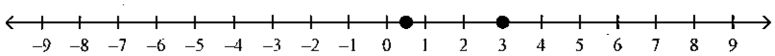
The ordered pairs that are solutions to the inequality are (2,2), (1,–2), and (0,0), as they are either in the shaded region or on the line.

PTS: 1 OBJ: Section 9.1

17. ANS:

First, rewrite the inequality as $2x^2 - 7x + 3 \geq 0$.
Next, factor the quadratic:
$2x^2 - 7x + 3 = (2x - 1)(x - 3)$

$$x = \frac{1}{2} \text{ or } x = 3$$



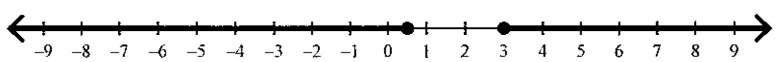
Choose a test point in each interval, such as 0, 1, and 4:

L.S. $= 2(0)^2 - 7(0) + 3$ R.S. $= 0$
$= 3$
L.S. $\geq$ R.S.

L.S. $= 2(1)^2 - 7(1) + 3$ R.S. $= 0$
$= -2$
L.S. $<$ R.S.

L.S. $= 2(4)^2 - 7(4) + 3$ R.S. $= 0$
$= 7$
L.S. $\geq$ R.S.

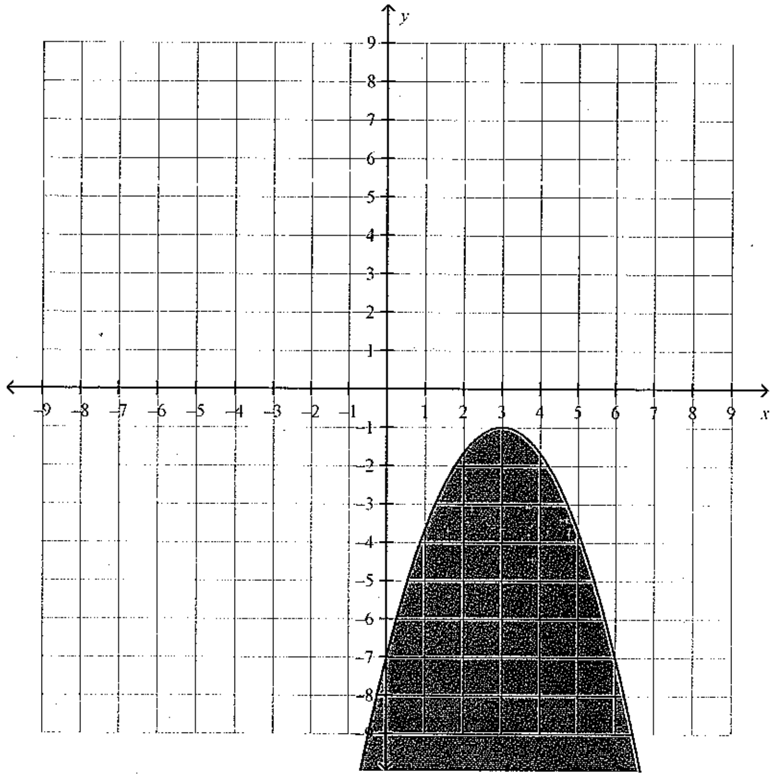
Therefore, the solution is $\left\{x \mid x \leq \frac{1}{2} \text{ or } x \geq 3, x \in R\right\}$.



PTS: 1 OBJ: Section 9.2

18. ANS:

a)



b) Test point used will vary.
Example: Use the test point (0, 0).

L.S. = 0 R.S. $= -\frac{2}{3}(0-3)^2 - 1$

$= -6 - 1$

$= -7$

L.S. > R.S.
Since the test point is not in the shaded region, the graphical solution is correct.

PTS: 1 OBJ: Section 9.3

19. ANS:

a) $t_n = 8.50 + (n-1)(0.75)$

$= 8.50 + 0.75n - 0.75$

$= 7.75 + 0.75n$

b) $t_6 = 7.75 + 0.75(6)$

$= 12.25$

The hourly rate after 6 years is \$12.25.

c) $15.25 = 7.75 + 0.75n$

$7.50 = 0.75n$

$n = 10$

You would need to work at the bookstore for 10 years to earn \$15.25 per hour.

PTS: 1 OBJ: Section 1.1

20. ANS:

a) $t_n = 3(2)^{n-1}$

b) $t_{11} = 3(2)^{11-1}$

$= 3(2)^{10}$

$= 3072$

PTS: 1 OBJ: Section 1.3

21. ANS:

a) Since $t_1 = 3$ and $r = \frac{2}{3}$,

$t_n = 3\left(\frac{2}{3}\right)^{n-1}$

b) $t_{11} = 3\left(\frac{2}{3}\right)^{11-1}$

$= 3\left(\frac{2}{3}\right)^{10}$

$= \frac{1024}{19\,683}$

PTS: 1 OBJ: Section 1.3

22. ANS:

a) $t_n = t_1 + (n-1)d$

$= -12 + (n-1)(3)$

$= 3n - 15$

b) $S_n = \frac{n}{2}[2t_1 + (n-1)d]$

$= \frac{n}{2}[2(-12) + (n-1)(3)]$

$= \frac{n}{2}(3n - 27)$

c) $t_{12} = 3(12) - 15$

$= 21$

d) Since $t_n = 12$,

$12 = 3n - 15$

$3n = 27$

$n = 9$

$S_9 = \frac{9}{2}(3(9) - 27)$

$= 0$

PTS: 1 OBJ: Section 1.2

23. ANS:

$S_n = \frac{t_1(r^n - 1)}{r - 1}$

$-3280 = \frac{t_1[(-3)^8 - 1]}{-3 - 1}$

$-3280 = \frac{t_1(6561 - 1)}{-4}$

$13\ 120 = t_1(6560)$

$t_1 = 2$

PTS: 1 OBJ: Section 1.4

24. ANS:

In the series, $t_1 = 0.7$. To find t_2, evaluate $S_2 - S_1$.

$$\begin{aligned} t_2 &= S_2 - S_1 \\ &= 2.1 - 0.7 \\ &= 1.4 \end{aligned}$$

To find r, evaluate $\frac{t_2}{t_1}$.

$$\begin{aligned} r &= \frac{t_2}{t_1} \\ &= \frac{1.4}{0.7} \\ &= 2 \end{aligned}$$

So, $r = 2$.

$$S_n = \frac{t_1(r^n - 1)}{r - 1}$$

$$\begin{aligned} S_{12} &= \frac{0.7(2^{12} - 1)}{2 - 1} \\ &= \frac{0.7(4096 - 1)}{1} \\ &= 2866.5 \end{aligned}$$

PTS: 1 OBJ: Section 1.4

25. ANS:

a) $2\sqrt{11}, 3\sqrt{5}, 4\sqrt{3}, 5\sqrt{2}$

b) $4\sqrt{7}, 2\sqrt{30}, 5\sqrt{5}, 3\sqrt{14}$

PTS: 1 OBJ: Section 5.1

26. ANS:

a) $\sqrt{20} + \sqrt{5} = 2\sqrt{5} + \sqrt{5}$
$= 3\sqrt{5}$

b) $5\sqrt{12} - 2\sqrt{27} = 5(2\sqrt{3}) - 2(3\sqrt{3})$
$= 10\sqrt{3} - 6\sqrt{3}$
$= 4\sqrt{3}$

c) $\sqrt{3}(\sqrt{5} + \sqrt{7}) = \sqrt{15} + \sqrt{21}$

d) $\frac{24\sqrt{14}}{8\sqrt{2}} = \frac{24}{8}\left(\sqrt{\frac{14}{2}}\right)$
$= 3\sqrt{7}$

PTS: 1 OBJ: Section 5.1 | Section 5.2

27. ANS:

a) $\sqrt{162} = \sqrt{81 \times 2}$
$= 9\sqrt{2}$

b) $5\sqrt{2} - 2\sqrt{5} + \sqrt{125} - \sqrt{8} = 5\sqrt{2} - 2\sqrt{5} + \sqrt{25 \times 5} - \sqrt{4 \times 2}$
$= 5\sqrt{2} - 2\sqrt{5} + 5\sqrt{5} - 2\sqrt{2}$
$= 3\sqrt{2} + 3\sqrt{5}$

c) $\sqrt{3}(4\sqrt{6} + 2\sqrt{3}) = 4\sqrt{18} + 2\sqrt{9}$
$= 4\sqrt{9 \times 2} + 2(3)$
$= 12\sqrt{2} + 6$

d) $\sqrt{2}(2\sqrt{2} + 2) - 3(5\sqrt{2} + 1) = 2\sqrt{4} + 2\sqrt{2} - 15\sqrt{2} - 3$
$= 4 - 13\sqrt{2} - 3$
$= -13\sqrt{2} + 1$

PTS: 1 OBJ: Section 5.1 | Section 5.2

28. ANS:

$4 - \sqrt{4 + x^2} = x$
$\sqrt{4 + x^2} = 4 - x$
$4 + x^2 = (4 - x)^2$
$4 + x^2 = 16 - 8x + x^2$
$8x = 12$
$x = \frac{12}{8}$
$x = \frac{3}{2}$

PTS: 1 OBJ: Section 5.3

29. ANS:

$\sqrt{b + 1} = \sqrt{b + 6} - 1$
$b + 1 = b + 6 - 2\sqrt{b + 6} + 1$
$2\sqrt{b + 6} = 6$
$\sqrt{b + 6} = 3$
$b + 6 = 9$
$b = 3$

PTS: 1 OBJ: Section 5.3

30. ANS:

$$\frac{x^2-2x}{x+1}\times\frac{x^2-1}{x^2+x-6}=\frac{x(x-2)}{x+1}\times\frac{(x+1)(x-1)}{(x-2)(x+3)}$$

$$=\frac{x(x-1)}{x+3},\ x\neq -3, x\neq -1, x\neq 2$$

PTS: 1 OBJ: Section 6.2

31. ANS:

$$\frac{4x-1}{x^2+7x+12}\div\frac{2x-1}{x^2+x-12}=\frac{4x-1}{(x+3)(x+4)}\times\frac{(x+4)(x-3)}{2x-1}$$

$$=\frac{(4x-1)(x-3)}{(x+3)(2x-1)},\ x\neq -4, x\neq -3, x\neq \frac{1}{2}, x\neq 3$$

PTS: 1 OBJ: Section 6.2

32. ANS:

$$\frac{x}{x^2-3x-4}-\frac{4}{x+1}=\frac{x}{(x+1)(x-4)}-\frac{4(x-4)}{(x+1)(x-4)}$$

$$=\frac{x-4x+16}{(x+1)(x-4)}$$

$$=\frac{-3x+16}{(x+1)(x-4)},\ x\neq -1,\ x\neq 4$$

PTS: 1 OBJ: Section 6.3

33. ANS:

$$\frac{5}{x^2-1}-\frac{2}{x^2+4x+3}+\frac{3}{x^2+2x-3}=\frac{5}{(x-1)(x+1)}-\frac{2}{(x+1)(x+3)}+\frac{3}{(x-1)(x+3)}$$

$$=\frac{5(x+3)}{(x-1)(x+1)(x+3)}-\frac{2(x-1)}{(x-1)(x+1)(x+3)}+\frac{3(x+1)}{(x-1)(x+1)(x+3)}$$

$$=\frac{5x+15-2x+2+3x+3}{(x-1)(x+1)(x+3)}$$

$$=\frac{6x+20}{(x-1)(x+1)(x+3)},\ x\neq -3,\ x\neq -1, x\neq 1$$

PTS: 1 OBJ: Section 6.3

34. ANS:

$$\frac{5}{x-1}+\frac{2}{x+1}=-6$$

$$\frac{5(x+1)}{(x-1)(x+1)}+\frac{2(x-1)}{(x+1)(x-1)}=-6$$

$$5x+5+2x-2=-6(x+1)(x-1)$$

$$7x+3=-6x^2+6$$

$$6x^2+7x-3=0$$

$$(2x+3)(3x-1)=0$$

$2x+3=0$ and $3x-1=0$

$2x=-3$ $\quad 3x=1$

$x=-\frac{3}{2}$ $\quad x=\frac{1}{3}$

Check:

$$\text{L.S.}=\frac{5}{\left(-\frac{3}{2}\right)-1}+\frac{2}{\left(-\frac{3}{2}\right)+1} \text{ and R.S.}=\frac{5}{\left(\frac{1}{3}\right)-1}+\frac{2}{\left(\frac{1}{3}\right)+1}$$

$$=\frac{5}{\left(-\frac{5}{2}\right)}+\frac{2}{\left(-\frac{1}{2}\right)} \qquad =\frac{5}{\left(-\frac{2}{3}\right)}+\frac{2}{\left(\frac{4}{3}\right)}$$

$$=-2+(-4) \qquad =\frac{-15}{2}+\frac{3}{2}$$

$$=-6 \qquad =-6$$

L.S. = R.S

PTS: 1 OBJ: Section 6.4

35. ANS:

a) $6 + |5 - 11| = 6 + |-6|$
$= 6 + 6$
$= 12$

b) $-2 - |7| + |3 - 2| = -2 - 7 + |1|$
$= -9 + 1$
$= -8$

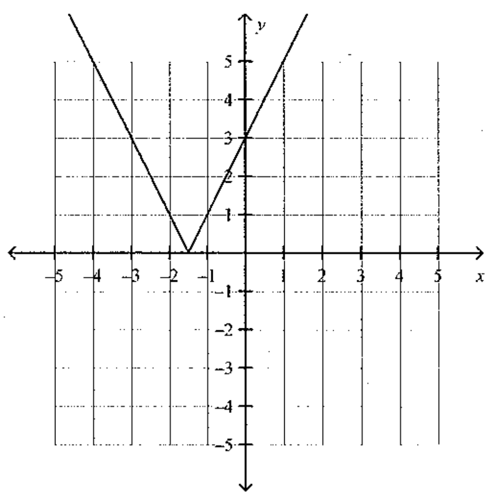
c) $\dfrac{24}{-|12 \div (-2)|} = \dfrac{24}{-|-6|}$
$= \dfrac{24}{-6}$
$= -4$

d) $|2| \times \left(-|-3|\right) \times (-2) = 2(-3)(-2)$
$= 12$

PTS: 1 OBJ: Section 7.1

36. ANS:

a)



b) The domain is all real numbers or $\{x|\ x \in R\}$.

The range is all non-negative values of *y*, or $\{y|\ y \geq 0, y \in R\}$.

c) $y = \begin{cases} -2x - 3 \text{ if } x < -\dfrac{3}{2} \\ 2x + 3 \text{ if } x \geq -\dfrac{3}{2} \end{cases}$

PTS: 1 OBJ: Section 7.2

37. ANS:

a) $f(x) = \left|2x^2 - 16x + 29\right|$

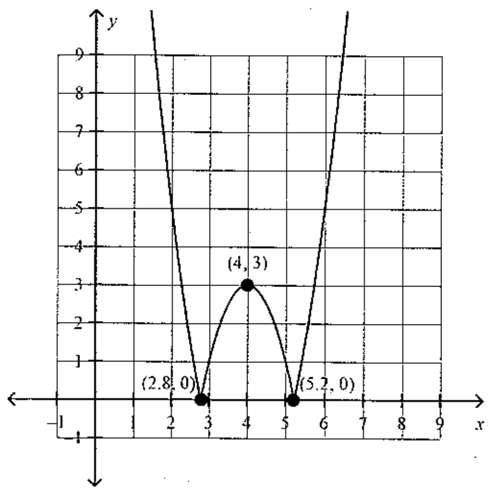
$= \left|2(x^2 - 8x) + 29\right|$

$= \left|2(x^2 - 8x + 16 - 16) + 29\right|$

$= \left|2(x-4)^2 - 32 + 29\right|$

$= \left|2(x-4)^2 - 3\right|$

b)



c) The domain is all real numbers or $\{x|\ x \in R\}$.

The range is all non-negative values of y, or $\{y|\ y \geq 0, y \in R\}$.

PTS: 1 OBJ: Section 7.2

38. ANS:

Solve for both cases of $y = \left|\frac{1}{2}x + 1\right|$ and $y = x + 1$

Case 1: Positive: $\frac{1}{2}x + 1 = x + 1$

$x = 0$

Case 2: Negative $\frac{1}{2}x + 1 = -(x + 1)$

$\frac{1}{2}x + 1 = -x - 1$

$\frac{3}{2}x = -2$

$x = \frac{-4}{3}$

The check for $x = 0$ is successful

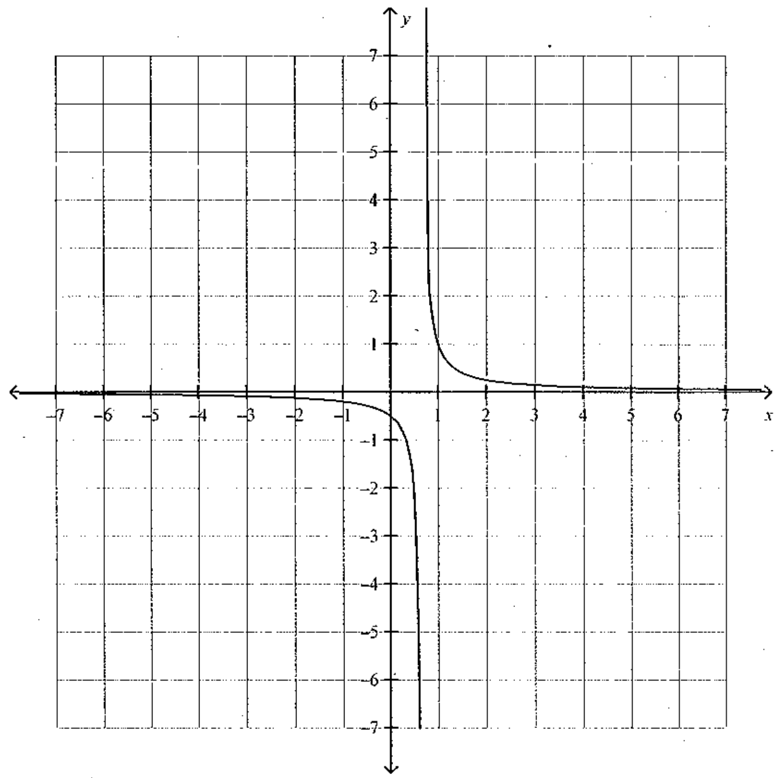
The check for $x = \frac{-4}{3}$ is extraneous

SOLUTION: $x = 0$

PTS: 1 OBJ: Section 7.3

39. ANS:

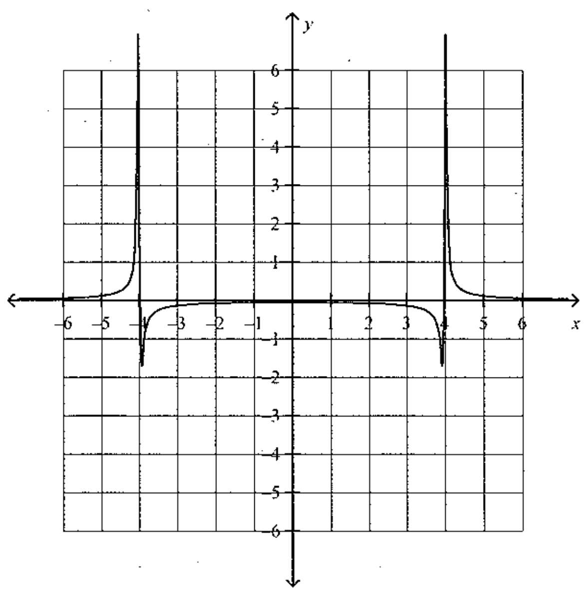
a)



The non-permissible value occurs when $3x - 2 = 0$ or when $x = \dfrac{2}{3}$.

The equation of the vertical asymptote is $x = \dfrac{2}{3}$.

b)



The non-permissible values occur when $x^2 - 16 = 0$ or when $x = \pm 4$.
The equations of the vertical asymptotes are $x = 4$ and $x = -4$.

PTS: 1 OBJ: Section 7.4

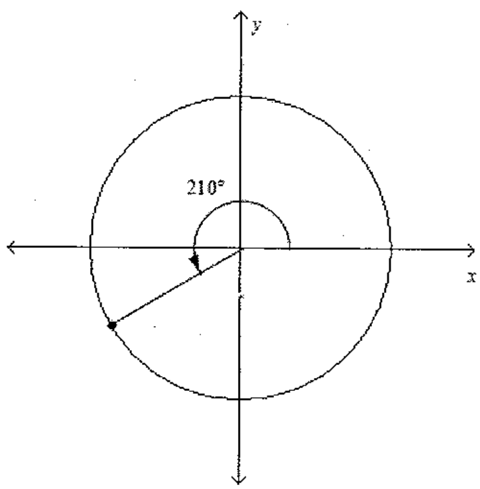
PROBLEM

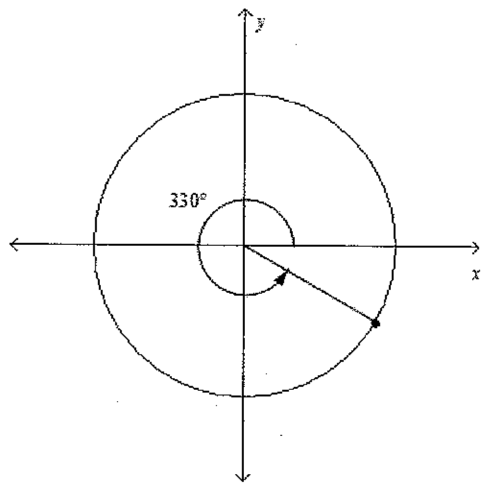
1. ANS:

a) Since $\sin 30° = \frac{1}{2}$, the reference angle is 30°. The sine ratio is negative in the third and fourth quadrants.

Look for reflections of the 30° angle in these quadrants.
third quadrant: $180° + 30° = 210°$
fourth quadrant: $360° - 30° = 330°$

b) Using a calculator, $\sin 210° = -\frac{1}{2}$ and $\sin 330° = -\frac{1}{2}$.





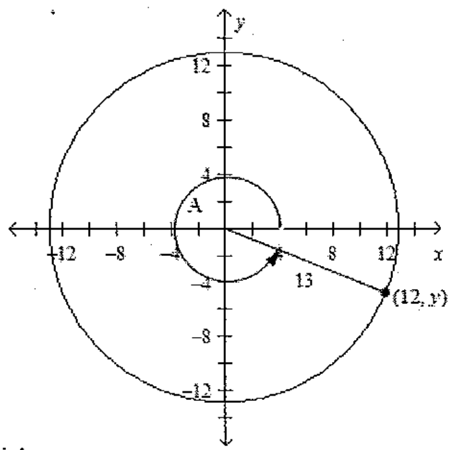
PTS: 1 OBJ: Section 2.2

2. ANS:

a) Since the cosine ratio is positive, the angle is in the first or the fourth quadrant.

b) If the sine ratio is negative, the angle is located in the fourth quadrant.

c)



d) Use the Pythagorean theorem.

$r^2 = x^2 + y^2$

$13^2 = 12^2 + y^2$

$y^2 = 169 - 144$

$= 25$

$y = \pm 5$

Since the point is in the fourth quadrant, $y = -5$.
Therefore, a point on the terminal arm is $(12, -5)$.

e) $\sin A = -\frac{5}{13}, \tan A = -\frac{5}{12}$

PTS: 1 OBJ: Section 2.1 | Section 2.2

3. ANS:

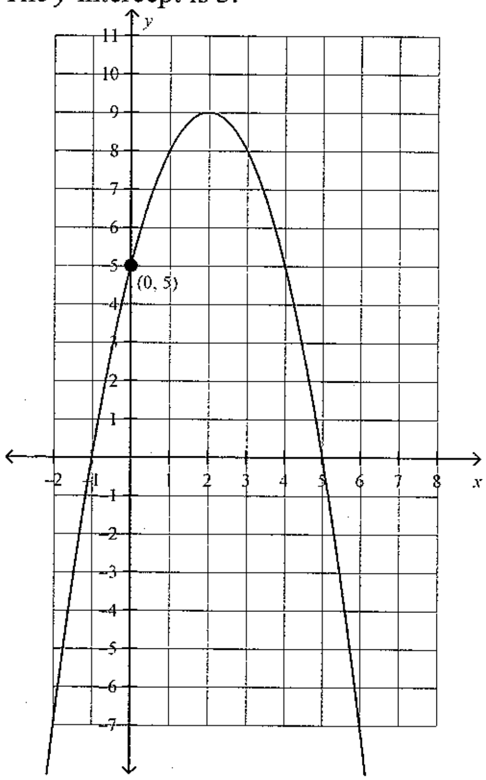
a) $y = -(x-2)^2 + 9$

$= -(x^2 - 4x + 4) + 9$

$= -x^2 + 4x - 4 + 9$

$= -x^2 + 4x + 5$

b) The y-intercept is 5.



PTS: 1 OBJ: Section 3.1

4. ANS:

Read the vertex from the graph. Then, write the equation in vertex form, and use another point to find a.

$y = -3(x+5)^2 + 5$

PTS: 1 OBJ: Section 3.1

5. ANS:
a) The maximum profit occurs at the vertex (3.5, 4500) or \$4500.
b) Substitute $d = 10$ into the equation:

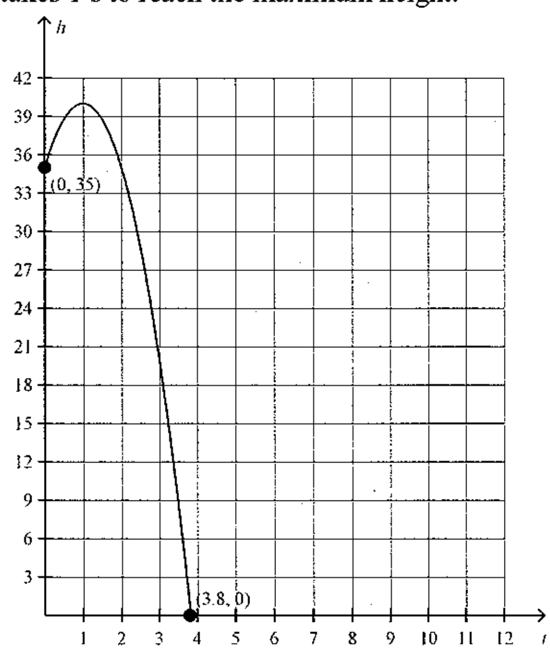
$$R = -50(10 - 3.5)^2 + 4500$$
$$= -50(6.5)^2 + 4500$$
$$= -2112.50 + 4500$$
$$= 2387.5$$

The income would be \$2387.50.

PTS: 1 OBJ: Section 3.1

6. ANS:
a)
$$h = -5t^2 + 10t + 35$$
$$= -5(t^2 - 2t) + 35$$
$$= -5(t^2 - 2t + 1 - 1) + 35$$
$$= -5((t - 1)^2 - 1) + 35$$
$$= -5(t - 1)^2 + 5 + 35$$
$$= -5(t - 1)^2 + 40$$

The maximum height of the ball is 40 m.
b) It takes 1 s to reach the maximum height.
c)



Since $t \geq 0$, the only t-intercept is approximately 3.8. The ball hits the ground after about 3.8 s.
d) From the equation, when $t = 0$, $h = 35$. The top of the cliff is 35 m above the ground.

PTS: 1 OBJ: Section 3.3

7. ANS:

a) Complete the square to find the vertex.

$P = -40t^2 + 120t$

$= -40(t^2 - 3t)$

$= -40(t^2 - 3t + 2.25) + 90$

$= -40(t - 1.5)^2 + 90$

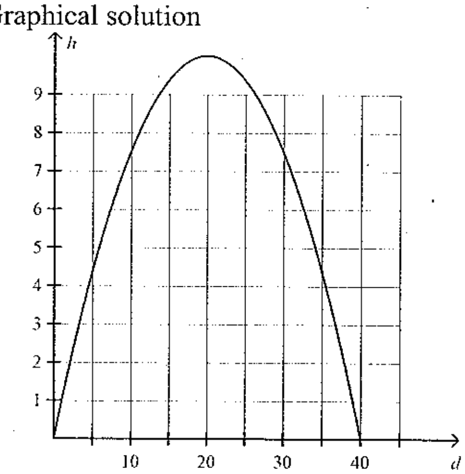
The maximum is 90 (the P-coordinate of the vertex). The greatest percent of prices memorized is 90%.

b) The maximum is at the point (1.5, 90). So, it takes 1.5 h to memorize 90% of the prices.

PTS: 1 OBJ: Section 3.3

8. ANS:

Graphical solution



Determine the zeros of the function (or roots of the equation) by setting $h = 0$ and then factoring the equation:

$0 = -0.025d^2 + d$

$= d(-0.025d + 1)$

$d = 0$ or $-0.025d + 1 = 0$

$-0.025d = -1$

$d = 40$

The right base is 40 m from the left base.

PTS: 1 OBJ: Section 4.1 | Section 4.2

9. ANS:

The ball is in the air until $h = 0$.

Factor the trinomial to determine when this occurs.

$$0 = 30t - 5t^2$$

$$0 = 5t(6 - t)$$

$$t = 0 \text{ or } t = 6$$

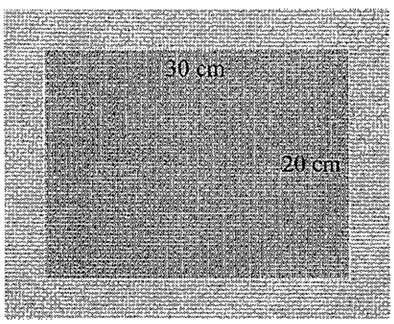
The zeros occur at $t = 0$ and $t = 6$.

The ball is in the air for 6 s.

PTS: 1 OBJ: Section 4.2

10. ANS:

Sketch a diagram to visualize the situation.



The area of the photo is 30 cm × 20 cm = 600 cm². The area of the border is four times this or 2400 cm².

Therefore, the area of the photo and border is 3000 cm².

Let x be the width of the border, in centimetres.

The outside dimensions of the border are $(30 + 2x)$ by $(20 + 2x)$.

$$(30 + 2x)(20 + 2x) = 3000$$

$$600 + 60x + 40x + 4x^2 = 3000$$

$$4x^2 + 100x - 2400 = 0$$

$$4(x^2 + 25x - 600) = 0$$

$$(x + 40)(x - 15) = 0$$

$$x = -40 \text{ or } x = 15$$

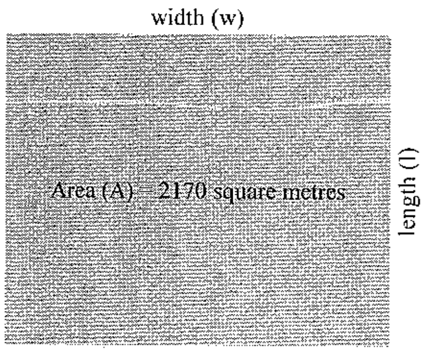
The zeros are at $x = -40$ and $x = 15$. Discard the negative zero.

The width of the border is 15 cm.

The outside dimensions of the border are 60 cm by 50 cm.

PTS: 1 OBJ: Section 4.2

11. ANS:
Draw a diagram to visualize the problem.



$$P = 2l + 2w \qquad A = lw$$
$$202 = 2(l + w) \qquad 2170 = (101 - w)w$$
$$101 = l + w \qquad 2170 = 101w - w^2$$
$$l = 101 - w \qquad w^2 - 101w + 2170 = 0$$
$$(w - 31)(w - 70) = 0$$
$$w = 31 \text{ or } w = 70$$

Thus, $l = 70$ or $l = 31$.
The dimensions of the base are 70 m by 31 m.

PTS: 1 OBJ: Section 4.2

12. ANS:
Set $h = 0$ and solve for d.

$$d = \frac{-24 \pm \sqrt{(24)^2 - 4(-5)(30)}}{2(-5)}$$
$$= \frac{-24 \pm \sqrt{576 + 600}}{-10}$$
$$= \frac{-24 \pm \sqrt{1176}}{-10}$$

$d = -1.03$ or $d = 5.83$
Since a negative distance is not reasonable, the projectile landed approximately 5.8 m from the launch pad.

PTS: 1 OBJ: Section 4.4

13. ANS:
Solve by substitution:

$-4t+300=-4.9(t-5)^2+300$
FOIL $(t-5)^2$ and get every term to one side:
$-4.9t^2+53t-122.5=0$
Use the quadratic formula to get $t=3.35$ and $t=7.46$
Reject $t=3.35$

$y=-4(7.5)+300=270$

Remember, the second parachutist exits the plane 5s after the first parachutist, so the only point of intersection that's relevant is at approximately 7.5s. Ignore the 3.35s point of intersection because it occurs before the second parachutist even jumps. Thus, the second parachutist reaches the first one 7.5s into the first parachutist's jump at an altitutude of approximately 270m.

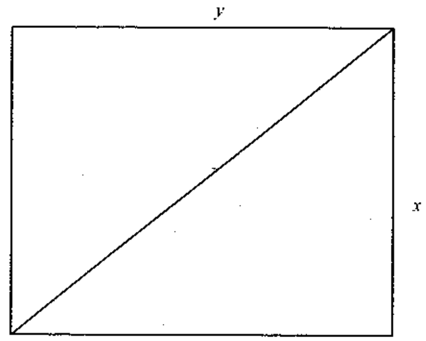
PTS: 1 OBJ: Section 8.1

14. ANS:
$4x^2-7=4x^2+13$

$0=20$
Since this is impossible, there is no solution to this system of equations.

PTS: 1 OBJ: Section 8.2

15. ANS:
Draw a diagram to visualize the situation.



$2x + 2y = 42$

$x + y = 21$

$x^2 + y^2 = 225$
Substitute $y = 21 - x$ into the third equation and solve for x:

$$x^2 + (21 - x)^2 = 225$$

$$x^2 + 441 - 42x + x^2 = 225$$

$$2x^2 - 42x + 216 = 0$$

$$x^2 - 21x + 108 = 0$$

$$(x - 9)(x - 12) = 0$$

$x = 9$ and $x = 12$
Substitute these values into $y = 21 - x$ to solve for y.
$y = 21 - 9$ or $y = 21 - 12$

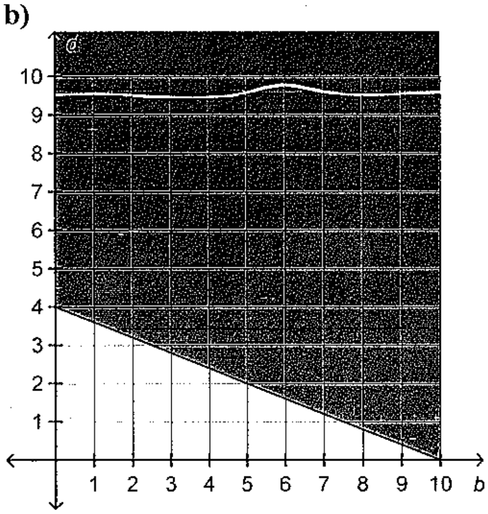
$= 12$ $= 9$
The dimensions should be 9 cm by 12 cm.

PTS: 1 OBJ: Section 8.2

16. ANS:

a) Let d represent the number of dresses sold and b represent the number of blouses sold. Then, $125d + 50b \geq 500$, which can be simplified to $5d + 2b \geq 20$.

b)



c) From the graph, the point (3, 3) is just inside the shaded region. This represents the sale of three blouses and three dresses for sales of $3(125) + 3(50) = 525$ or \$525.

PTS: 1 OBJ: Section 9.1

17. ANS:

a) 50, 54, 58, 62

b) $t_1 = 50,\ d = 4$

c) $S_n = \frac{n}{2}[2t_1 + (n-1)d]$

$$S_8 = \frac{8}{2}[2(50) + (8-1)(4)]$$
$$= 4(100 + 28)$$
$$= 512$$

He will have picked up 512 bottles after stopping at the eighth restaurant.

d) $S_{20} = \frac{20}{2}[2(50) + (20-1)(4)]$

$$= 10(100 + 76)$$
$$= 1760$$

Use the explicit formula for the general term of an arithmetic sequence to determine the number of bottles at the 21st restaurant.

$$t_n = t_1 + (n-1)d$$
$$t_{21} = 50 + (21-1)(4)$$
$$= 50 + (20)(4)$$
$$= 50 + 80$$
$$= 130$$

He has 1760 bottles in the truck and will be picking up 130 more at the next restaurant. This would bring the total to 1760 + 130, or 1890, which is less than 2000. This means that he can stop at the next restaurant.

PTS: 1 OBJ: Section 1.2

18. ANS:

a)

Year	Value ($)
0	42 000.00
1	37 380.00
2	33 268.20
3	29 608.70
4	26 351.74
5	23 453.05

b) $V(n) = 42\,000(0.89)^n$, where V represents the value and n represents the number of years since the system was purchased.

c) $V(20) = 42\,000(0.89)^{20}$

$\doteq 4083.66$

The value of the system after 20 years is $4083.66.

d) This value is most likely not realistic, as most companies would replace a computer system before the 20-year mark to upgrade the system to current needs. This would often be done before the end of the 10th year of owning a new system (or less, for some companies that require more up-to-date computer technology).

PTS: 1 OBJ: Section 1.3

19. ANS:

a) $0.\bar{5} = 0.5 + 0.05 + 0.005 + \cdots$

This is an infinite geometric series with $t_1 = 0.5$ and $r = 0.1$.

$$\begin{aligned} S_\infty &= \frac{t_1}{1-r} \\ &= \frac{0.5}{1-0.1} \\ &= \frac{0.5}{0.9} \\ &= \frac{5}{9} \end{aligned}$$

b) $0.1\bar{2} = 0.1 + 0.02 + 0.002 + 0.0002 + \cdots$

After 0.1, $t_1 = 0.02$ and $r = 0.1$.

$$\begin{aligned} S_\infty &= \frac{t_1}{1-r} \\ &= \frac{0.02}{1-0.1} \\ &= \frac{0.02}{0.9} \\ &= \frac{2}{90} \end{aligned}$$

Add this fraction to 0.1 (or $\frac{1}{10}$):

$$\begin{aligned} \frac{1}{10} + \frac{2}{90} &= \frac{9+2}{90} \\ &= \frac{11}{90} \end{aligned}$$

PTS: 1 OBJ: Section 1.5

20. ANS:

Use the Pythagorean theorem.

$$\begin{aligned} c^2 &= a^2 + b^2 \\ &= (4x^2y^2)^2 + (8x^2y^2)^2 \\ c &= \sqrt{(4x^2y^2)^2 + (8x^2y^2)^2} \\ &= \sqrt{16x^4y^4 + 64x^4y^4} \\ &= \sqrt{80x^4y^4} \\ &= 4\sqrt{5}x^2y^2 \end{aligned}$$

A simplified expression for the measure of the hypotenuse is $4\sqrt{5}x^2y^2$.

PTS: 1 OBJ: Section 5.1

21. ANS:

No. The left side of the equation is possible when *a* and *b* are both negative, because the product *ab* will be positive and the square root of the product will be a real number. However, the right side of the equation will result in non-real numbers. Therefore, the equation is not true when *a* and *b* are negative.

PTS: 1 OBJ: Section 5.2

22. ANS:

a)

$$s = 2\pi\sqrt{\frac{l}{32}}$$

$$\frac{s}{2\pi} = \sqrt{\frac{l}{32}}$$

$$\left(\frac{s}{2\pi}\right)^2 = \frac{l}{32}$$

$$l = 32\left(\frac{s}{2\pi}\right)^2$$

$$l = 32\left(\frac{s^2}{4\pi^2}\right)$$

$$l = \frac{8s^2}{\pi^2}$$

b) Substitute $s = 1.5$ into the new equation:

$$l = \frac{8s^2}{\pi^2}$$

$$= \frac{8(1.5)^2}{\pi^2}$$

≈ 1.824

The pendulum is approximately 1.8 ft long.

PTS: 1 OBJ: Section 5.2 | Section 5.3

23. ANS:

a) $t = \dfrac{30}{5x} + \dfrac{20}{x} + \dfrac{5}{\frac{x}{5}}$

$= \dfrac{6}{x} + \dfrac{20}{x} + \dfrac{25}{x}$

$= \dfrac{51}{x}$

b) Since the swimming speed is $\frac{x}{5}$, solve the equation $\frac{x}{5} = 2$.

$\dfrac{x}{5} = 2$

$x = 10$

From part a), the total time for the race is given by $t = \dfrac{51}{x}$.

$t = \dfrac{51}{x}$

$= \dfrac{51}{10}$

$= 5.1$

Therefore, it will take Cynthia 5 h 6 min to compete the race.

c) Since the cycling speed is $5x$, solve the equation $5x = 40$.

$5x = 40$

$x = 8$

From part a), the total time for the race is given by $t = \dfrac{51}{x}$.

$t = \dfrac{51}{x}$

$= \dfrac{51}{8}$

$= 6.375$

Therefore, it will take Shaitha 6 h 22.5 min to compete the race. This is 1 h 16.5 min longer than Cynthia.

PTS: 1 OBJ: Section 6.3

24. ANS:

$$P = 2(w+h)$$

$$5 = 2\left(\frac{3}{x+2} + \frac{2}{x-3}\right)$$

$$5 = 2\left(\frac{3(x-3)}{(x+2)(x-3)} + \frac{2(x+2)}{(x+2)(x-3)}\right)$$

$$5 = \frac{2(3x-9+2x+4)}{(x+2)(x-3)}$$

$$5 = \frac{2(5x-5)}{(x+2)(x-3)}$$

$$5 = \frac{10(x-1)}{(x+2)(x-3)}$$

$$5(x+2)(x-3) = 10(x-1)$$

$$(x+2)(x-3) = 2(x-1)$$

$$x^2 - x - 6 = 2x - 2$$

$$x^2 - 3x - 4 = 0$$

$$(x-4)(x+1) = 0$$

$x = 4$ or $x = -1$
But x cannot be -1, because that would give a negative value for the width of the rectangle. Thus, $x = 4$.

PTS: 1 OBJ: Section 6.3 | Section 6.4

25. ANS:

The time for the first 5 km is calculated using the equation $t = \frac{d}{s} = \frac{5}{s}$. The time for the last 4 km is $t = \frac{4}{s-2}$, because he jogged at 2 km/h less than the first 5 km.
The total time is 1 h, which is the sum of the time for the 5-km segment and the time for the 4-km segment:

$$1 = \frac{5}{s} + \frac{4}{s-2}$$

Add the rational expressions and solve for s:

$$1 = \frac{5}{s} + \frac{4}{s-2}$$

$$1 = \frac{5(s-2)}{s(s-2)} + \frac{4s}{s(s-2)}$$

$$s(s-2) = 5(s-2) + 4s$$

$$s^2 - 2s = 5s - 10 + 4s$$

$$s^2 - 11s + 10 = 0$$

$$(s-1)(s-10) = 0$$

$$s = 1 \text{ or } s = 10$$

Since a speed of 1 km/h would result in a negative speed for the 4-km segment, this answer is rejected. Jerry jogged at a speed of 10 km/h for the first 5 km.

PTS: 1 OBJ: Section 6.1 | Section 6.4

26. ANS:

Let s represent the speed of the car. Then, $s + 15$ represents the speed of the bus. Since the times are the same,

$$\frac{480}{s} = \frac{570}{s+15}$$

$$480(s+15) = 570s$$

$$16(s+15) = 19s$$

$$16s + 240 = 19s$$

$$3s = 240$$

$$s = 80$$

The speed of the car was 80 km/h and the speed of the bus was 95 km/h.

PTS: 1 OBJ: Section 6.1 | Section 6.4