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EXERCISE SOLUTIONS

PROBATIO

LESSON 1

1. 4^3

2. $(-3)^4$

3. n^5

4. $4^3 r^2 t^3$

5. 7^2

6. 6^5

7. $3^4 a^4$

8. 0^5

9. $5^2 c^3 d^4$

10. $-8^2 = -(8 \cdot 8) = -64$

11. $5^5 = 5 \cdot 5 \cdot 5 \cdot 5 \cdot 5 = 3125$

12. $6^4 = 6 \cdot 6 \cdot 6 \cdot 6 = 1296$

13. $(-8)^2 = (-8)(-8) = 64$

14. $-4^3 = -(4 \cdot 4 \cdot 4) = -(64) = -64$

15. $(-4)^3 = (-4) \cdot (-4) \cdot (-4) = -64$

16. $2^2 \cdot 3^4 = 2 \cdot 2 \cdot 3 \cdot 3 \cdot 3 \cdot 3 = 324$

17. $-2^2 \cdot 3^2 = -(2 \cdot 2) \cdot 3 \cdot 3 = -4 \cdot 9 = -36$

18. $4^2 \cdot 3^3 = 4 \cdot 4 \cdot 3 \cdot 3 \cdot 3 = 432$

19. $(-4)^3 \cdot (-2)^3 = (-4) \cdot (-4) \cdot (-4) \cdot (-2) \cdot (-2) \cdot (-2) = 512$

20. $3^2 \cdot 5 - 2^5 + 75 \div 15$
$= 9 \cdot 5 - 32 + 75 \div 15$
$= 45 - 32 + 5$
$= 13 + 5$
$= 18$

21. $(3 \cdot 5^2 - 15 \div 3) \div (-7)$
$= (3 \cdot 25 - 15 \div 3) \div -7$
$= (75 - 5) \div -7$
$= (70) \div -7$
$= -10$

22. $2 \cdot (2^3 - 5) \cdot 3$
$= 2 \cdot (8 - 5) \cdot 3$
$= 2 \cdot 3 \cdot 3$
$= 6 \cdot 3$
$= 18$

23. $(-10)^2 - 5(10^3) \cdot (-2)$
$= 100 - 5(1000) \cdot (-2)$
$= 100 - 5000 \cdot (-2)$
$= 100 + 10000$
$= 10100$

24. $7(5 \cdot 2 - 3^2) + 5[6^2 + (2)^5]$
$= 7(5 \cdot 2 - 9) + 5[36 + 32]$
$= 7(10 - 9) + 5(68)$
$= 7 \cdot 1 + 5 \cdot 68$
$= 7 + 340$
$= 347$

25. $-2[10 - 3(4 - 2^3)]$
$= -2[10 - 3(4 - 8)]$
$= -2[10 - 3(-4)]$
$= -2[10 + 12]$
$= -2[22]$
$= -44$

26. $4 + 6[(9 - 3)^2 + (2^2 - 7)^3]$
$= 4 + 6[(6)^2 + (4 - 7)^3]$
$= 4 + 6[36 + (-3)^3]$
$= 4 + 6[36 + (-27)]$
$= 4 + 6(9)$
$= 4 + 54$
$= 58$

27. $2^2 (3^2 - 2 \cdot 2^3) - (20 + 3^3)$
$= 4(9 - 2 \cdot 8) - (20 + 27)$
$= 4(9 - 16) - (47)$
$= 4(-7) - 47$
$= -28 - 47$
$= -75$

28. $3 + 2[4(12 - 7) + (2^3 - 3^2)^2]$
$= 3 + 2[4(5) + (8 - 9)^2]$
$= 3 + 2[4(5) + (-1)^2]$
$= 3 + 2[20 + 1]$
$= 3 + 2(21)$
$= 3 + 42$
$= 45$

29. $\dfrac{-2(15-3\cdot 2^2)}{5^2-3^2}+\dfrac{11+12\div 2^2\cdot 3^2}{2(13-5)}$

$=\dfrac{-2(15-3\cdot 4)}{25-9}+\dfrac{11+12\div 4\cdot 9}{2\cdot 8}$

$=\dfrac{-2(15-12)}{16}+\dfrac{11+3\cdot 9}{16}$

$=\dfrac{-2(3)}{16}+\dfrac{11+27}{16}$

$=\dfrac{-6}{16}+\dfrac{38}{16}$

$=\dfrac{32}{16}$

$=2$

LESSON 2

1. $x^2\cdot x^5$

$=x^{2+5}$

$=x^7$

2. $y^6\cdot y^3$

$=y^{6+3}$

$=y^9$

3. $2^3\cdot 2^2$

$=2^{3+2}$

$=2^5$

$=32$

4. $a^8\cdot a^5$

$=a^{8+5}$

$=a^{13}$

5. $s^2\cdot t^4$

$=s^2t^4$ Unlike Bases

6. $10^2\cdot 10^4$

$=10^{2+4}$

$=10^6$

$=1000000$

7. $b^3\cdot b^7$

$=b^{3+7}$

$=b^{10}$

8. $x^4\cdot y^5$

$=x^4y^5$ Unlike Bases

9. $3^m\cdot 3^n$

$=3^{m+n}$

10. $2^x\cdot 2^y$

$=2^{x+y}$

11. $\dfrac{x^9}{x^4}$

$=x^{9-4}$

$=x^5$

12. $\dfrac{n^7}{n^2}$

$=n^{7-2}$

$=n^5$

13. $\dfrac{a^x}{a^y}$

$=a^{x-y}$

14. $\dfrac{r^6}{t^2}$

$=\dfrac{r^6}{t^2}$ Unlike Bases

15. $\dfrac{b^5}{b^3}$

$=b^{5-3}$

$=b^2$

16. $\dfrac{z^4}{z^3}$

$=z^{4-3}$

$=z$

17. $\dfrac{x^4}{y^3}$ Unlike Bases

18. $\dfrac{m^{14}}{m^7}$

$=m^{14-7}$

$=m^7$

19. $\dfrac{c^8}{c^1}$

$=c^{8-1}$

$=c^7$

20. $\dfrac{3^5}{3^2}$

$=3^{5-2}$

$=3^3$

$=27$

UNIT I

LESSON 12

1. $p^2 - 81 = 0$

$p^2 + 0p + (-81) = 0$

$a = 1 \quad b = 0 \quad c = -81$

$p^2 - 81 = 0$

$(p + 9)(p - 9) = 0$

$p + 9 = 0$

$(p + 9) + (-9) = (0) + (-9)$

$p = -9$

$p - 9 = 0$

$(p - 9) + 9 = (0) + 9$

$p = 9$

$S = \{-9, 9\}$

2. $\frac{2}{3}y - 5 = 7$

$\left(\frac{2}{3}y - 5\right) + (-7) = (7) + (-7)$

$\frac{2}{3}y + (-12) = 0$

$0y^2 + \frac{2}{3}y + (-12) = 0$

$a = 0 \quad b = \frac{2}{3} \quad c = -12$

or

$3\left(0y^2 + \frac{2}{3}y + (-12)\right) = 3(0)$

$0y^2 + 2y + (-36) = 0$

$a = 0 \quad b = 2 \quad c = -36$

$\frac{2}{3}y - 12 = 0$

$\left(\frac{2}{3}y - 12\right) + 12 = (0) + 12$

$\frac{2}{3}y = 12$

$\left(\frac{2}{3}y\right) \cdot \left(\frac{3}{2}\right) = (12) \cdot \left(\frac{3}{2}\right)$

$1y = 18$

$2y - 36 = 0$

$(2y - 36) + 36 = (0) + 36$

$2y = 36$

$(2y) \cdot \left(\frac{1}{2}\right) = (36) \cdot \left(\frac{1}{2}\right)$

$1y = 18$

$S = \{18\}$

3. $x^2 + 3x = 0$

$x^2 + 3x + 0 = 0$

$a = 1 \quad b = 3 \quad c = 0$

$x^2 + 3x = 0$

$x(x + 3) = 0$

$x = 0 \qquad x + 3 = 0$

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

$x = -3$

$S = \{0, -3\}$

4. $t^2 = 25$

$(t^2) + (-25) = (25) + (-25)$

$t^2 - 25 = 0$

$a = 1 \quad b = 0 \quad c = -25$

$t^2 - 25 = 0$

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

$t + 5 = 0 \qquad t - 5 = 0$

$(t + 5) + (-5) = (0) + (-5) \qquad (t - 5) + 5 = (0) + 5$

$t = -5 \qquad t = 5$

$S = \{-5, 5\}$

5. $-9z^2 + 144 = 0$

$-9z^2 + 0z + 144 = 0$

$a = -9 \quad b = 0 \quad c = 144$

$-9z^2 + 144 = 0$

$-9(z^2 - 16) = 0$

$-9(z + 4)(z - 4) = 0$

$-9 \neq 0 \qquad z + 4 = 0 \qquad z - 4 = 0$

$(z + 4) + (-4) = (0) + (-4) \qquad (z - 4) + 4 = (0) + 4$

$z = -4 \qquad z = 4$

$S = \{-4, 4\}$

6.

$$9x - 12 = 7x$$
$$(9x - 12) + (-7x) = (7x) + (-7x)$$
$$2x - 12 = 0$$
$$0x^2 + 2x - 12 = 0$$
$$a = 0 \qquad b = 2 \qquad c = -12$$

$$2x - 12 = 0$$
$$2(x - 6) = 0$$

$$2 \neq 0 \qquad x - 6 = 0$$
$$(x - 6) + 6 = (0) + 6$$
$$x = 6$$

$$S = \{6\}$$

7.

$$x^2 + 1 = 6$$
$$x^2 + 1 + (-6) = (6) + (-6)$$
$$x^2 - 5 = 0$$
$$x^2 + 0x + (-5) = 0$$
$$a = 1 \qquad b = 0 \qquad c = -5$$

$$x^2 - 5 = 0$$
$$(x + \sqrt{5})(x - \sqrt{5}) = 0$$

$$x + \sqrt{5} = 0 \qquad\qquad x - \sqrt{5} = 0$$
$$(x + \sqrt{5}) + (-\sqrt{5}) = (0) + (-\sqrt{5}) \qquad (x - \sqrt{5}) + \sqrt{5} = (0) + \sqrt{5}$$
$$x = -\sqrt{5} \qquad\qquad x = \sqrt{5}$$

$$S = \{-\sqrt{5}, \sqrt{5}\}$$

15. $f(x) = (x - 5)^2 + 40$

$h = 5 \quad k = 40 \quad a = 1$

Vertex: (5, 40)
Axis of Symmetry: $x = 5$
Graph opens upward: $a = 1$ and $1 > 0$
Minimum value: 40
Parent: $|1| = 1$

16. $f(x) = 2\left(x + \frac{3}{4}\right)^2 - 6$

$h = -\frac{3}{4} \quad k = -6 \quad a = 2$

Vertex: $\left(-\frac{3}{4}, -6\right)$
Axis of Symmetry: $x = -\frac{3}{4}$
Graph opens upward: $a = 2$ and $2 > 0$
Minimum value: –6
Vertically stretched: $|2| > 1$

17. $f(x) = -3(x - 5)^2$

$h = 5 \quad k = 0 \quad a = -3$

Vertex: (5, 0)
Axis of Symmetry: $x = 5$
Graph opens downward: $a = -3$ and $-3 < 0$
Maximum value: 0
Vertically stretched: $|-3| > 1$

18. $f(x) = -2(x + 4)^2 - 3$

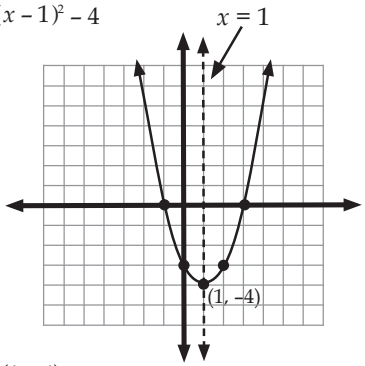
$h = -4 \quad k = -3 \quad a = -2$

Vertex: (–4, –3)
Axis of Symmetry: $x = -4$
Graph opens downward: $a = -2$ and $-2 < 0$
Maximum value: –3
Vertically stretched: $|-2| > 1$

LESSON 24

1. $f(x) = x^2 - 2x - 3$
$f(x) = (x^2 - 2x + 1) - 3 - 1$
$f(x) = (x - 1)^2 - 4$

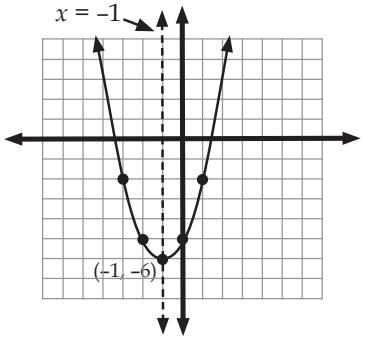
x	y
1	–4
0	–3
2	–3
3	0
–1	0



Vertex: (1, –4)
Axis of symmetry: $x = 1$
Opens up, parent shape
Min. = –4

2. $f(x) = x^2 + 2x - 5$
$f(x) = (x^2 + 2x + 1) - 5 - 1$
$f(x) = (x + 1)^2 - 6$

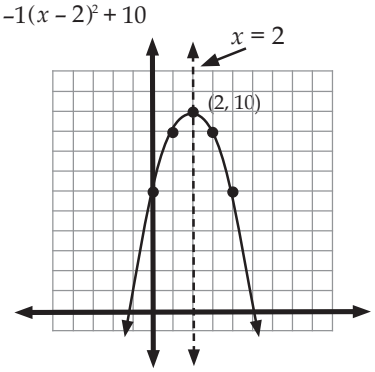
x	y
–1	–6
0	–5
–2	–5
–3	–2
1	–2



Vertex: (–1, –6)
Axis of symmetry: $x = -1$
Opens up, parent shape
Min. = –6

3. $f(x) = -x^2 + 4x + 6$
$f(x) = -1(x^2 - 4x + 4) + 6 + (-1)(-4)$
$f(x) = -1(x - 2)^2 + 10$

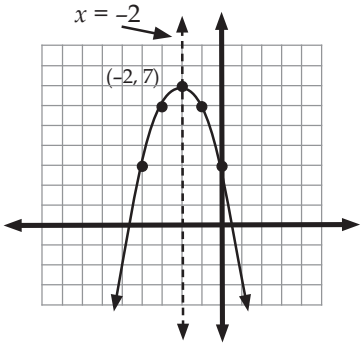
x	y
2	10
3	9
1	9
0	6
4	6



Vertex: (2, 10)
Axis of symmetry: $x = 2$
Opens down, parent shape
Max = 10

4. $f(x) = -x^2 - 4x + 3$
$f(x) = -(x^2 + 4x + 4) + 3 + (-1)(-4)$
$f(x) = -(x + 2)^2 + 7$

x	y
–2	7
–1	6
–3	6
0	3
–4	3



Vertex: (–2, 7)
Axis of symmetry: $x = -2$
Opens down, parent shape
Max = 7

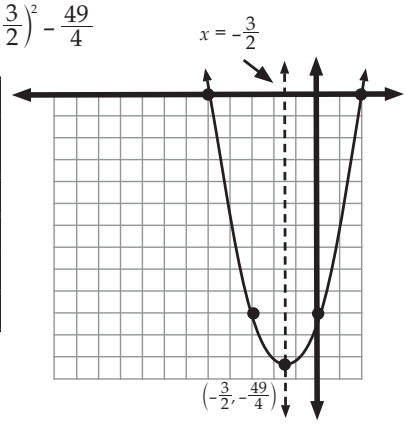
5. $f(x) = x^2 + 3x - 10$

$f(x) = \left(x^2 + 3x + \frac{9}{4}\right) - 10 - \frac{9}{4}$

$f(x) = \left(x + \frac{3}{2}\right)^2 - \frac{40}{4} - \frac{9}{4}$

$f(x) = \left(x + \frac{3}{2}\right)^2 - \frac{49}{4}$

x	y
$-\frac{3}{2}$	$-\frac{49}{4}$
-3	-10
0	-10
2	0
-5	0



Vertex: $\left(-\frac{3}{2}, -\frac{49}{4}\right)$

Axis of symmetry: $x = -\frac{3}{2}$

Opens up, parent shape

Min. $= -\frac{49}{4}$

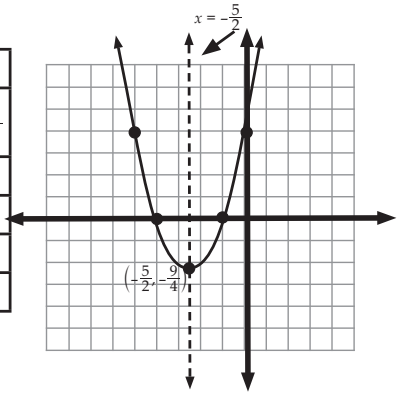
6. $f(x) = x^2 + 5x + 4$

$f(x) = \left(x^2 + 5x + \frac{25}{4}\right) + 4 - \frac{25}{4}$

$f(x) = \left(x + \frac{5}{2}\right)^2 + \frac{16}{4} - \frac{25}{4}$

$f(x) = \left(x + \frac{5}{2}\right)^2 - \frac{9}{4}$

x	y
$-\frac{5}{2}$	$-\frac{9}{4}$
-1	0
-4	0
0	4
-5	4



Vertex: $\left(-\frac{5}{2}, -\frac{9}{4}\right)$

Axis of symmetry: $x = -\frac{5}{2}$

Opens up, parent shape

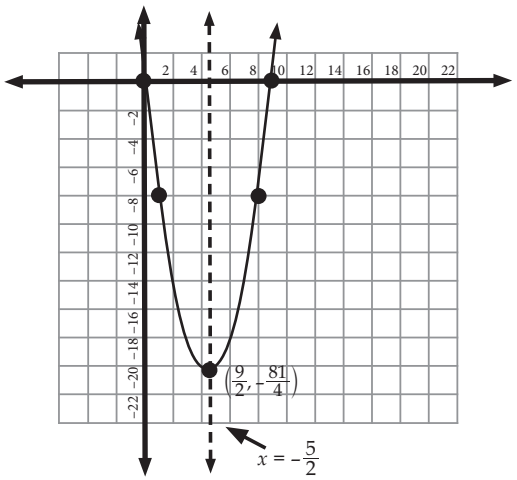
Min. $= -\frac{9}{4}$

7. $f(x) = x^2 - 9x$

$f(x) = \left(x^2 - 9x + \frac{81}{4}\right) - \frac{81}{4}$

$f(x) = \left(x - \frac{9}{2}\right)^2 - \frac{81}{4}$

x	y
$\frac{9}{2}$	$-\frac{81}{4}$
1	-8
8	-8
0	0
9	0



Vertex: $\left(\frac{9}{2}, -\frac{81}{4}\right)$

Axis of symmetry: $x = \frac{9}{2}$

Opens up, parent shape

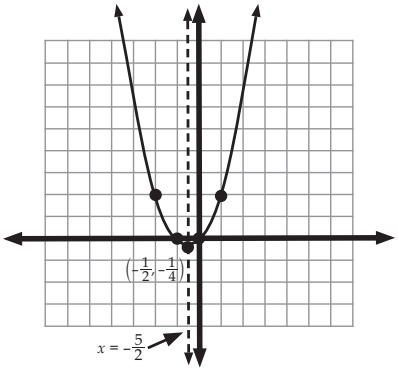
Min. $= -\frac{81}{4}$

8. $f(x) = x^2 + x$

$f(x) = \left(x^2 + x + \frac{1}{4}\right) - \frac{1}{4}$

$f(x) = \left(x + \frac{1}{2}\right)^2 - \frac{1}{4}$

x	y
$-\frac{1}{2}$	$-\frac{1}{4}$
-1	0
0	0
1	2
-2	2



Vertex: $\left(-\frac{1}{2}, -\frac{1}{4}\right)$

Axis of symmetry: $x = -\frac{1}{2}$

Opens up, parent shape

Min. $= -\frac{1}{4}$