*Part A: Radical Expressions*

## Practice 1

1.

$a^{\frac{7}{2}}$

$a^3\sqrt{a}$

2.

$a^{\frac{8}{2}}$

$a^4$

3.

$y^{\frac{12}{3}}$

$y^4$

4.

$x^{\frac{8}{3}}y^{\frac{3}{3}}$

$x^2y\sqrt[3]{x^2}$

5.

$\sqrt{3^1 \cdot 5^2x^8y^3} = 3^{\frac{1}{2}}5^{\frac{2}{2}}x^{\frac{8}{2}}y^{\frac{3}{2}}$

$5x^4y\sqrt{3y}$

6.

$\sqrt{2^3x^{16}y^9} = 2^{\frac{3}{2}}x^{\frac{16}{2}}y^{\frac{9}{2}}$

$2x^8y^4\sqrt{2y}$

7.

$\sqrt[3]{4^3x^7y^{11}} = 4^{\frac{3}{3}}x^{\frac{7}{3}}y^{\frac{11}{3}}$

$4x^2y^3\sqrt[3]{xy^2}$

8.

$\sqrt[3]{10^3a^8b^9} = 10^{\frac{3}{3}}a^{\frac{8}{3}}b^{\frac{9}{3}}$

$10a^2b^3\sqrt[3]{a^2}$

9.

$\sqrt{3^2 \cdot 7^1 x^5 y^{15}} = 3^{\frac{2}{2}} 7^{\frac{1}{2}} x^{\frac{5}{2}} y^{\frac{15}{2}}$

$3x^2 y^7 \sqrt{7xy}$

10.

$\sqrt[3]{2^5 a^{13} b^{75}} = 2^{\frac{5}{3}} a^{\frac{13}{3}} b^{\frac{75}{3}}$

$2a^4 b^{25} \sqrt[3]{2^2 a}$

$2a^4 b^{25} \sqrt[3]{4a}$

11.

$15\sqrt{2x}$

12.

$-3\sqrt{3}$

13.

$10\sqrt{11}$

14.

$4\sqrt{3} - 8\sqrt{7}$

15.

$2\sqrt{3} + \sqrt{3^2} + \sqrt{2^2 \cdot 3^1}$

$2\sqrt{3} + 3^{\frac{2}{2}} + \left(2^{\frac{2}{2}} \cdot 3^{\frac{1}{2}}\right)$

$2\sqrt{3} + 3 + 2\sqrt{3}$

$4\sqrt{3} + 3$

16.

$\sqrt[3]{2^4 \cdot 3^1} + 8\sqrt[3]{6} - \sqrt[3]{3^4 \cdot 2^1}$

$\left(2^{\frac{4}{3}} \cdot 3^{\frac{1}{3}}\right) + 8\sqrt[3]{6} - \left(3^{\frac{4}{3}} \cdot 2^{\frac{1}{3}}\right)$

$2\sqrt[3]{6} + 8\sqrt[3]{6} - 3\sqrt[3]{6}$

$7\sqrt[3]{6}$

## Practice 2

1.

$x^{\frac{1}{2}}y^{\frac{4}{2}}$

$y^2\sqrt{x}$

2.

$a^{\frac{2}{2}}b^{\frac{3}{2}}$

$ab\sqrt{b}$

3.

$x^{\frac{9}{3}}y^{\frac{15}{3}}$

$x^3y^5$

4.

$x^{\frac{2}{3}}y^{\frac{8}{3}}$

$y^2\sqrt[3]{x^2y^2}$

5.

$\sqrt{2^1 \cdot 3^2 a^{20} y^4} = 2^{\frac{1}{2}}3^{\frac{2}{2}}a^{\frac{20}{2}}y^{\frac{4}{2}}$

$3a^{10}y^2\sqrt{2}$

6.

$\sqrt{3^1 \cdot 5^1 x^{100} y^5} = 3^{\frac{1}{2}}5^{\frac{1}{2}}x^{\frac{100}{2}}y^{\frac{5}{2}}$

$x^{50}y^2\sqrt{(3)(5)y}$

$x^{50}y^2\sqrt{15y}$

7.

$x^{\frac{19}{3}}y^{\frac{14}{3}}z^{\frac{12}{3}}$

$x^6y^4z^4\sqrt[3]{xy^2}$

8.

$\sqrt[3]{2^4 \cdot 3^1 x^{18} y^7} = 2^{\frac{4}{3}} 3^{\frac{1}{3}} x^{\frac{18}{3}} y^{\frac{7}{3}}$

$2x^6 y^2 \sqrt[3]{(2)(3)y}$

$2x^6 y^2 \sqrt[3]{6y}$

9.

$\sqrt{2^2 \cdot 5^1 a^{20} b^3} = 2^{\frac{2}{2}} 5^{\frac{1}{2}} a^{\frac{20}{2}} b^{\frac{3}{2}}$

$2a^{10} b \sqrt{5b}$

10.

$\sqrt[3]{2^1 \cdot 3^3 x^{22} y^{20}} = 2^{\frac{1}{3}} 3^{\frac{3}{3}} x^{\frac{22}{3}} y^{\frac{20}{3}}$

$3x^7 y^6 \sqrt[3]{2xy^2}$

11.

$\sqrt{5a} + 3\sqrt{5a}$

$4\sqrt{5a}$

12.

$7\sqrt{2z} - \sqrt{2z}$

$6\sqrt{2z}$

13.

$6\sqrt{5} - 12\sqrt{5} + \sqrt{15}$

$\sqrt{15} - 6\sqrt{5}$

14.

$8\sqrt{3} + 5\sqrt{3} - 6\sqrt{2} + \sqrt{2}$

$13\sqrt{3} - 5\sqrt{2}$

15.

$5^{\frac{3}{3}} + 9^{\frac{2}{2}} - \sqrt[3]{6}$

$5 + 9 - \sqrt[3]{6}$

$14 - \sqrt[3]{6}$

16.

$4^{\frac{2}{2}} + 2^{\frac{3}{2}} - 10^{\frac{3}{3}} - \left(2^{\frac{1}{3}} \cdot 10^{\frac{3}{3}}\right)$

$4 + 2\sqrt{2} - 10 - 10\sqrt[3]{2}$

$-6 + 2\sqrt{2} - 10\sqrt[3]{2}$

*Part B: Radical Equations*

**Practice 1**

1.

$7^8 = 7^{\frac{a}{2}}$

$8 = \frac{a}{2}$

$a = 16$

2.

$(2^2)^{\frac{3}{5}} = 2^a$

$2^{\frac{6}{5}} = 2^a$

$a = \frac{6}{5}$

3.

$3^2 = 27a$

$\frac{3^2}{27} = a$

$\frac{3^2}{3^3} = a$

$a = \frac{1}{3}$ or $a = 3^{-1}$

4.

$(100)(10^{-2}) = a$

$(10^2)(10^{-2}) = a$

$10^{2+(-2)} = a$

$10^0 = a$

$a = 1$

5.

$$x^2 = 12$$
$$\sqrt{x^2} = \sqrt{12}$$
$$|x| = 2^{\frac{2}{2}} \cdot 3^{\frac{1}{2}}$$
$$x = \pm 2\sqrt{3}$$

6.

$p^2 = -1$

no real solution

7.

$$x^2 = 75$$
$$\sqrt{x^2} = \sqrt{75}$$
$$|x| = \sqrt{3^1 \cdot 5^2}$$
$$|x| = 3^{\frac{1}{2}} 5^{\frac{2}{2}}$$
$$x = \pm 5\sqrt{3}$$

8.

$$x^2 = 25$$
$$\sqrt{x^2} = \sqrt{25}$$
$$|x| = \sqrt{5^2}$$
$$|x| = 5^{\frac{2}{2}}$$
$$x = \pm 5$$

9.

Sample: Any value can be multiplied by itself. There are two values that when squared result in 9, −3 and 3. So p could equal 3 or −3. However, the radicand of an even root is the product of a number multiplied by itself, so it must be positive. No real number multiplied by itself is equal to −81. The only solution for r is 81.

10.

$$\left(\sqrt{b}\right)^2 = (4)^2$$
$$b = 16$$

**11.**

$$(\sqrt{r-1})^2 = (3)^2$$
$$r - 1 = 9$$
$$r = 10$$

**12.**

$$\left(\sqrt{\frac{1}{2}x + 1}\right)^2 = (5)^2$$
$$\frac{1}{2}x + 1 = 25$$
$$\frac{1}{2}x = 24$$
$$x = 48$$

**13.**

$$\left(\sqrt{3x-2}\right)^2 = (0)^2$$
$$3x - 2 = 0$$
$$3x = 2$$
$$x = \frac{2}{3}$$

## Practice 2

**1.**

$$\left(5^2\right)^3 = 5^a$$
$$5^6 = 5^a$$
$$a = 6$$

**2.**

$$2^6 = a^6$$
$$a = 2$$

**3.**

$$7^{-1} = 7^{\frac{a}{9}}$$
$$-1 = \frac{a}{9}$$
$$a = -9$$

4.

$$9^{-3} = 9^{2a}$$
$$-3 = 2a$$
$$a = -\frac{3}{2}$$

5.

$$x^2 = 16$$
$$\sqrt{x^2} = \sqrt{16}$$
$$|x| = \sqrt{4^2}$$
$$|x| = 4$$
$$x = \pm 4$$

6.

$$c^2 = 18$$
$$\sqrt{c^2} = \sqrt{18}$$
$$|c| = \sqrt{3^2 \cdot 2^1}$$
$$|c| = 3^{\frac{2}{2}} \cdot 2^{\frac{1}{2}}$$
$$c = \pm 3\sqrt{2}$$

7.

$$x^2 = 12$$
$$\sqrt{x^2} = \sqrt{12}$$
$$|x| = \sqrt{2^2 \cdot 3^1}$$
$$|x| = 2^{\frac{2}{2}} \cdot 3^{\frac{1}{2}}$$
$$x = \pm 2\sqrt{3}$$

8.

$$x^2 = 50$$
$$\sqrt{x^2} = \sqrt{50}$$
$$|x| = \sqrt{2^1 \cdot 5^2}$$
$$|x| = 2^{\frac{1}{2}} \cdot 5^{\frac{2}{2}}$$
$$x = \pm 5\sqrt{2}$$

9.

Sample: The square root is taken when solving for a variable that has been squared. Squaring the variable hides the sign of the value it represents. The value being squared could be positive or negative because both would result in the same solution. The two solutions represent both of these possibilities.

10.

$$\sqrt{k} = 11$$
$$\left(\sqrt{k}\right)^2 = (11)^2$$
$$k = 121$$

11.

$$\left(\sqrt{q + 2}\right)^2 = (3)^2$$
$$q + 2 = 9$$
$$q = 7$$

12.

$$\left(\sqrt{\frac{2}{3}x + 8}\right)^2 = (8)^2$$
$$\frac{2}{3}x + 8 = 64$$
$$\frac{2}{3}x = 56$$
$$x = 84$$

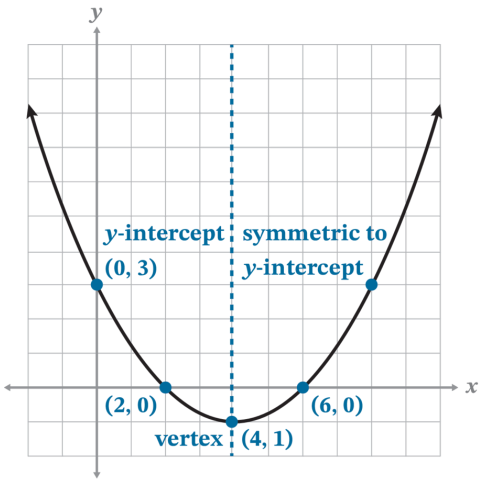
13.

no solution

## Targeted Review

| Problem | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lesson Origin | 26 | 26 | 26 | 20 | 27 | 27 | 27 | 28 | 28 | 28 | 28 | 27 |

1.




2.

domain: $(-\infty, \infty)$

range: $[-1, \infty)$

3. solutions: $x = -0.602, 2.769$

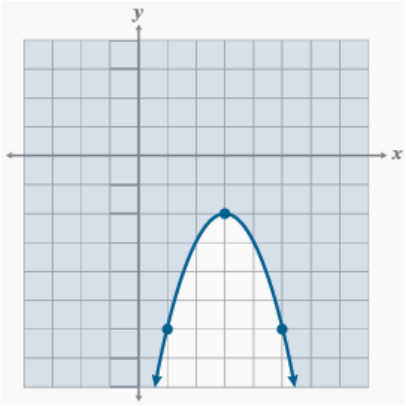
4.

$5(x + y)(x + y)$

$5(x^2 + 2xy + y^2)$

$5x^2 + 10xy + 5y^2$

5.



6.
$a = 5, h = -11, k = -26$

The direction of the parabola will open upwards and will be five times more narrow than the parent function. The vertex will move 11 spaces left and 26 spaces down from the origin.

7.
Sample: Quadratic equations can have zero, one, or two real solutions. Quadratic inequalities have an infinite number of solutions that are represented by the shaded region of the graph.

8.
$\frac{2^{\frac{1}{2}+\frac{1}{2}}}{a^{\frac{1}{4}+\frac{3}{4}}}$
$\frac{2}{a}$

9.
$\frac{b^2}{c^{-3}d^{-4}}$
$b^2c^3d^4$

10.
$p^{-3}q^6r^7$

11. B
A) $a^9b^{-9}$
B) $\frac{a^9}{b^9}$ $\frac{a^{18}b^{-3}}{a^9b^6} = \frac{a^{18}a^{-9}}{b^3b^5} = \frac{a^9}{b^9}$
C) $\frac{b^9}{a^9}$
D) $\frac{a^{27}}{b^3}$

Distractor Rationale:
A) This answer contains a negative exponent.
C) This answer is the reciprocal of the correct answer.
D) This answer does not follow the quotient rules for exponents and tries to apply the product rule incorrectly.

12. B

A) $y > -(x+3)^2 + 5$ Vertex: $(-3, 5)$; dashed, downwards facing parabola, shaded outside

B) $y < -(x+3)^2 + 5$ Vertex: $(-3, 5)$; dashed, downwards facing parabola, shaded inside

C) $y > -(x-3)^2 + 5$ Vertex: $(3, 5)$; dashed, downwards facing parabola, shaded outside

D) $y < -(x-3)^2 + 5$ Vertex: $(3, 5)$; dashed, downwards facing parabola, shaded inside

Distractor Rationale:
A) This has the incorrect direction for the inequality symbol.
C) This has the incorrect direction for the inequality symbol and represents the graph shifting right because $h = 3$.
D) This represents the graph shifting right because $h = 3$.