

Part A: Negative Exponents and Zero Exponents

Practice 1

1.

$$a^{-9} b^3 c^{-5} d^7$$

2.

$$x^{-1} y^6 z^3$$

3.

$$e^{-\frac{3}{2}} f^5 g^{\frac{1}{2}}$$

4.

$$p^5 q^{-6} r^7$$

5.

$$\frac{x^8 y^1}{z^{-6}}$$
$$x^8 yz^6$$

6.

$$\frac{y^2 z}{w^{-4} x^{-3}}$$
$$w^4 x^3 y^2 z$$

7.

$$\frac{3^8 x^4}{2^{12} y}$$

8.

$$\frac{z^4}{x^{\frac{1}{2}} y^3}$$

9.

$$\frac{b^2}{2^8 a^{11} c^5}$$

10.

$$\frac{1}{15}$$

11.

$$\frac{2^2 x^6}{y^{-3} z^{-\frac{1}{2}}}$$
$$4x^6 y^3 z^{\frac{1}{2}}$$

12.

$$\frac{a^2 b^{-3}}{4^{-1} c^{-3}}$$
$$\frac{4a^2 c^3}{b^3}$$

Practice 2

1.

$$e^4 f^8 g^{12}$$

2.

$$p^3 q^{-4} r^2 s$$

3.

$$d^{-\frac{1}{2}} e^6 f^{\frac{1}{2}}$$

4.

$$a^3 b^{-8} c^{11} f^{-10}$$

5.

$$w^6 x^{-2} z^{-1}$$

6.

$$\frac{w^8}{x^{-3} y^5}$$
$$w^8 x^3 y^{-5}$$

7.

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

8.

$$\frac{1}{w^6 x^3 y^4 z^{11}}$$

9.

1

10.

$$\frac{a^{\frac{1}{2}}}{b^3}$$

11.

$$\frac{1}{5^{-1} c^7}$$
$$\frac{5}{c^7}$$

12.

$$\frac{3^{-2}xz^{-1}}{y^{-2}}$$

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

*Part B: Quotient Rules for Exponents***Practice 1**

1.

$$\frac{y^{-2}}{x^{-2}}$$

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

2.

$$\frac{a^{12}b^{32}}{c^4}$$

3.

$$\frac{b^{-6}c^{36}}{a^{-15}}$$

$$\frac{a^{15}c^{36}}{b^6}$$

4.

$$\frac{w^{-15}y^{-9}}{x^6z^3}$$

$$\frac{1}{w^{15}x^6y^9z^3}$$

5.

$$\frac{x^{5-3}}{y^{8-2}}$$

$$\frac{x^2}{y^6}$$

6.

$$x^{8+8}$$

$$x^{16}$$

7.

$$\frac{6^{\frac{2}{3}-\frac{1}{3}}}{x^{4-1}}$$

$$\frac{6^{\frac{1}{3}}}{x^3}$$

8.

$$\frac{a^{7-3} b^{-1+4}}{c^{-2+5}}$$

$$\frac{a^4 b^3}{c^3}$$

9.

$$\frac{5^{8-5} y^{7-3}}{x^{4+2}}$$

$$\frac{5^3 y^4}{x^6}$$

10.

$$\left(\frac{c^8}{a^5 b^3}\right)^2 \left(\frac{a^8}{b^4 c}\right)^{-3} = \frac{c^{16}}{a^{10} b^6} \cdot \frac{a^{-24}}{b^{-12} c^{-3}} = \frac{c^{16+3}}{a^{10+24} b^{6-12}}$$

$$\frac{b^6 c^{19}}{a^{34}}$$

11.

$$\frac{x^{-3}}{4^{\frac{1}{2}} x^4} \cdot 10x^{15} = \frac{10x^{12}}{2x^4}$$

$$5x^8$$

12.

$$\left(\frac{2^4 x^{12} \cdot xy^{1+1}}{3z}\right)^2 = \left(\frac{2^4 x^{13} y^2}{3z}\right)^2$$

$$\frac{2^8 x^{26} y^4}{3^2 z^2} \text{ OR } \frac{256x^{26}y^4}{9z^2}$$

Practice 2

1.

$$\frac{x^7}{y^7}$$

2.

$$\frac{b^4 d^{-1}}{a^1 c^2}$$

$$\frac{b^4}{ac^2 d}$$

3.

$$\frac{a^{-6} b^2}{c^{-12}}$$

$$\frac{b^2 c^{12}}{a^6}$$

4.

$$\frac{5^2 x^{-8}}{3^{-2} y^{-10} z^2}$$

$$\frac{3^2 \cdot 5^2 y^{10}}{x^8 z^2}$$

5.

$$2^{-3+5} x^{5-2}$$

$$2^2 x^3 \text{ or } 4x^3$$

6.

$$a^{1-\frac{1}{2}}$$

$$a^{\frac{1}{2}}$$

7.

$$\frac{a^{5-3}}{3^{8-6} b^{2-1}}$$

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

8.

$$\frac{x^{25+11} z^{3+3}}{y^{15-2}}$$

$$\frac{x^{36} z^6}{y^{13}}$$

9.

$$5^{\frac{5}{3}+\frac{1}{3}} y^{\frac{1}{2}-\frac{1}{2}} = 5^{\frac{6}{3}} y^0$$

$$5^2 = 25$$

10.

$$\left(\frac{5^2 x^{12}}{y^{16}}\right)\left(\frac{3y^3}{x^9}\right) = \frac{3 \cdot 5^2 x^{12} y^3}{x^9 y^{16}}$$

$$\frac{75x^3}{y^{13}}$$

11.

$$\frac{x^9 y^{\frac{3}{2}} \cdot 2^{-1} x^{-5}}{5^2 x^2 y^1} = \frac{2^{-1} 4 x^{\frac{3}{2}}}{5^2 x^2 y^1} = \frac{x^{4-2} y^{\frac{3}{2}-1}}{2 \cdot 25}$$

$$\frac{x^2 y^{\frac{1}{2}}}{50}$$

12.

$$5^{\frac{1}{2}} a^4 \cdot \left(\frac{a^4 b^5}{10a^{11} b^{12}} \right) = \frac{5^{\frac{1}{2}} a^8 b^4}{10a^{11} b^{12}}$$

$$\frac{5^{\frac{1}{2}}}{10a^3 b^7}$$

Targeted Review

Problem	1	2	3	4	5	6	7	8	9	10	11	12
Lesson Origin	26	24	26	26	27	27	27	PA	24	20	27	26

1.

$$a = 1, b = 5, c = 6$$

$$\text{AoS: } x = -\left(\frac{5}{2 \cdot 1}\right) = -2.5$$

$$\text{vertex: } y = (-2.5)^2 + 5(-2.5) + 6$$

$$(-2.5, -0.25)$$

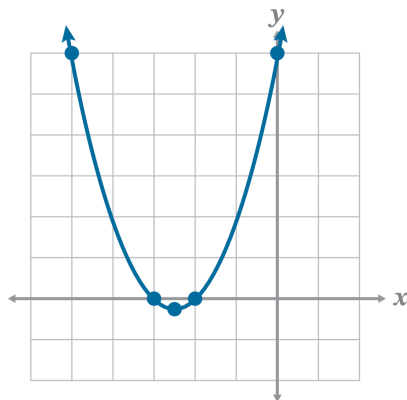
$$y\text{-intercept: } (0, 6)$$

2.

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

$$x = -3, -2$$

3.



4.

$$\text{domain: } (-\infty, \infty)$$

$$\text{range: } [-0.25, \infty)$$

5.

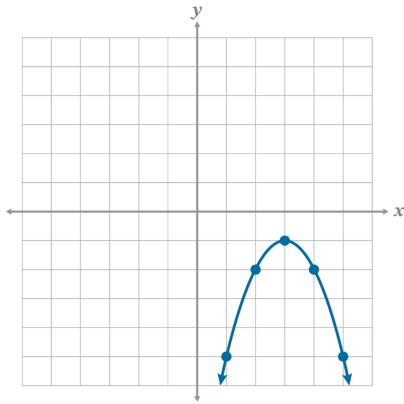
The graph is dilated by a factor of 2 since $a = 2$. The graph will shift 42 spaces left and 18 spaces down from the origin because $(h, k) = (-42, -18)$

6.

$$a = -1, h = 3, k = -1$$

The graph will reflect over the x -axis. The graph will shift right 3 spaces and down one space from the origin.

7.



8.

a)

5

b)

-11

9.

$$10(3x^2 - 11x - 190)$$

$$10(3x + 19)(x - 10)$$

10.

$$(5x^2 + 6x + 30) + (-x^2 - 2x - 13)$$

$$4x^2 + 4x + 17$$

11.

$f(x)$ shifts up 4 spaces from the origin.

$f(x)$ shifts down 4 spaces from the origin.

$f(x)$ shifts right 5 spaces from the origin.

$f(x)$ shifts left 5 spaces from the origin.

Distractor Rationale:

The 2nd and 4th box represent $(-5, -4)$. This graph is $(5, 4)$ for (h, k) .

12.

- The range of the parabola includes all real numbers.
 The vertex is $(-4, -18)$.
 $x = -10$
 $x = 2$

Distractor Rationale:

The range is $[-18, \infty)$.

$$y = \frac{1}{2}x^2 + 4x - 10$$

$$\text{AoS} = -\left(\frac{b}{2a}\right) = -\left(\frac{4}{2\left(\frac{1}{2}\right)}\right) = -4$$

$$y = \frac{1}{2}(-4)^2 + 4(-4) - 10$$

$$y = \frac{1}{2}(16) - 16 - 10$$

$$y = 8 - 16 - 10$$

$$y = -18$$

Vertex: $(-4, -18)$ Range: $[-18, \infty)$

Solutions:

$$0 = \frac{1}{2}x^2 + 4x - 10$$

Multiply by 2.

$$0 = x^2 + 8x - 20$$

$$0 = (x + 10)(x - 2)$$

$$x = -10 \text{ or } x = 2$$