

# Radicals Worksheet

Name: KEY

## Evaluate the Perfect Squares

$$\begin{array}{cccccccccccccccc} 1^2 & 2^2 & 3^2 & 4^2 & 5^2 & 6^2 & 7^2 & 8^2 & 9^2 & 10^2 & 11^2 & 12^2 & 13^2 & 14^2 & 15^2 \\ 1 & 4 & 9 & 16 & 25 & 36 & 49 & 64 & 81 & 100 & 121 & 144 & 169 & 196 & 225 \end{array}$$

1. Simplify the following.

$$\begin{array}{cccccc} \sqrt{1} & \sqrt{4} & \sqrt{9} & \sqrt{16} & \sqrt{25} & \sqrt{36} \\ =1 & =2 & =3 & =4 & =5 & =6 \\ \\ \sqrt{144} & \sqrt{\frac{4}{9}} & \sqrt{\frac{9}{100}} & \sqrt{\frac{9}{36}} & \sqrt{\frac{25}{100}} & \sqrt{\frac{900}{100}} \\ =12 & =\frac{2}{3} & =\frac{3}{10} & =\frac{3}{6}=\frac{1}{2} & =\frac{5}{10}=\frac{1}{2} & =\sqrt{9} \\ & & & & & =3 \end{array}$$

2. Find the value of the following.

$$\begin{array}{ccccc} \sqrt{49} & 2\sqrt{16} & 25\sqrt{4} & \sqrt{9}+\sqrt{36} & 5\sqrt{4}+10\sqrt{9} \\ =7 & =2 \cdot 4 & =25 \cdot 2 & =3+6 & =5 \cdot 2 + 10 \cdot 3 \\ & =8 & =50 & =9 & =10+30 \\ & & & & =40 \end{array}$$

3. Convert the following entire radicals to mixed radicals in simplest form.

$$\begin{array}{cccccc} \sqrt{12} & \sqrt{27} & \sqrt{32} & \sqrt{60} & \sqrt{72} & \sqrt{242} \\ =\sqrt{4} \cdot \sqrt{3} & =\sqrt{9} \cdot \sqrt{3} & =\sqrt{16} \cdot \sqrt{2} & =\sqrt{4} \cdot \sqrt{15} & =\sqrt{36} \cdot \sqrt{2} & =\sqrt{121} \cdot \sqrt{2} \\ =2\sqrt{3} & =3\sqrt{3} & =4\sqrt{2} & =2\sqrt{15} & =6\sqrt{2} & =11\sqrt{2} \end{array}$$

4. Simplify the following.

$$\begin{array}{cccccc} \sqrt{200} & \sqrt{36} & \sqrt{45} & \sqrt{49} & \sqrt{64} & \sqrt{108} \\ =\sqrt{100} \cdot \sqrt{2} & =6 & =\sqrt{9} \cdot \sqrt{5} & =7 & =8 & =\sqrt{36} \cdot \sqrt{3} \\ =10\sqrt{2} & & =3\sqrt{5} & & & =6\sqrt{3} \end{array}$$

5. Simplify the following.

$$\sqrt{18} = \sqrt{9 \cdot 2}$$

$$= 3\sqrt{2}$$

$$5\sqrt{24} = 5\sqrt{4 \cdot 6}$$

$$= 5 \cdot 2\sqrt{6}$$

$$= 10\sqrt{6}$$

$$\sqrt{15} = \sqrt{15}$$

$$4\sqrt{20} = 4\sqrt{4 \cdot 5}$$

$$= 4 \cdot 2\sqrt{5}$$

$$= 8\sqrt{5}$$

$$6\sqrt{16} = 6 \cdot 4$$

$$= 24$$

$$7\sqrt{17} = 7\sqrt{17}$$

$$8\sqrt{18} = 8\sqrt{9 \cdot 2}$$

$$= 8 \cdot 3\sqrt{2}$$

$$= 24\sqrt{2}$$

$$10\sqrt{98} = 10\sqrt{49 \cdot 2}$$

$$= 10 \cdot 7\sqrt{2}$$

$$= 70\sqrt{2}$$

$$\sqrt{18} = \sqrt{9 \cdot 2}$$

$$= 3\sqrt{2}$$

$$5\sqrt{24} = 5\sqrt{4 \cdot 6}$$

$$= 5 \cdot 2\sqrt{6}$$

$$= 10\sqrt{6}$$

$$\sqrt{32} = \sqrt{16 \cdot 2}$$

$$= 4\sqrt{2}$$

$$\sqrt{200} = \sqrt{100 \cdot 2}$$

$$= 10\sqrt{2}$$

6. Convert the following radicals to mixed radicals in simplest form.

$$3\sqrt{12}$$

$$= 3\sqrt{4 \cdot 3}$$

$$= 6\sqrt{3}$$

$$2\sqrt{32}$$

$$= 2\sqrt{16 \cdot 2}$$

$$= 8\sqrt{2}$$

$$5\sqrt{24}$$

$$= 5\sqrt{4 \cdot 6}$$

$$= 10\sqrt{6}$$

$$6\sqrt{98}$$

$$= 6\sqrt{49 \cdot 2}$$

$$= 42\sqrt{2}$$

$$4\sqrt{200}$$

$$= 4\sqrt{100 \cdot 2}$$

$$= 40\sqrt{2}$$

$$8\sqrt{18}$$

$$= 8\sqrt{9 \cdot 2}$$

$$= 24\sqrt{2}$$

7. Simplify the following.

$$4\sqrt{8}$$

$$= 4\sqrt{4 \cdot 2}$$

$$= 8\sqrt{2}$$

$$2\sqrt{16}$$

$$= 2 \cdot 4$$

$$= 8$$

$$16\sqrt{18}$$

$$= 16\sqrt{9 \cdot 2}$$

$$= 48\sqrt{2}$$

$$32\sqrt{9}$$

$$= 32 \cdot 3$$

$$= 96$$

$$25\sqrt{25}$$

$$= 25 \cdot 5$$

$$= 125$$

$$4\sqrt{1}$$

$$= 4$$

8. Simplify the following.

$$4\sqrt{4}$$

$$= 4 \cdot 2$$

$$= 8$$

$$2\sqrt{81}$$

$$= 2 \cdot 9$$

$$= 18$$

$$9\sqrt{25}$$

$$= 9 \cdot 5$$

$$= 45$$

$$3\sqrt{9}$$

$$= 3 \cdot 3$$

$$= 9$$

$$100\sqrt{2 \cdot 18}$$

$$= 100\sqrt{36}$$

$$= 100 \cdot 6$$

$$= 600$$

$$\sqrt{16 \cdot 16}$$

$$= \sqrt{16 \cdot 4}$$

$$= 4 \cdot 2$$

$$= 8$$

9. Convert the following mixed radicals to entire radicals.

$$3\sqrt{2}$$

$$= \sqrt{9 \cdot 2}$$

$$= \sqrt{18}$$

$$2\sqrt{3}$$

$$= \sqrt{4 \cdot 3}$$

$$= \sqrt{12}$$

$$5\sqrt{6}$$

$$= \sqrt{25 \cdot 6}$$

$$= \sqrt{150}$$

$$6\sqrt{7}$$

$$= \sqrt{36 \cdot 7}$$

$$= \sqrt{252}$$

$$4\sqrt{10}$$

$$= \sqrt{16 \cdot 10}$$

$$= \sqrt{160}$$

$$2\sqrt{11}$$

$$= \sqrt{4 \cdot 11}$$

$$= \sqrt{44}$$

### Evaluate the Perfect Cubes

$1^3$	$2^3$	$3^3$	$4^3$	$5^3$	$6^3$	$7^3$	$8^3$	$9^3$	$10^3$
1	8	27	64	125	216	343	512	729	1000

1. Evaluate the following.

$$\begin{array}{cccccc}
 \sqrt[3]{1} & \sqrt[3]{-8} & \sqrt[3]{27} & \sqrt[3]{\frac{27}{8}} & \sqrt[3]{\frac{1000}{125}} & \sqrt[3]{\frac{10}{270}} \\
 = 1 & = -2 & = 3 & = \frac{3}{2} & = \frac{10}{5} = 2 & = \sqrt[3]{\frac{1}{27}} \\
 & & & & & = \frac{1}{3}
 \end{array}$$

2. Simplify the following. (mixed radical in simplest form where possible)

$$\begin{array}{llll}
 \sqrt[3]{16} = \sqrt[3]{8 \cdot 2} & \sqrt[3]{54} = \sqrt[3]{27 \cdot 2} & \sqrt[3]{48} = \sqrt[3]{8 \cdot 6} & 5\sqrt[3]{2000} = 5\sqrt[3]{1000 \cdot 2} \\
 = 2\sqrt[3]{2} & = 3\sqrt[3]{2} & = 2\sqrt[3]{6} & = 5 \cdot 10\sqrt[3]{2} \\
 & & & = 50\sqrt[3]{2}
 \end{array}$$

3. Convert the following mixed radicals to entire radicals.

$$\begin{array}{llll}
 2\sqrt[3]{3} = \sqrt[3]{8 \cdot 3} & 3\sqrt[3]{2} = \sqrt[3]{27 \cdot 2} & 2\sqrt[3]{4} = \sqrt[3]{8 \cdot 4} & 5\sqrt[3]{10} = \sqrt[3]{125 \cdot 10} \\
 = \sqrt[3]{24} & = \sqrt[3]{54} & = \sqrt[3]{32} & = \sqrt[3]{1250}
 \end{array}$$

4. Simplify the following. (mixed radical in simplest form where possible)

$$\begin{array}{llll}
 2\sqrt[3]{16} = 2\sqrt[3]{8 \cdot 2} & \sqrt[3]{216} = 6 & 4\sqrt[3]{8} = 4 \cdot 2 & 3\sqrt[3]{8000} = 3\sqrt[3]{8 \cdot 1000} \\
 = 2 \cdot 2\sqrt[3]{2} & & = 8 & = 3 \cdot 2 \cdot 10 \\
 = 4\sqrt[3]{2} & & & = 60
 \end{array}$$

## Radicals & Variables

1. Simplify the following.

$$\begin{array}{llllll} \sqrt{x^2} & \sqrt{x^4} & \sqrt{x^6} & \sqrt{x^{10}y^8} & \sqrt{16x^{16}} & \sqrt{36x^8} \\ = x & = x^2 & = x^3 & = x^5y^4 & = 4x^8 & = 6x^4 \end{array}$$

2. Simplify the following. (mixed radical in simplest form where possible)

$$\begin{array}{llllll} \sqrt{x^3} & \sqrt{x^5} & \sqrt{x^7} & \sqrt{x^{15}} & \sqrt{9x^9} & \sqrt{18x^7} \\ = \sqrt{x^2} \cdot \sqrt{x} & = \sqrt{x^4} \cdot \sqrt{x} & = \sqrt{x^6} \cdot \sqrt{x} & = \sqrt{x^{12}} \cdot \sqrt{x^3} & = 3\sqrt{x^8} \sqrt{x} & = \sqrt{9} \cdot \sqrt{x^6} \cdot \sqrt{2x} \\ = x\sqrt{x} & = x^2\sqrt{x} & = x^3\sqrt{x} & = x^6\sqrt{x} & = 3x^4\sqrt{x} & = 3x^3\sqrt{2x} \end{array}$$

$$\begin{array}{lll} \sqrt{12x^3y^6} & \sqrt{50x^{11}y^5} & \sqrt{36x^{16}y^9} \\ = \sqrt{4} \sqrt{x^2} y^3 \sqrt{3x} & = \sqrt{25} \sqrt{x^{10}} \sqrt{y^4} \sqrt{2xy} & = 6x^8 \sqrt{y^8} \sqrt{y} \\ = 2xy^3\sqrt{3x} & = 5x^5y^2\sqrt{2xy} & = 6x^8y^4\sqrt{y} \end{array}$$

3. Simplify the following. (mixed radical in simplest form where possible)

$$\begin{array}{llll} \sqrt[3]{8x^3} = 2x & \sqrt[3]{16x^{12}} & \sqrt[3]{16x^{10}} & \sqrt[3]{27x^8y^4} \\ = \sqrt[3]{8} x^4 \sqrt[3]{2} & = 3\sqrt[3]{8} \sqrt[3]{x^9} \sqrt[3]{2x} & = 3\sqrt[3]{x^6} \sqrt[3]{y^3} \sqrt[3]{x^2y} \\ = 2x^4\sqrt[3]{2} & = 6x^3\sqrt[3]{2x} & = 3x^2y\sqrt[3]{x^2y} \end{array}$$

4. The square root of large numbers

$$\begin{array}{l} \sqrt{720} \\ = \sqrt{144 \cdot 5} \\ = \boxed{12\sqrt{5}} \end{array}$$

$$\begin{array}{l} 2 \overline{) 720} \\ 2 \overline{) 360} \\ 2 \overline{) 180} \\ 2 \overline{) 90} \\ 5 \overline{) 45} \\ 3 \overline{) 15} \\ 3 \overline{) 3} \\ \hline \end{array}$$

$$2 \cdot 2 \cdot 2 \cdot 2 \cdot 3 \cdot 3 \cdot 5 = 720$$

$$(2 \cdot 2 \cdot 3)(2 \cdot 2 \cdot 3) \cdot 5 = 720$$

$$12^2 \cdot 5 = 720$$

$$\begin{array}{l} \sqrt{1944} \\ = \sqrt{18^2 \cdot 6} \\ = \boxed{18\sqrt{6}} \end{array}$$

$$\begin{array}{l} 2 \overline{) 1944} \\ 2 \overline{) 972} \\ 2 \overline{) 486} \\ 3 \overline{) 243} \\ 3 \overline{) 81} \\ 3 \overline{) 27} \\ 3 \overline{) 9} \\ 3 \overline{) 3} \\ \hline \end{array}$$

$$2 \cdot 2 \cdot 2 \cdot 3 \cdot 3 \cdot 3 \cdot 3 = 1944$$

$$(2 \cdot 3 \cdot 3)(2 \cdot 3 \cdot 3)(2 \cdot 3) = 1944$$

$$18^2 \cdot 6 = 1944$$

$$\begin{array}{l} \sqrt{3375} \\ = \sqrt{15^2 \cdot 15} \\ = \boxed{15\sqrt{15}} \end{array}$$

$$\begin{array}{l} 5 \overline{) 3375} \\ 5 \overline{) 675} \\ 5 \overline{) 135} \\ 3 \overline{) 27} \\ 3 \overline{) 9} \\ 3 \overline{) 3} \\ \hline \end{array}$$

$$3 \cdot 3 \cdot 3 \cdot 5 \cdot 5 \cdot 5 = 3375$$

$$(3 \cdot 5)(3 \cdot 5)(3 \cdot 5) = 3375$$

$$15^2 \cdot 15 = 3375$$