

Complete the following table:

Power of 2	Radical $\sqrt{\quad}$
$0^2 = 0 \cdot 0 = 0$	$\sqrt{0} = 0$
$1^2 = 1 \cdot 1 = 1$	$\sqrt{1} = 1$
$2^2 = 2 \cdot 2 = 4$	$\sqrt{4} = 2$
$3^2 = 9$	$\sqrt{9} = 3$
$4^2 = 16$	$\sqrt{16} = 4$
$5^2 = 5 \cdot 5 = 25$	$\sqrt{25} = 5$
$6^2 = 36$	$\sqrt{36} = 6$
$7^2 = 49$	$\sqrt{49} = 7$
$8^2 = 64$	$\sqrt{64} = 8$
$9^2 = 81$	$\sqrt{81} = 9$
$10^2 = 100$	$\sqrt{100} = 10$
$11^2 = 121$	$\sqrt{121} = 11$
$12^2 = 144$	$\sqrt{144} = 12$

$$\sqrt[3]{8} = 2$$

Example 1: Using the above information estimate the value of each radical by saying between what two numbers it is between.

1. $\sqrt{34} = 5 \text{ } \hat{=} \text{ } 6$

2. $\sqrt{200} = 14 \text{ and } 15$

$$14 \cdot 14 = 196$$

$$15 \cdot 15 = 225$$

3. $\sqrt{119} = 10 \text{ } \hat{=} \text{ } 11$

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

4. $8\sqrt{7} =$

$16 \text{ } \hat{=} \text{ } 24$ (21 $\hat{=} \text{ } 22$)

$$\sqrt{7 \cdot 8 \cdot 8} = \sqrt{448}$$

$$20 \cdot 20 = 400$$

$$21 \cdot 21 = 441$$

$$22 \cdot 22 = 484$$

Example 2: Simplifying Radicals

1. Factor Tree
2. Rewrite with prime factors
3. Pull out pairs
4. Multiply, if necessary.

Simplify each radical. Show your work.

1. $\sqrt{128} = \sqrt{2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2}$

Factor tree for 128:
 128 → 4 × 32
 4 → 2 × 2
 32 → 8 × 4
 8 → 2 × 4
 4 → 2 × 2

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

2. $\sqrt{200} = \sqrt{5 \cdot 5 \cdot 2 \cdot 2 \cdot 2}$

Factor tree for 200:
 200 → 5 × 40
 40 → 5 × 8
 8 → 2 × 4
 4 → 2 × 2

$5 \cdot 2 \sqrt{2}$
 $10\sqrt{2}$

3. $\sqrt{850} = \sqrt{2 \cdot 5 \cdot 5 \cdot 17}$

Factor tree for 850:
 850 → 10 × 85
 10 → 2 × 5
 85 → 5 × 17

$5\sqrt{2 \cdot 17}$
 $5\sqrt{34}$

4. $\sqrt{8} = 2\sqrt{2}$

5. $\sqrt{320} = 8\sqrt{5}$

6. $\sqrt{32} = 4\sqrt{2}$

7. $-7\sqrt{200} = -7\sqrt{2 \cdot 2 \cdot 2 \cdot 5 \cdot 5}$
 Prime factorization tree for 200:
 200 → 2 × 100 → 2 × 2 × 50 → 2 × 2 × 2 × 25 → 2 × 2 × 2 × 2 × 5 × 5
 Simplification: $-7 \cdot 2 \cdot 5 \sqrt{2} = -70\sqrt{2}$

8. $3\sqrt{160} = 3\sqrt{2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 5}$
 Prime factorization tree for 160:
 160 → 2 × 80 → 2 × 2 × 40 → 2 × 2 × 2 × 20 → 2 × 2 × 2 × 2 × 5
 Simplification: $3 \cdot 2 \cdot 2 \sqrt{2 \cdot 5} = 12\sqrt{10}$

9. $\sqrt{16x^2} = \sqrt{2 \cdot 2 \cdot 2 \cdot 2 \cdot x \cdot x}$
 Prime factorization tree for 16:
 16 → 2 × 8 → 2 × 2 × 4 → 2 × 2 × 2 × 2
 Simplification: $2 \cdot 2 \cdot x = 4x$

10. $\sqrt{350x} = \sqrt{7 \cdot 5 \cdot 5 \cdot 2 \cdot x}$
 Prime factorization tree for 350:
 350 → 2 × 175 → 2 × 5 × 35 → 2 × 5 × 5 × 7
 Simplification: $5\sqrt{7 \cdot 2 \cdot x} = 5\sqrt{14x}$

11. $\sqrt{900x^3} = \sqrt{3 \cdot 3 \cdot 2 \cdot 2 \cdot 5 \cdot 5 \cdot x \cdot x \cdot x}$
 Prime factorization tree for 900:
 900 → 3 × 300 → 3 × 3 × 100 → 3 × 3 × 2 × 2 × 25 → 3 × 3 × 2 × 2 × 5 × 5
 Simplification: $3 \cdot 2 \cdot 5 \cdot x \sqrt{x} = 30x\sqrt{x}$

12. $\sqrt{340x^4} = \sqrt{2 \cdot 2 \cdot 5 \cdot 17 \cdot x \cdot x \cdot x \cdot x}$
 Prime factorization tree for 340:
 340 → 2 × 170 → 2 × 2 × 85 → 2 × 2 × 5 × 17
 Simplification: $2 \cdot x \cdot x \sqrt{5 \cdot 17} = 2x^2\sqrt{85}$

