Review of Simplifying Radicals

Name______________________

Date_____________Block____

index $\sqrt[n]{a}$ radical sign, radicand

PARTS OF A RADICAL

Note: When there is no index shown, the index is understood to be 2 (square root)

$\sqrt{a^2} =$ $\qquad$ $\sqrt{a \bullet a} =$ $\qquad$ $\left(\sqrt{a}\right)^2 =$

A radical is in simplest form when:

1. The radicand has no factor that is a perfect square other than 1. Some perfect squares are: 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144, 169, 196, 225, and 625.
2. The radicand does not contain a fraction.
3. No radical appears in the denominator.

☺ **To simplify a radical when the radicand contains a factor that is a perfect square, apply the product property of square roots:**

PRODUCT PROPERTY: $\sqrt{a \bullet b} = \sqrt{a} \bullet \sqrt{b}$

1. Write the radicand as a product of factors – one of which is a perfect square.
2. Apply the product property and write as a product of 2 radicals *(preferably the perfect square first).*
3. Take the square root of the perfect square and express as a product – the square root of the perfect square and the other square root factor.

Examples:

a. $\sqrt{8} = \sqrt{\boxed{4}} \bullet \sqrt{2} = 2\sqrt{2}$

b. $\sqrt{96} = \sqrt{\boxed{16}} \bullet \sqrt{6} = 4\sqrt{6}$

c. $2\sqrt{12} \bullet 5\sqrt{5} = 2 \bullet 5 \bullet \sqrt{12} \bullet \sqrt{5} = 10\sqrt{\boxed{4}}\sqrt{3} \bullet \sqrt{5} = 20\sqrt{15}$

Simplify the following:

1. $\sqrt{72}$ $\quad \sqrt{36} \cdot \sqrt{2} = 6\sqrt{2}$
2. $\sqrt{162}$ $\quad \sqrt{81} \cdot \sqrt{2} = 9\sqrt{2}$
3. $\sqrt{28}$ $\quad \sqrt{4} \cdot \sqrt{7} = 2\sqrt{7}$
4. $\sqrt{48}$ $\quad \sqrt{16}\sqrt{3} = 4\sqrt{3}$
5. $\sqrt{6^2}$ $\quad 6$
6. $\sqrt{242}$ $\quad \sqrt{121} \cdot \sqrt{2} = 11\sqrt{2}$
7. $\sqrt{3} \bullet \sqrt{8}$ $\quad \sqrt{3} \cdot \sqrt{4} \cdot \sqrt{2} = 2\sqrt{6}$
8. $\sqrt{5} \bullet \sqrt{10}$ $\quad \sqrt{50} = \sqrt{25} \cdot \sqrt{2} = 5\sqrt{2}$
9. $5\sqrt{8}$ $\quad 5\sqrt{4}\sqrt{2} = 10\sqrt{2}$
10. $2\sqrt{10} \bullet 3\sqrt{5}$ $\quad 6\sqrt{50} = 6\sqrt{25 \cdot 2} = 30\sqrt{2}$
11. $\sqrt{28} \bullet \sqrt{2}$ $\quad \sqrt{4 \cdot 7 \cdot 2} = 2\sqrt{14}$
12. $\sqrt{7} \bullet \sqrt{7}$ $\quad 7$
13. $\sqrt{12}$ $\quad \sqrt{4} \cdot \sqrt{3} = 2\sqrt{3}$
14. $\sqrt{60}$ $\quad \sqrt{4} \cdot \sqrt{15}$ $\quad 2\sqrt{15}$
15. $\sqrt{80}$ $\quad \sqrt{4 \cdot 4 \cdot 5}$ $\quad 4\sqrt{5}$
16. $3\sqrt{75}$ $\quad 3\sqrt{25}\sqrt{3}$ $\quad 15\sqrt{3}$

☺ **To simplify a fraction when the denominator contains a radical, you apply the quotient property of square roots. It is called "Rationalizing the Denominator".**

QUOTIENT PROPERTY: $\sqrt[n]{\frac{a}{b}} = \frac{\sqrt[n]{a}}{\sqrt[n]{b}}$

1. Multiply the fractions by an expression that will make the denominator a perfect square.
2. Write the new product.
3. Apply the quotient property and simplify the denominator – rationalize it.
4. Simplify the numerator.
5. Reduce any fractions outside the radical.

Rationalizing the Denominator: When there is a radical in the denominator, apply the following:

If the denominator is:	Multiply the numerator and denominator by:	Examples:
$\sqrt{b}$	$\sqrt{b}$	$\frac{3}{\sqrt{2}} = \frac{3}{\sqrt{2}} \bullet \frac{\sqrt{2}}{\sqrt{2}} = \frac{3\sqrt{2}}{2}$

More Examples:

a. $\sqrt{\frac{3}{8}} = \sqrt{\frac{3}{8}} \bullet \sqrt{\frac{2}{2}} = \sqrt{\frac{6}{16}} = \frac{\sqrt{6}}{4}$

b. $\frac{1}{\sqrt{5}} = \frac{1}{\sqrt{5}} \bullet \frac{\sqrt{5}}{\sqrt{5}} = \frac{\sqrt{5}}{\sqrt{25}} = \frac{\sqrt{5}}{5}$

c. $\frac{6}{\sqrt{2}} = \frac{6}{\sqrt{2}} \bullet \frac{\sqrt{2}}{\sqrt{2}} = \frac{6\sqrt{2}}{\sqrt{4}} = \frac{6\sqrt{2}}{2} = 3\sqrt{2}$

Simplify the following:

17. $\frac{11}{\sqrt{3}}$ $\quad \frac{11\sqrt{3}}{3}$

18. $\frac{5}{\sqrt{5}}$ $\quad \frac{5\sqrt{5}}{5} \quad \sqrt{5}$

19. $\frac{\sqrt{8}}{\sqrt{3}}$ $\frac{\sqrt{3}}{\sqrt{3}} \quad \frac{\sqrt{4}\cdot\sqrt{6}}{3} \quad \frac{2\sqrt{6}}{3}$

20. $\frac{\sqrt{64}}{\sqrt{8}}$ $\quad \sqrt{8} = \quad 2\sqrt{2}$

21. $\sqrt{\frac{5}{3}}$ $\quad \frac{\sqrt{15}}{3}$

22. $\frac{\sqrt{50}}{\sqrt{2}}$ $\quad \sqrt{25} \quad 5$

23. $\frac{12}{\sqrt{2}}$ $\frac{\sqrt{2}}{\sqrt{2}} \quad \frac{12\sqrt{2}}{2} \quad 6\sqrt{2}$

24. $\frac{\sqrt{27}}{\sqrt{2}}$ $\frac{\sqrt{2}}{\sqrt{2}} \quad \frac{\sqrt{9\cdot3\cdot2}}{2} \quad \frac{3\sqrt{6}}{2}$

25. $\frac{9}{\sqrt{3}}$ $\frac{\sqrt{3}}{\sqrt{3}} \quad \frac{9\sqrt{3}}{3} \quad 3\sqrt{3}$

26. $\frac{5\sqrt{3}}{\sqrt{2}}$ $\frac{\sqrt{2}}{\sqrt{2}} = \frac{5\sqrt{6}}{2}$