Geometry: 9.1 - Simplifying Radicals Day 1

Vocabulary: $\sqrt[2]{a}$

- $\sqrt{\ }$ is the radical sign
- the ***index*** is the root; for ***square root*** the index is 2 (for cube root, index is 3)
- a, or what's under the radical sign, is called the ***radicand***

Multiplying Radicals:
2 or more radicals can be multiplied, provided each has the same index - just multiply the radicands!

Rule: $\sqrt[n]{a} \cdot \sqrt[n]{b} = \sqrt{ab}$

For a radical expression to be completely simplified:
1. All perfect squares must be factored out of radicand
2. **NO FRACTIONS** left under a radical sign!
3. **NO RADICALS** left in the denominator of a fraction!

Perfect Squares	
$1^2 =$	1
$2^2 =$	4
$3^2 =$	9
$4^2 =$	16
$5^2 =$	25
$6^2 =$	36
$7^2 =$	49
$8^2 =$	64
$9^2 =$	81
$10^2 =$	100
$11^2 =$	121
$12^2 =$	144
$13^2 =$	169
$14^2 =$	196
$15^2 =$	225
$16^2 =$	256
$17^2 =$	289
$18^2 =$	324
$19^2 =$	361
$20^2 =$	400

Simplify completely.

1. $\sqrt{36}$ → 6

2. $-\sqrt{100}$ → -10

3. $\sqrt[3]{18}$ → $\sqrt{9}$ (2) → $3\sqrt{2}$

4. $\sqrt[4]{48}$ → $\sqrt{16}$ (3) → $4\sqrt{3}$

5. $\sqrt[6]{72}$ → $\sqrt{36}$ (2) → $6\sqrt{2}$

* 6. $\sqrt[2]{7\sqrt{20}}$ → $\sqrt{4}$ (5) → $14\sqrt{5}$

7. $\sqrt[2]{6\sqrt{28}}$ → $\sqrt{4}$ (7) → $12\sqrt{7}$

8. $\sqrt[18]{-2\sqrt{324}}$ → -36

9. $\sqrt{10} \cdot \sqrt{6}$ → $\sqrt[2]{60}$ → $\sqrt{4}$ (15) → $2\sqrt{15}$

10. $\sqrt[3]{27} \cdot \sqrt{2}$ → $\sqrt{9}$ (3) → $3\sqrt{3 \cdot 2}$ → $3\sqrt{6}$

11. $7\sqrt{6} \cdot 2\sqrt{50}$ → $(7 \cdot 2) \cdot (\sqrt{6} \cdot \sqrt{50})$ → $14 \cdot \sqrt[19]{300}$ → $\sqrt{100}$ (3) → $(14 \cdot 10)\sqrt{3}$ → $140\sqrt{3}$

12. $3\sqrt{2} \cdot 5\sqrt{3} \cdot 4\sqrt{5}$ → $(3 \cdot 5 \cdot 4) \cdot (\sqrt{2} \cdot \sqrt{3} \cdot \sqrt{5})$ → $60\sqrt{30}$

13) $(2\sqrt{5})^2$

$2^2(\sqrt{5})^2$

$4 \cdot 5$

$\boxed{20}$

14) $(3\sqrt{2})^2$

$3^2 \cdot (\sqrt{2})^2$

$9 \cdot 2$

$\boxed{18}$

15) $(2\sqrt{105})^2$

$2^2 \cdot (\sqrt{105})^2$

$4 \cdot 105$

$\boxed{420}$

Adding/Subtracting Radicals - you can only combine radicals with the same radicand

16) $1\sqrt{5} - 2\sqrt{5} + 9\sqrt{5}$

$(1-2+9)\sqrt{5}$

$\boxed{8\sqrt{5}}$

17) $6\sqrt{7} + 1\sqrt{14} - 5\sqrt{14} - 12\sqrt{7}$

$(6-12)\sqrt{7} + (1-5)\sqrt{14}$

$\boxed{-6\sqrt{7} - 4\sqrt{14}}$

18) $3\sqrt{8} + 2\sqrt{3} - 10\sqrt{8}$ (2, 4·2, 4·2)

$6\sqrt{2} + 2\sqrt{3} - 20\sqrt{2}$

$(6-20)\sqrt{2} + 2\sqrt{3}$

$\boxed{-14\sqrt{2} + 2\sqrt{3}}$

19) $4\sqrt{27} + 5\sqrt{18} - 9\sqrt{48} + 5\sqrt{288}$ (3, 9·3, 9·2, 16·3, 144·2)

$12\sqrt{3} - 36\sqrt{3} + 15\sqrt{2} + 60\sqrt{2}$

$\boxed{75\sqrt{2} - 24\sqrt{3}}$

20) $3\sqrt{6x} - 5\sqrt{6x}$

$(3-5)\sqrt{6x}$

$\boxed{-2\sqrt{6x}}$

21) $2\sqrt{25y} + 3\sqrt{28y} - \sqrt{324y} - 2\sqrt{63x}$ (5, 2, 18, 3, 4·7, 9·7)

$10\sqrt{y} + 6\sqrt{7y} - 18\sqrt{y} - 6\sqrt{7x}$

$\boxed{-8\sqrt{y} + 6\sqrt{7y} - 6\sqrt{7x}}$

Geometry: 9.1 - Simplifying Radicals Day 2

Dividing Radicals: $\frac{\sqrt{a}}{\sqrt{b}} = \sqrt{\frac{a}{b}}$ If dividing two radicals with same index, just divide the radicands!

Remember:

For a radical expression to be completely simplified:
1. All perfect squares must be factored out of radicand
2. **NO FRACTIONS** left under a radical sign!
3. **NO RADICALS** left in the denominator of a fraction!

Warm-up: Simplify completely.

1. $\sqrt{2} \cdot \sqrt{2}$ → $(\sqrt{2})^2$ → 2
2. $\sqrt{5} \cdot \sqrt{5}$ → $(\sqrt{5})^2$ → 5
3. $\sqrt{15} \cdot \sqrt{15}$ → $(\sqrt{15})^2$ → 15
4. $\sqrt{237} \cdot \sqrt{237}$ → $(\sqrt{237})^2$ → 237

Simplify completely - remember the rules about fractions!

5. $\frac{\sqrt{60}}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}}$ → $\frac{\sqrt{180}}{3}$ → $\frac{6\sqrt{5}}{3}$ → $2\sqrt{5}$

6. $\sqrt{\frac{18}{8}}\sqrt{\frac{9}{4}}$ or $\frac{3\sqrt{2}}{2\sqrt{2}}$ → $\frac{\sqrt{9}}{\sqrt{4}}$ → $\frac{3}{2}$

7. $\frac{1}{\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}}$ → $\frac{\sqrt{2}}{2}$

8. $\sqrt{\frac{8}{6}}\sqrt{\frac{4}{3}}$ → $\frac{\sqrt{4}}{\sqrt{3}} = \frac{2}{\sqrt{3}} \frac{\sqrt{3}}{\sqrt{3}}$ → $\frac{2\sqrt{3}}{3}$

9. $\frac{6}{5\sqrt{7}} \cdot \frac{\sqrt{7}}{\sqrt{7}}$ → $\frac{6\sqrt{7}}{5 \cdot 7}$ → $\frac{6\sqrt{7}}{35}$

10. $\frac{4}{\sqrt{24}} < \frac{4}{6}$ → $\frac{4}{2\sqrt{6}} \cdot \frac{\sqrt{6}}{\sqrt{6}}$ → $\frac{4\sqrt{6}}{2 \cdot 6}$ → $\frac{4\sqrt{6}}{12}$ → $\frac{\sqrt{6}}{3}$

(11) $\frac{10}{3\sqrt{40}}$

$\frac{10}{6\sqrt{10}} \cdot \frac{\sqrt{10}}{\sqrt{10}}$

$\frac{10\sqrt{10}}{60}$ $\boxed{\frac{\sqrt{10}}{6}}$

(12) $\frac{\sqrt{75}}{\sqrt{50}}$

$\frac{5\sqrt{3}}{5\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}}$

$\boxed{\frac{\sqrt{6}}{2}}$

(13) $\frac{4}{3} \cdot \sqrt{\frac{5}{6}}$

$\frac{4\sqrt{5}}{3\sqrt{6}} \cdot \frac{\sqrt{6}}{\sqrt{6}} = \frac{4\sqrt{30}}{3 \cdot 6}$

$\boxed{\frac{2\sqrt{30}}{9}}$ $\frac{2\sqrt{30}}{9 \cdot 3}$

Solving Equations: Solve for x.

All **quadratic equations** have two solutions.

(21) below unless it is a perfect-square trinomial!!

(14) $x^2 - 49 = 0$

$x^2 = 49$

$\sqrt{x^2} = \pm\sqrt{49}$

$\boxed{x = \pm 7}$

(15) $x^2 - 45 = 0$

$x^2 = 45$

$\sqrt{x^2} = \pm\sqrt{45}$ $\sqrt{9}\sqrt{5}$

$\boxed{x = \pm 3\sqrt{5}}$

(16) $2x^2 - 5 = 4$

$\frac{2x^2}{2} = \frac{9}{2}$

$\sqrt{x^2} = \pm\sqrt{\frac{9}{2}}$

$x = \pm \frac{\sqrt{9}}{\sqrt{2}} \frac{\sqrt{2}}{\sqrt{2}} = \pm\frac{\sqrt{9 \cdot 2}}{2} = \boxed{\pm \frac{3\sqrt{2}}{2}}$

(17) $16x^2 - 13x = 19x$

$16x^2 - 32x = 0$

$16x(x - 2) = 0$

$16x = 0 \quad x - 2 = 0$

$x = 0 \quad x = 2$

$\boxed{x = \{0, 2\}}$

(18) $8x^2 - 15x = 7x$

$8x^2 - 22x = 0$

$2x(x - 11) = 0$

$2x = 0 \quad x - 11 = 0$

$x = 0 \quad x = 11$

$\boxed{x = \{0, 11\}}$

(19) $2x^2 - 8x = 5x^2 + 12x$

$0 = 3x^2 + 20x$

$x(3x + 20) = 0$

$x = 0 \quad 3x + 20 = 0$

$3x = -20$

$\boxed{x = \{0, -\frac{20}{3}\}}$ $x = -\frac{20}{3}$

(20) $x^2 - 5x = 24$

$x^2 - 5x - 24 = 0$

$(x - 8)(x + 3) = 0$

$\boxed{x = \{-3, 8\}}$

(21) $2x^2 + 12x + 36 = x^2$

$x^2 + 12x + 36 = 0$

$(x + 6)(x + 6) = 0$

$(x + 6)^2 = 0$

$\boxed{x = -6}$

Why won't zero work this time?

(22) $x^2 + 11x + (4\sqrt{3})^2 = (3\sqrt{2})^2$

$x^2 + 11x + (16 \cdot 3) = (9 \cdot 2)$

$x^2 + 11x + 48 = 18$

$x^2 + 11x + 30 = 0$

$(x + 5)(x + 6) = 0$

$\boxed{x = \{-5, -6\}}$

Geometry Quadratics NAME: _____

Solve by factoring:

1. $m^2 - 5m = 14$ $m^2 - 5m - 14 = 0$ $(m+2)(m-7) = 0$ $m = \{-2, 7\}$

2. $x^2 = -4x - 3$ $x^2 + 4x + 3 = 0$ $(x+3)(x+1) = 0$ $x = \{-1, -3\}$

Use the Quadratic Formula to Solve:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Remember!
First make sure the equation is written in the form: $Ax^2 + Bx + C = 0$

Then find:
A = ? B = ? C = ?

3. $2x^2 - 21x - 36 = 0$
A=2 B=-21 C=-36
$x = \frac{-(-21) \pm \sqrt{(-21)^2 - 4(2)(-36)}}{2(2)}$
$\sqrt{441 + 288}$
$\sqrt{729} = 27$
$x = \frac{21+27}{4} = \frac{48}{4} = 12$
$x = \frac{21-27}{4} = \frac{-6}{4} = -\frac{3}{2}$
$x = \{12, -\frac{3}{2}\}$

4. $2w^2 - 11w = -12$
$2w^2 - 11w + 12 = 0$
A=2 B=-11 C=12
$w = \frac{-(-11) \pm \sqrt{(-11)^2 - 4(2)(12)}}{2(2)}$
$\sqrt{121 - 96}$
$\sqrt{25} = 5$
$w = \frac{11+5}{4} = \frac{16}{4} = 4$
$w = \frac{11-5}{4} = \frac{6}{4} = \frac{3}{2}$
$w = \{4, \frac{3}{2}\}$

5. $3h^2 + 17h = -10$
$3h^2 + 17h + 10 = 0$
A=3 B=17 C=10
$h = \frac{-(17) \pm \sqrt{(17)^2 - 4(3)(10)}}{2(3)}$
$\sqrt{289 - 120}$
$\sqrt{169} = 13$
$h = \frac{-17+13}{6} = \frac{-4}{6} = -\frac{2}{3}$
$h = \frac{-17-13}{6} = \frac{-30}{6} = -5$
$h = \{-\frac{2}{3}, -5\}$