Good morning!

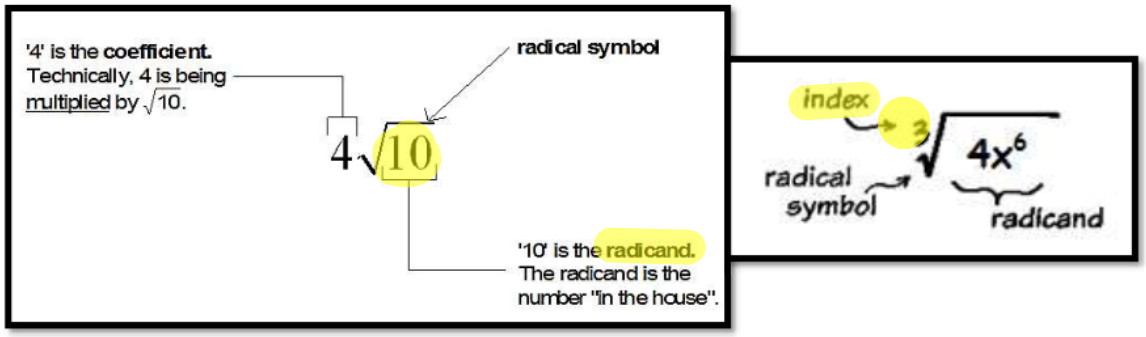
1. "Here"
2. Notes Simplifying Radicals and Expressions
3. Practice simplifying radicals
4. Homework is on DeltaMath

Simplifying Radicals

Perfect Squares	1	4	9	16	25	36	49	64	81	100	121	144
	$\sqrt{1}$	$\sqrt{4}$	$\sqrt{9}$	$\sqrt{16}$	$\sqrt{25}$	$\sqrt{36}$	$\sqrt{49}$	$\sqrt{64}$	$\sqrt{81}$	$\sqrt{100}$	$\sqrt{121}$	$\sqrt{144}$
Square Root	1	2	3	4	5	6	7	8	9	10	11	12

A **radical** is any number with a radical symbol ($\sqrt{\ }$).

A **radical expression** is an expression (coefficients and/or variables) with radical.



When are Radical Expressions in Simplest Form?

A radical expression is in **simplest form** if:

- No perfect square factors other than 1 are in the radicand
  Example: $\sqrt{11}$
- What if there is a perfect square factor in the radicand? According to the Product Properties of Radicals, we can split the radical into the product of two radicals. Then we can evaluate the square root of the perfect square factor. It becomes the coefficient of the radical.
  Example: $\sqrt{20}$

$2\sqrt{44} = 2\sqrt{11}$
4 11
2 2


LOOKS LIKE WE FOUND
a Square Root

Simplifying Radicals

Guided Example: Simplify $\sqrt{108}$.

Step 1: Begin by finding perfect square factors of the radicand.	$\sqrt{108}$ → $4 \cdot 27$
Step 2: Split the radical into the product of two radicals. *Look for the biggest perfect square factor of the radicand*	$\sqrt{4} \cdot \sqrt{27}$
Step 3: Evaluate the square root of the perfect square factor, and place it in the front of the radical as a coefficient. Leave the remaining factor inside the radical.	$2\sqrt{27}$ ($3 \cdot 9$) → $3 \cdot 2\sqrt{3} \cdot \sqrt{9}$
Step 4: Repeat steps 1-4 until radical cannot be simplified further.	$6\sqrt{3}$

Practice:

a. $\sqrt{32}$ $= 2 \cdot 2\sqrt{2} = 4\sqrt{2}$

b. $\sqrt{48} = 4\sqrt{3}$ ($\sqrt{4}\sqrt{12}$, $\sqrt{4}\sqrt{3}$, $2 \cdot 2\sqrt{3}$)

c. $\sqrt{28}$ $= 2\sqrt{7}$ ($\sqrt{4} = 2$)

d. $\sqrt{14} = \sqrt{14}$

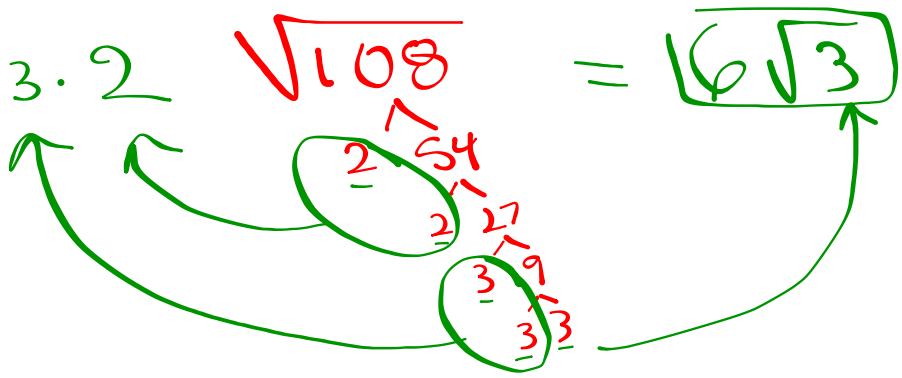
e. $3\sqrt{96} = 12\sqrt{2 \cdot 3} = 12\sqrt{6}$ ($2 \cdot 2$)

f. $4\sqrt{20} = 8\sqrt{5}$

g. $6\sqrt{120} = 12\sqrt{3 \cdot 5 \cdot 2} = 12\sqrt{30}$ ($2 \cdot 2$)

h. $2\sqrt{36} = 12$ ($3 \cdot 2$)

i. $\sqrt{24} = 2\sqrt{6}$ (2)


3 · 2
√108
= 6√3
2
54
2
27
3
9
3
3


UNDER-
STANDING
SQUARE
ROOTS
JONNY HAWKINS
CARTOONSTOCK
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Perfect Square	1	4	9	16	25	36	49	64	81	100	121	144	169
$\sqrt{\ }$	1	2	3	4	5	6	7	8	9	10	11	12	13

Simplify each radical expression, if possible. Find the correct answer below.
Write the letters in the boxes below to answer the riddle.

1) $\sqrt{100}$	2) $\sqrt{24}$	3) $\sqrt{18}$	4) $\sqrt{4}$
5) $\sqrt{7}$	6) $\sqrt{98}$	7) $\sqrt{16}$	8) $\sqrt{8}$
9) $\sqrt{20}$	10) $\sqrt{63}$	11) $\sqrt{32}$	12) $\sqrt{12}$
13) $\sqrt{121}$	14) $\sqrt{45}$	15) $\sqrt{48}$	16) $\sqrt{10}$
17) $\sqrt{50}$	18) $\sqrt{72}$	19) $\sqrt{300}$	20) $\sqrt{75}$

Answer Choices:

$3\sqrt{10}$	$7\sqrt{2}$	$2\sqrt{6}$	$\sqrt{4}$	9	$3\sqrt{7}$	$5\sqrt{3}$	$4\sqrt{3}$	$4\sqrt{6}$	$2\sqrt{5}$
?	A	A	!	R	E	!	S	S	V
2	$\sqrt{7}$	$2\sqrt{7}$	$\sqrt{3}$	10	$16\sqrt{2}$	$2\sqrt{2}$	6	12	$9\sqrt{8}$
W	H	O	T	E	J	E	V	R	O
$3\sqrt{5}$	$3\sqrt{2}$	$8\sqrt{3}$	$4\sqrt{2}$	$9\sqrt{2}$	3	$\sqrt{12}$	$6\sqrt{2}$	1	$\sqrt{10}$
G	T	E	R	Q	U	W	E	C	T
7	25	11	$8\sqrt{2}$	$24\sqrt{2}$	$2\sqrt{3}$	$5\sqrt{2}$	8	$10\sqrt{3}$	4
P	R	U	W	H	B	H	A	M	T

Why are frogs so happy?

THEY																			

"Welcome to Homework Helpline. For help with science, press 2. For help with math, press the square root of nine."

Add/Subtract Radicals

1. Simplify $2\sqrt{6} - 2\sqrt{24}$

$2\sqrt{6}$: $2 \cdot 3$ — $2\sqrt{24}$: $24 = 6 \cdot 4$, $6 = 2 \cdot 3$, $4 = 2 \cdot 2$

2. Combine like terms (coefficients add/subtracted)

$2\sqrt{6} - 4\sqrt{6} = \boxed{-2\sqrt{6}}$

Multiply Radicals

$5\sqrt{8} \cdot 3\sqrt{7}$

1. Out times Out, In times In

$2 \cdot 15\sqrt{56}$: $56 = 8 \cdot 7$, $8 = 4 \cdot 2$, $4 = 2 \cdot 2$

2. Simplify

$30\sqrt{14}$

$30\sqrt{2 \cdot 7}$

7.1

☐ (4) calculator **Simplifying Radical Expressions: Dividing and rationalizing the Denominator**

$\frac{6}{3}$ =_____ $\frac{\sqrt{6}}{\sqrt{2}}$ =_____ $\frac{\sqrt{6}}{2}$ =_____ $\frac{12\sqrt{6}}{2}$ =_____ $\frac{12\sqrt{6}}{\sqrt{2}}$ =_____

Simplest form for fractions with √

1. No perfect square factor under √ ex. $\sqrt{75} = \sqrt{25}\sqrt{3} = 5\sqrt{3}$
2. No fractions under a √ ex. $\sqrt{\frac{3}{4}} = \frac{\sqrt{3}}{\sqrt{4}} = \frac{\sqrt{3}}{2}$
3. No √ in a denominator ex. $\frac{2}{\sqrt{3}} \bullet \frac{\sqrt{3}}{\sqrt{3}} = \frac{2\sqrt{3}}{\sqrt{9}} = \frac{2\sqrt{3}}{3}$
4. Must be reduced ex. $\frac{8\sqrt{5}}{2} = 4\sqrt{5}$

no $\frac{\#}{\sqrt{\#}}$

11) $\frac{\sqrt{8}}{\sqrt{7}} \cdot \frac{\sqrt{7}}{\sqrt{7}} = \frac{\sqrt{56}}{7} = \frac{2\sqrt{14}}{7}$ ($\sqrt{49} = 7$)

12) $\frac{7}{8\sqrt{7}} \cdot \frac{\sqrt{7}}{\sqrt{7}} = \frac{7\sqrt{7}}{8 \cdot 7} = \frac{\sqrt{7}}{8}$

$\frac{5}{5} = 1$ $\frac{\sqrt{5}}{\sqrt{5}} = 1$

$\sqrt{12} = \sqrt{4}\sqrt{3} = 2\sqrt{3}$

13) $\frac{\sqrt{2}}{\sqrt{6}} \cdot \frac{\sqrt{6}}{\sqrt{6}} = \frac{\sqrt{12}}{6} = \frac{2\sqrt{3}}{6} = \frac{\sqrt{3}}{3}$ ($\sqrt{36} \to 6$)

14) $\frac{\sqrt{21}}{\sqrt{15}} \cdot \frac{\sqrt{15}}{\sqrt{15}} = \frac{\sqrt{315}}{15} = \frac{3\sqrt{35}}{15} = \frac{\sqrt{35}}{5}$

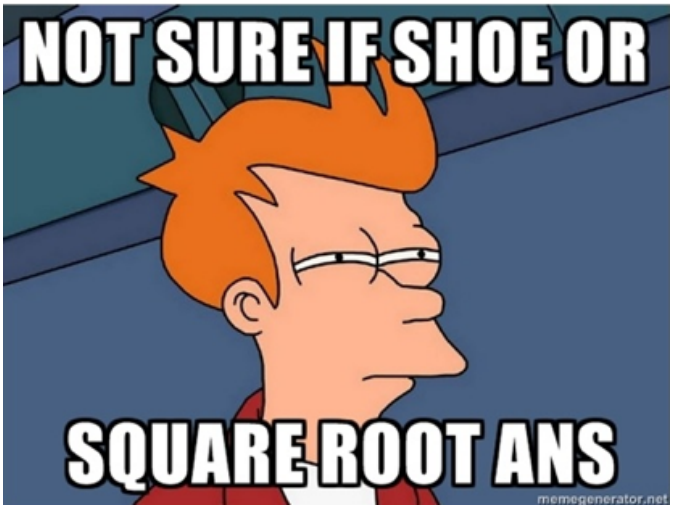
$\sqrt{315}$: $105 \cdot 3$, $7 \cdot 15$, $7 \cdot 5 \cdot 3$

15) $\frac{\sqrt{3}}{6\sqrt{7}}$

16) $\frac{\sqrt{5}}{\sqrt{3}}$

17) $\frac{\sqrt{15}}{3\sqrt{6}}$

18) $\frac{\sqrt{8}}{2\sqrt{7}}$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☐ (5) calculator **Exit Ticket**

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☐ (6) calculator **Homework**

Simplify each radical expression. ODD PROBLEMS REQUIRED

1. $\sqrt{5}\,\sqrt{15}$

2. $\sqrt{14}\,\sqrt{35}$

3. $\sqrt{2}\,(\sqrt{3} - \sqrt{5})$

4. $\sqrt{3}\,(\sqrt{27} - \sqrt{3})$

5. $\sqrt{2}\,(\sqrt{6} + \sqrt{10})$

6. $\sqrt{7}\,(3 - \sqrt{7})$

7. $\sqrt{5}\,(3\sqrt{5} - 4\sqrt{3})$

8. $\sqrt{y}\,(\sqrt{y} - \sqrt{5})$

7.1

☐ (6) calculator **Homework**

☐ Simplify each radical expression. ODD PROBLEMS REQUIRED

21. $\sqrt{\frac{27}{16}}$

22. $\sqrt{\frac{14}{y^2}}$

23. $\sqrt{\frac{24}{25}}$

24. $\sqrt{\frac{7}{5}}$

25. $\sqrt{\frac{10}{7}}$

26. $\frac{2}{\sqrt{3}}$

27. $\frac{5}{\sqrt{10}}$

28. $\frac{6}{\sqrt{3}}$

29. $\frac{2}{\sqrt{6}}$

15) $-3\sqrt{20}-\sqrt{5}$

16) $2\sqrt{45}-2\sqrt{5}$

17) $3\sqrt{18}-2\sqrt{2}$

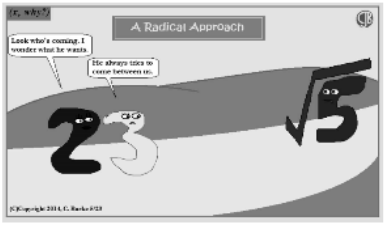
18) $-3\sqrt{18}+3\sqrt{8}-\sqrt{24}$

19) $3\sqrt{18}+3\sqrt{12}+2\sqrt{27}$

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

Exit Ticket **Name**_____ **Date** _____ **Per**_____ **7.1**

Simplify each expression completely.



2. $\sqrt{14}\,\sqrt{35}$

4. $\sqrt{3}\,(\sqrt{27} - \sqrt{3})$

24. $\sqrt{\frac{7}{5}}$

26. $\frac{2}{\sqrt{3}}$

16) $2\sqrt{45} - 2\sqrt{5}$

18) $-3\sqrt{18} + 3\sqrt{8} - \sqrt{24}$

DO NOW **Name**_____ **Date** _____ **Per**_____ **7.1**

A perfect square is a number whose square root is an integer. Half of the first 300 perfect squares are listed for you. Fill in the other 15 perfect squares.

$\sqrt{1}=1$ because $1^2=1$

$\sqrt{\quad}=\_\_\_\_$ because $\_\_\_\_^2=\_\_\_\_$

$\sqrt{\quad}=\_\_\_\_$ because $\_\_\_\_^2=\_\_\_\_$

$\sqrt{\quad}=\_\_\_\_$ because $\_\_\_\_^2=\_\_\_\_$

$\sqrt{25}=5$ because $5^2=25$

$\sqrt{\quad}=\_\_\_\_$ because $\_\_\_\_^2=\_\_\_\_$

$\sqrt{49}=7$ because $7^2=49$

$\sqrt{\quad}=\_\_\_\_$ because $\_\_\_\_^2=\_\_\_\_$

$\sqrt{\quad}=\_\_\_\_$ because $\_\_\_\_^2=\_\_\_\_$

$\sqrt{100}=10$ because $10^2=100$

$\sqrt{\quad}=\_\_\_\_$ because $\_\_\_\_^2=\_\_\_\_$

$\sqrt{144}=12$ because $12^2=144$

$\sqrt{\quad}=\_\_\_\_$ because $\_\_\_\_^2=\_\_\_\_$

$\sqrt{196}=14$ because $14^2=196$

$\sqrt{15}=225$ because $15^2=225$

$\sqrt{256}=16$ because $16^2=256$

$\sqrt{\quad}=\_\_\_\_$ because $\_\_\_\_^2=\_\_\_\_$

$\sqrt{\quad}=\_\_\_\_$ because $\_\_\_\_^2=\_\_\_\_$

$\sqrt{361}=19$ because $19^2=361$

$\sqrt{\quad}=\_\_\_\_$ because $\_\_\_\_^2=\_\_\_\_$

$\sqrt{441}=21$ because $21^2=441$

$\sqrt{\quad}=\_\_\_\_$ because $\_\_\_\_^2=\_\_\_\_$

$\sqrt{\quad}=\_\_\_\_$ because $\_\_\_\_^2=\_\_\_\_$

$\sqrt{576}=24$ because $24^2=576$

$\sqrt{625}=25$ because $25^2=625$

$\sqrt{\quad}=\_\_\_\_$ because $\_\_\_\_^2=\_\_\_\_$

$\sqrt{729}=27$ because $27^2=729$

$\sqrt{784}=28$ because $28^2=784$

$\sqrt{\quad}=\_\_\_\_$ because $\_\_\_\_^2=\_\_\_\_$

$\sqrt{900}=30$ because $30^2=900$

☐ **DO NOW – Geometry Regents Lomac 2014-2015** **Date ____. due ____.** **Similarity Simplifying Radicals** **7.1**

(DN) ON BACK OF PACKET

Name _____ **Per**_____

LO: I can simplify radical expressions including adding, subtracting, multiplying, dividing and rationalizing denominators.

☐ (1) calculator **Simplifying Radicals: Finding hidden perfect squares and taking their root.**

Simplify each expression by factoring to find perfect squares and then taking their root.

1) $\sqrt{75}$

2) $\sqrt{16}$

3) $\sqrt{36}$

4) $\sqrt{64}$

5) $\sqrt{80}$

6) $\sqrt{30}$

7) $\sqrt{8}$

8) $\sqrt{18}$

9) $\sqrt{32}$

10) $\sqrt{12}$

11) $\sqrt{8}$

12) $\sqrt{108}$

13) $\sqrt{125}$

14) $\sqrt{50}$

15) $\sqrt{175}$

16) $\sqrt{28}$

17) $\sqrt{45}$

18) $\sqrt{72}$

19) $\sqrt{20}$

20) $\sqrt{150}$

7.1

☐ (2) calculator

Simplifying Radical Expressions: Adding and Subtracting

☐ Add or subtract radicals by simplifying each term and then combining like terms.

a. $2\sqrt{2} + \sqrt{5} - 6\sqrt{2} = -4\sqrt{2} + \sqrt{5}$ **Subtract like radicals.**

b. $4\sqrt{3} - \sqrt{27} = 4\sqrt{3} - \sqrt{9 \cdot 3}$ **Perfect square factor**

$= 4\sqrt{3} - \sqrt{9} \cdot \sqrt{3}$ **Use product property.**

$= 4\sqrt{3} - 3\sqrt{3}$ **Simplify.**

$= \sqrt{3}$ **Subtract like radicals.**

1) $3\sqrt{6} - 4\sqrt{6}$

2) $-3\sqrt{7} + 4\sqrt{7}$

3) $-11\sqrt{21} - 11\sqrt{21}$

4) $-9\sqrt{15} + 10\sqrt{15}$

5) $-10\sqrt{7} + 12\sqrt{7}$

6) $-3\sqrt{17} - 4\sqrt{17}$

7) $-10\sqrt{11} - 11\sqrt{11}$

8) $-2\sqrt{3} + 3\sqrt{27}$

9) $2\sqrt{6} - 2\sqrt{24}$

10) $2\sqrt{6} + 3\sqrt{54}$

11) $-\sqrt{12} + 3\sqrt{3}$

12) $3\sqrt{3} - \sqrt{27}$

13) $3\sqrt{8} + 3\sqrt{2}$

14) $-3\sqrt{6} + 3\sqrt{6}$

7.1

☐ (3) calculator **Simplifying Radical Expressions: Multiplying**

☐ (a) Multiply numbers that are BOTH OUTSIDE the radical.
Multiply numbers that are BOTH INSIDE the radical.
Simplify the expression

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

$2\sqrt{3} \cdot 5 =$ _____ $2\sqrt{3} \cdot \sqrt{5} =$ _____ $2\sqrt{3} \cdot 4\sqrt{5} =$ _____

1) $\sqrt{6} \cdot 4\sqrt{6}$

2) $-\sqrt{5} \cdot \sqrt{20}$

3) $-\sqrt{2} \cdot \sqrt{3}$

4) $4\sqrt{8} \cdot \sqrt{2}$

5) $\sqrt{12} \cdot \sqrt{15}$

6) $\sqrt{5} \cdot -2\sqrt{5}$

7) $-3\sqrt{5} \cdot \sqrt{20}$

8) $\sqrt{15} \cdot 3\sqrt{5}$

9) $\sqrt{9} \cdot \sqrt{3}$

10) $-4\sqrt{8} \cdot \sqrt{10}$