2/11

Simplifying Radical Expressions Quiz Correct Answers

A significant portion of the class missed most of the quiz questions. So these are the correct answers with all the work shown.

1) $\sqrt{18x^3} = \sqrt{2 \cdot 3 \cdot 3 \cdot x \cdot x \cdot x} = 3x\sqrt{2x}$

$18 \to 3,\ 6$; $6 \to 2,\ 3$

2) $\sqrt[3]{40a^3b^4} = \sqrt[3]{2 \cdot 2 \cdot 2 \cdot 5 \cdot a \cdot a \cdot a \cdot b \cdot b \cdot b \cdot b}$

$= 2ab\sqrt[3]{5b}$

$40 \to 4,\ 10$; $4 \to 2,\ 2$; $10 \to 2,\ 5$

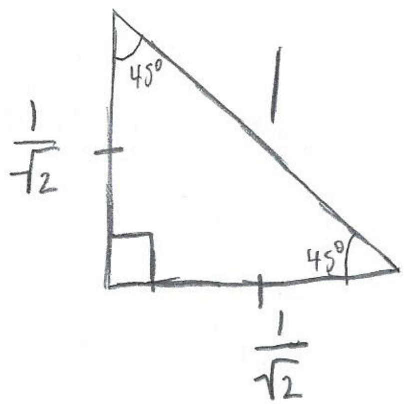
3) $\sqrt[9]{a^3b^6}$ Notice common factor of 3 $\sqrt[9/3]{a^{3/3}\, b^{6/3}} = \sqrt[3]{ab^2}$

4) $\sqrt[6]{27x^3} = \sqrt[6]{3^3x^3}$ Notice common factor of 3 $\sqrt[6/3]{3^{3/3}\, x^{3/3}}$

$= \sqrt[3]{3x}$

Notice 27 is a charts number

III. No radical may appear in the denominator



$\frac{1}{\sqrt{2}}$ is the length of the sides according to the pythagorean theorem.

We can change the look of any fraction by multiplying by a number over itself. Since any number over itself is 1 we are not changing the value of the fraction. We are just making it look differently.

Ex: $\frac{2}{5} \cdot \frac{3}{3} = \frac{6}{15}$

$\searrow .4 \swarrow$

So to get rid of the $\sqrt{2}$ in the denominator of $\frac{1}{\sqrt{2}}$.
We know that $\sqrt{2} \cdot \sqrt{2} = 2$ so if we multiply by $\frac{\sqrt{2}}{\sqrt{2}}$.

$$\frac{1}{\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}} = \frac{\sqrt{2}}{2}$$

rational

Irrational

Since the $\sqrt{2}$ in decimal form is an infinitely long decimal that does not repeat then we call $\sqrt{2}$ an irrational number. The process of changing from an irrational to a rational in the denominator is called Rationalizing the Denominator

Ex:

$$\frac{2}{\sqrt{6}} \cdot \frac{\sqrt{6}}{\sqrt{6}} = \frac{\cancel{2}^{\,1}\sqrt{6}}{\cancel{6}_{3}} = \frac{\sqrt{6}}{3}$$

Ex:

$$\underbrace{\frac{2}{2+\sqrt{3}} \cdot \frac{2-\sqrt{3}}{2-\sqrt{3}}}_{\text{Conjugates}} = \frac{2(2-\sqrt{3})}{(2+\sqrt{3})(2-\sqrt{3})}$$

$$= \frac{(2\cdot 2) - (2\cdot\sqrt{3})}{(2\cdot 2) - (2\cdot\sqrt{3}) + (2\cdot\sqrt{3}) - (\sqrt{3}\cdot\sqrt{3})}$$

we use the distributive property to multiply the numerator and the foil method for the denominator.

$$= \frac{4 - 2\sqrt{3}}{4 \cancel{- 2\sqrt{3} + 2\sqrt{3}} - 3}$$

If you do not know the foil method see the end of today's notes.

$$= \frac{4 - 2\sqrt{3}}{1} = 4 - 2\sqrt{3}$$

Ex: Conjugates

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

what is the conjugate?
So we change the sign in the middle to ge

$$\sqrt{3} + \sqrt{2}.$$

$$(\sqrt{3} - \sqrt{2})(\sqrt{3} + \sqrt{2}) = 3 + \sqrt{2}\cdot\sqrt{3} - \sqrt{2}\cdot\sqrt{3} - 2$$
$$= 3 + \sqrt{6} - \sqrt{6} - 2$$
$$= 3 - 2$$
$$= 1$$

Ex: $(\sqrt{7}+2)(\sqrt{7}-2) = 7 - 2\sqrt{7} + 2\sqrt{7} - 4$

$= 7 - 4$

$= 3$

Ex: $(\sqrt{5}-\sqrt{2})(\sqrt{5}+\sqrt{2}) = 5 - \sqrt{2}\cdot\sqrt{5} + \sqrt{2}\cdot\sqrt{5} - 2$

$= 5 - \sqrt{10} + \sqrt{10} - 2$

$= 5 - 2$

$= 3$

Ex: Questions from webassign

Rationalize the denominator.

$\frac{27}{\sqrt{5}+\sqrt{6}}$ } Since this is not just a square root we need to multiply by the conjugate.

$$\frac{27}{\sqrt{5}+\sqrt{6}} \cdot \frac{\sqrt{5}-\sqrt{6}}{\sqrt{5}-\sqrt{6}} = \frac{27(\sqrt{5}-\sqrt{6})}{(\sqrt{5}+\sqrt{6})(\sqrt{5}-\sqrt{6})} = \frac{27\sqrt{5}-27\sqrt{6}}{(5-\cancel{\sqrt{30}}+\cancel{\sqrt{30}}-6)}$$

$$= \frac{27\sqrt{5}-27\sqrt{6}}{-1}$$

$$= 27\sqrt{6} - 27\sqrt{5}$$

How to foil

For demonstration lets use $(a-b)$ and $(x-y)$. when we multiply things that look like this we need to use the foil method.

First. Outer. Inner. Last.

$(a+b)(x+y)$ = first terms times each other + the first and last terms times each other + the middle terms times each other + the last terms in each equation times each other =

$$= (a \cdot x) + (a \cdot y) + (b \cdot x) + (by)$$

First Outer Inner Last

$$= ax + ay + bx + by$$

Exs with numbers:

1) $(1+\sqrt{2})(1+\sqrt{3}) = (1 \cdot 1) + (1 \cdot \sqrt{3}) + (\sqrt{2} \cdot 1) + (\sqrt{2} \cdot \sqrt{3})$

First Outer Inner Last

$$= 1 + \sqrt{3} + \sqrt{2} + \sqrt{6}$$

2) $(1+\sqrt{5})(2+\sqrt{5}) = (1 \cdot 2) + (1 \cdot \sqrt{5}) + (\sqrt{5} \cdot 2) + (\sqrt{5} \cdot \sqrt{5})$

First Outer Inner Last

$$= 2 + \sqrt{5} + 2\sqrt{5} + 5$$

$$= 7 + 3\sqrt{5}$$