Print the worksheets first if possible.

Do the first 15 slides before turning on the video

Warm - Up - Try on Your Own

Simplifying Radicals $\sqrt{50}$

Adding Radicals $\sqrt{3}+2\sqrt{5}-3\sqrt{3}+7\sqrt{5}$

Simplifying Radicals $\sqrt{50}$

$= \sqrt{25 \times 2} = \sqrt{25}\sqrt{2}$

$= 5\sqrt{2}$

Adding Radicals $\sqrt{3} + 2\sqrt{5} - 3\sqrt{3} + 7\sqrt{5}$

$= -2\sqrt{3} + 9\sqrt{5}$

You will need an NSpire for this lesson if you don't have one you can download the Nspire app for IPad for free OR the Nspire Program for PC. Here's the link.

- **FREE SOFTWARE:**
  - We're offering free six-month licenses of TI software to all teachers and students. You can download these on our website now: Six-Month Software License.
  - We've also made the TI-Nspire™ CX and TI-Nspire™ CX CAS Apps for iPad® free to download through April 2020.

https://education.ti.com/en/resources/online-learning-program

Multiplying and Dividing with Radicals

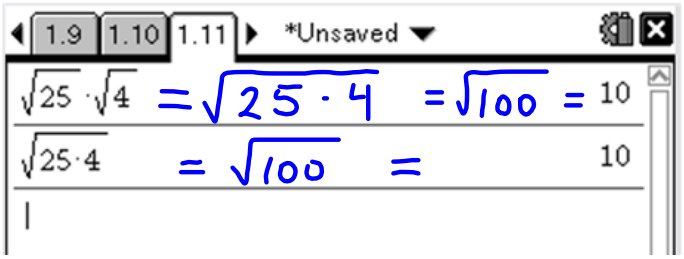
Learning Goals
- **multiply radicals**
- **divide radicals**
- **rationalize denominator**

Multiplying Radicals

Enter this into your Nspire and 'think' about what is happening"

Multiplying Radicals

Enter this into your Nspire and 'think' about what is happening"



Multiplying Radicals

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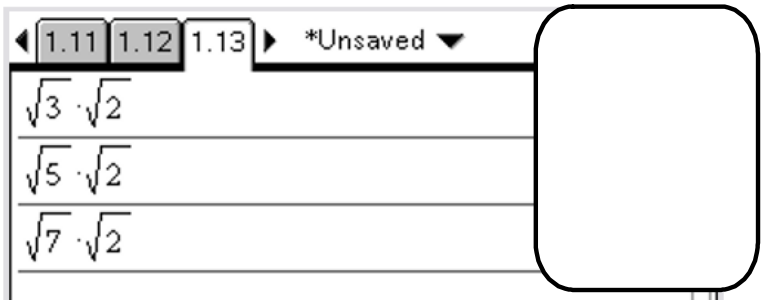

Multiplying Radicals

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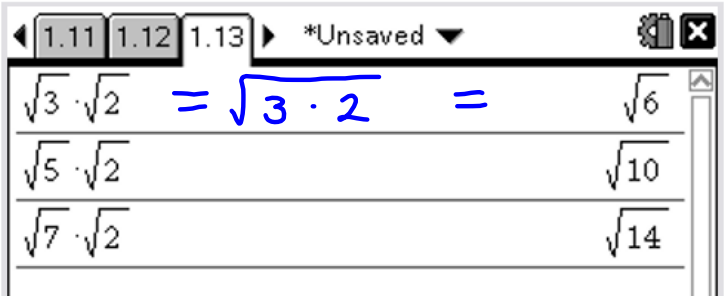
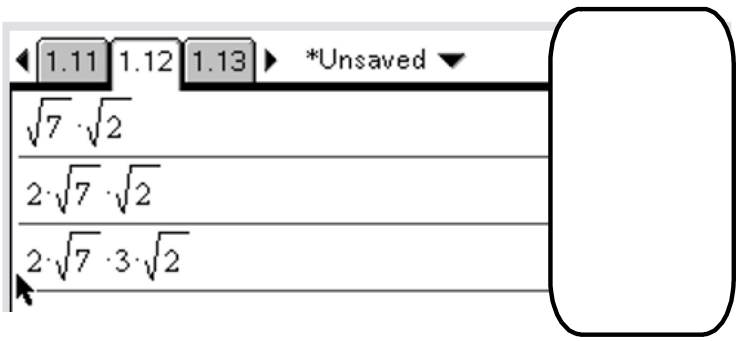
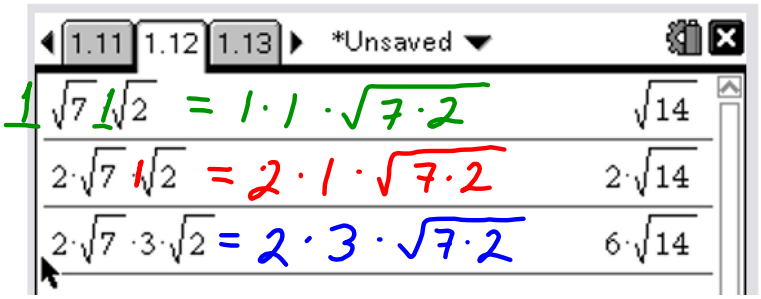


Enter this into your Nspire and 'think' about what is happening"



Steps:

Enter this into your Nspire and 'think' about what is happening"

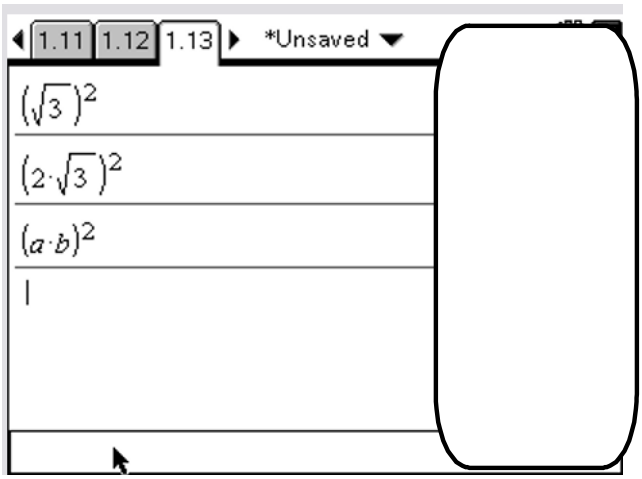


Steps:

1. Coefficients are multiplied
2. Radicals are multiplied
3. Reduce

Enter this into your Nspire and 'think' about what is happening"

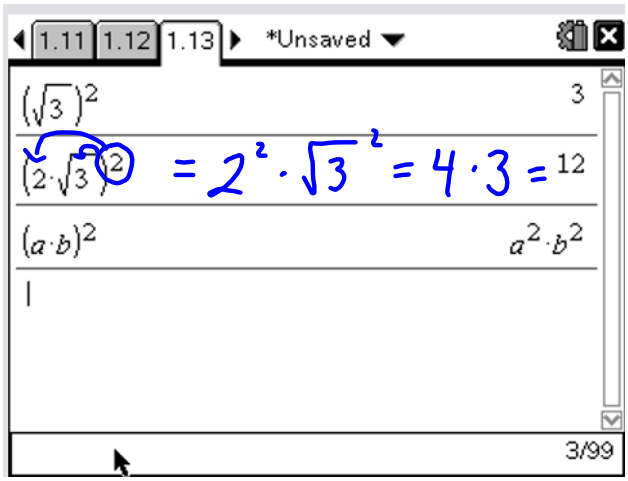
What happens when powers are involved?



Remember ...

Enter this into your Nspire and 'think' about what is happening"

What happens when powers are involved?



Remember ...

The power applies to everything within the bracket !

Enter this into your Nspire and 'think' about what is happening"

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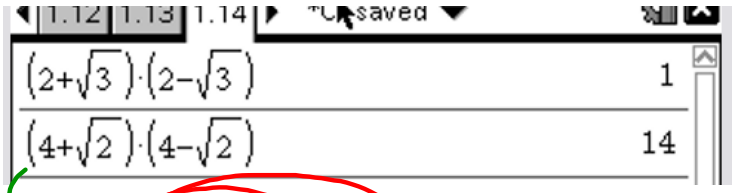


$(4+\sqrt{2})(4-\sqrt{2})$

$= 16 - 4\sqrt{2} + 4\sqrt{2} - \sqrt{4}$

$= 0$

$= 16 + 0 - 2$

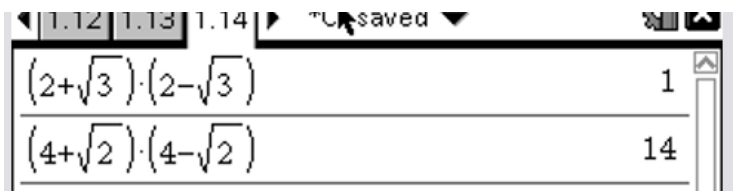
$= 14$

What the heck is going on here

The radicals disappeared !!!!!!

In order to "get rid of" the radicals we multiply by the conjugate.

Turn on the Video



What the heck is going on here

The radicals disappeared !!!!!!

In order to "get rid of" the radicals we multiply by the conjugate.

$(4+\sqrt{2})(4-\sqrt{2})$

Multiplying Radicals

Handout

Multiplying Radicals

When multiplying radicals, we

1. Multiple coefficients
2. Multiply radicals
3. Simplify

Product Property: For $a \geq 0, b \geq 0$: $\sqrt{a}\sqrt{b} = \sqrt{ab}$

Example: $2\sqrt{2} \times 3\sqrt{7}$

$= 6\sqrt{14}$

$(2+3\sqrt{5})(3-2\sqrt{6})$

	2	$+3\sqrt{5}$
3	6	$9\sqrt{5}$
$-2\sqrt{6}$	$-4\sqrt{6}$	$-6\sqrt{30}$

$6+9\sqrt{5}-4\sqrt{6}-6\sqrt{30}$

Try on Your Own

Simplify the following

a) $(3\sqrt{6})(-2\sqrt{5})$

b) $(2+\sqrt{3})(2-\sqrt{3})$

"pause the video and try these"

c) $(2+\sqrt{3})(2-\sqrt{5})$

Simplify the following

a) $(3\sqrt{6})(-2\sqrt{5})$

$= -6\sqrt{30}$

b) $(2+\sqrt{3})(2-\sqrt{3})$

	2	$\sqrt{3}$
2	4	~~$2\sqrt{3}$~~
-3	~~$-2\sqrt{3}$~~	$-\sqrt{9}$

$= 4 - \sqrt{9}$

$= 4 - 3$

$= 1$

c) $(2+\sqrt{3})(2-\sqrt{5})$

	2	$\sqrt{3}$
2	4	$2\sqrt{3}$
$-\sqrt{5}$	$-2\sqrt{5}$	$-\sqrt{15}$

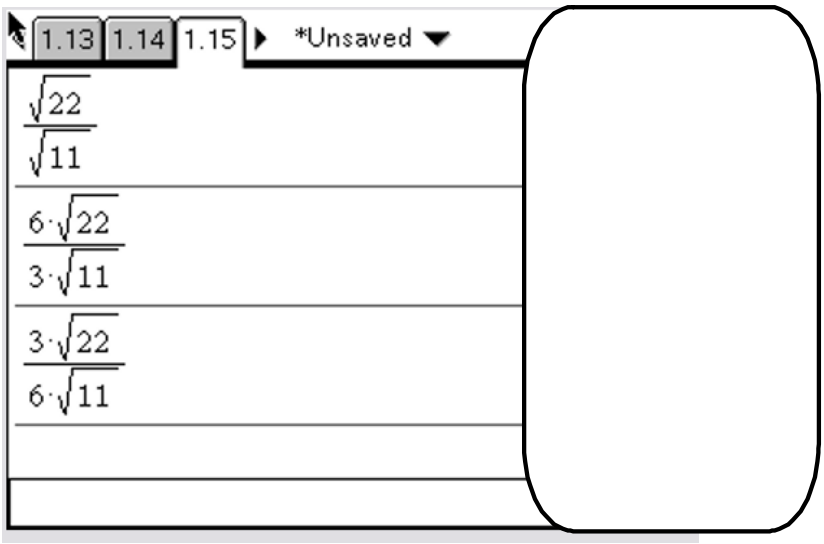
$= 4 + 2\sqrt{3} - 2\sqrt{5} - \sqrt{15}$

Dividing Radicals

Dividing Radicals

"Pause the Video and

Enter this into your Nspire and 'think' about what is happening"



Dividing Radicals

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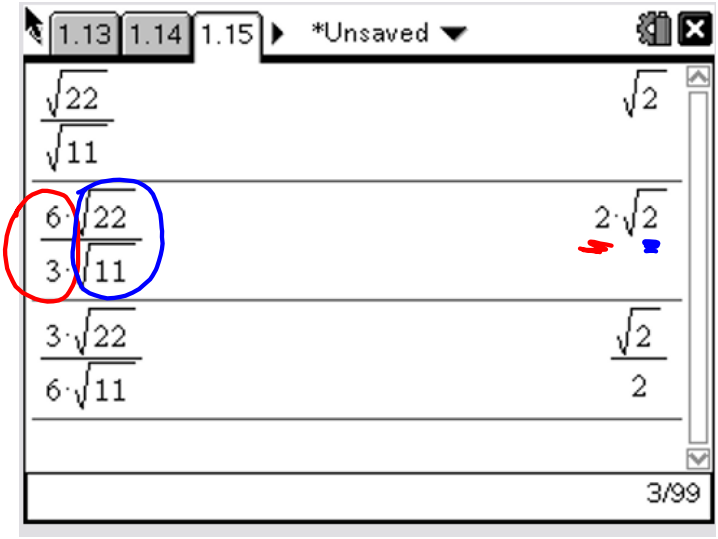


Rule: Divide inside the radical and than outside the radical

Division

Handout

Dividing Radicals

When dividing radicals,

1. Divide coefficients
2. Divide radicals
3. Simplify

Quotient Property: For $a \geq 0$, $b > 0$: $\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$

Example: Simplify

a) $\frac{6\sqrt{48}}{2\sqrt{6}}$

$= \frac{6}{2} \times \sqrt{\frac{48}{6}}$

$= 3 \times \sqrt{8}$

$= 3 \times 2\sqrt{2}$

$= 6\sqrt{2}$

b) $\frac{7\sqrt{12}}{\sqrt{3}}$

$= 7 \times \sqrt{\frac{12}{3}}$

$= 7 \times \sqrt{4}$

$= 7 \times 2$

$= 14$

c) $\frac{21\sqrt{8}}{9\sqrt{16}}$

$= \frac{21 \times 2\sqrt{2}}{9 \times 4}$

$= \frac{42\sqrt{2}}{36}$

$= \frac{7\sqrt{2}}{6}$

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

$= 2\sqrt{2}$

"Pause the Video and

Enter this into your Nspire and 'think' about what is happening"

Rationalize the Denominator

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

$\frac{1}{\sqrt{3}}$

$\frac{1}{\sqrt{4}}$

Rationalize the Denominator

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

$\frac{1}{\sqrt{3}} \quad \frac{\sqrt{3}}{3}$

$\frac{1}{\sqrt{4}} \quad \frac{1}{2}$

Rule:

Multiply by the same radical to get rid of the radical.

What do you have to do to make sure we don't change the question?

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

$$= 1$$

$$\frac{1}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{\sqrt{3}}{3}$$

Rationalizing the Denominator

A radical is not in simplest form if there is a radical in the denominator.

To eliminate this, we
1. Multiply top and bottom by the same radical
2. This essentially means multiply by 1
3. Simplify

Simplify each of the following, writing your answer with a positive denominator.

a) $\frac{1}{\sqrt{3}}$ b) $\frac{4\sqrt{3}}{\sqrt{5}}$ c) $\frac{3+\sqrt{2}}{2\sqrt{3}}$

Try on your own...

Rationalizing the Denominator

A radical is not in simplest form if there is a radical in the denominator.

To eliminate this, we
1. Multiply top and bottom by the same radical
2. This essentially means multiply by 1
3. Simplify

Simplify each of the following, writing your answer with a positive denominator.

a) $\frac{1}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}$

$= \frac{\sqrt{3}}{3}$

b) $\frac{4\sqrt{3}}{\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}}$

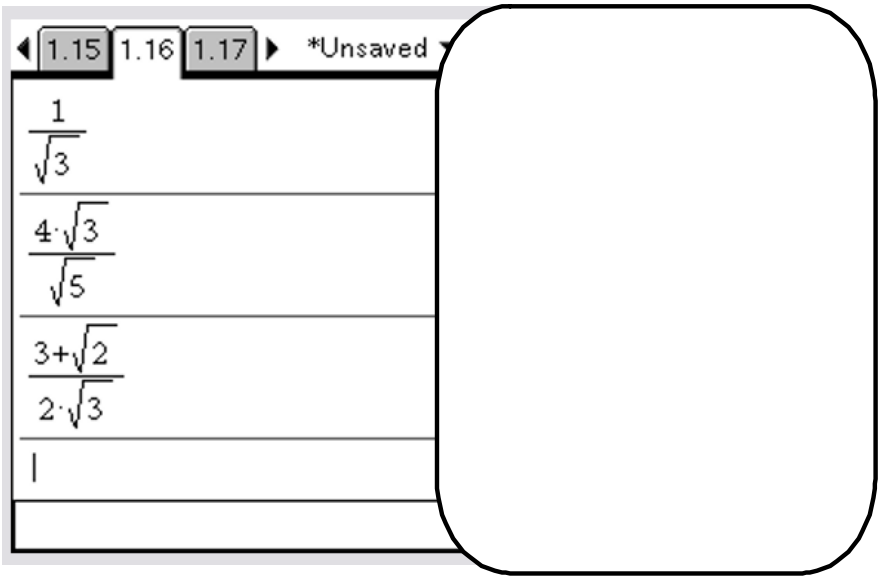
$= \frac{4\sqrt{15}}{5}$

c) $\frac{3+\sqrt{2}}{2\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}$

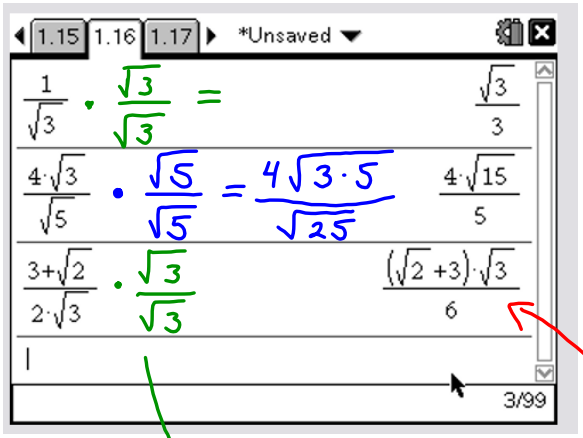
$= \frac{(3+\sqrt{2})(\sqrt{3})}{(2\sqrt{3})(\sqrt{3})}$ ← "expand"

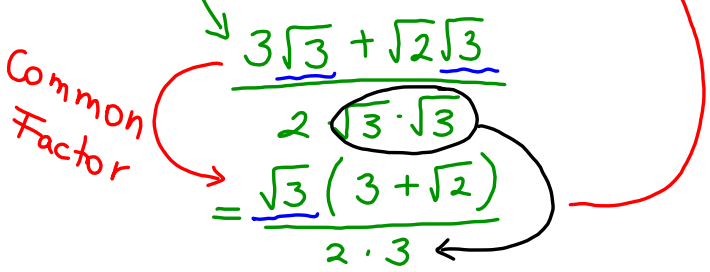
$= \frac{3\sqrt{3}+\sqrt{6}}{6}$

Final One ... Try these on Your Nspire and then explain using algebra how you would do this on your own.



Final One ... Try these on Your Nspire and then explain using algebra how you would do this On your own.





Try on Your Own - Worksheet

3U – C3 – day 3 – Try on Your Own …Multiplication and Division

1. Multiply

a) $2\sqrt{3}\times 5\sqrt{5}$ b) $\left(-4\sqrt{3}\right)^2$

d) $\left(2-2\sqrt{3}\right)\left(5+\sqrt{3}\right)$ e) $\left(x-\sqrt{3}\right)\left(x+\sqrt{5}\right)$

2. Express each of the following in simplest form.

a. $\frac{\sqrt{30}}{\sqrt{6}}$ $\frac{\sqrt{24}}{\sqrt{2}}$ $\frac{14\sqrt{16}}{2\sqrt{8}}$

3. Express each of the following in simplest form.

a) $\frac{\sqrt{24}}{\sqrt{6}}$ b) $\frac{-\sqrt{72}}{\sqrt{8}}$ c) $\frac{6\sqrt{75}}{3\sqrt{5}}$

4. Expand and Simplify

a) $(x+3)(x+2)$ b) $(x+3)(x-3)$

c) $\left(3+\sqrt{5}\right)\left(2-\sqrt{5}\right)$ d) $\left(2+\sqrt{5}\right)\left(2-\sqrt{5}\right)$ e) $(x+\sqrt{2})(x-\sqrt{2})$

5. Rationalize the denominator. (How can you make the root go away in the denominator?)

a) $\frac{1}{\sqrt{5}}$ b) $\frac{5}{\sqrt{2}}$ c) $\sqrt{\frac{9}{13}}$

d) $\frac{3\sqrt{5}}{2\sqrt{15}}$ e) $\frac{-\sqrt{18}}{2\sqrt{10}}$

Try on Your Own - Solutions

3U – C3 – day 3 – Try on Your Own …Multiplication and Division

1. Multiply

a) $2\sqrt{3}\times 5\sqrt{5}$

$= 10\sqrt{15}$

b) $\left(-4\sqrt{3}\right)^2$

$= (-4)^2 \cdot (\sqrt{3})^2$

$= 16 \cdot 3$

$= 48$

d) $\left(2-2\sqrt{3}\right)\left(5+\sqrt{3}\right)$

	2	$-2\sqrt{3}$
5	10	$-10\sqrt{3}$
$\sqrt{3}$	$2\sqrt{3}$	-6

$4 - 8\sqrt{3}$

e) $\left(x-\sqrt{3}\right)\left(x+\sqrt{5}\right)$

	x	$-\sqrt{3}$
x	x^2	$-\sqrt{3}x$
$\sqrt{5}$	$\sqrt{5}x$	$-\sqrt{15}$

$x^2 + (\sqrt{5}-\sqrt{3})x - \sqrt{15}$

2. Express each of the following in simplest form.

a. $\frac{\sqrt{30}}{\sqrt{6}}$ $\qquad$ $\frac{\sqrt{24}}{\sqrt{2}}$ $\qquad$ $\frac{14\sqrt{16}}{2\sqrt{8}}$

3. Express each of the following in simplest form.

a) $\frac{\sqrt{24}}{\sqrt{6}}$

$= \sqrt{\frac{24}{6}}$

$= \sqrt{4}$

$= 2$

b) $\frac{-\sqrt{72}}{\sqrt{8}}$

$= -\sqrt{\frac{72}{8}}$

$= -\sqrt{9}$

$= -3$

c) $\frac{6\sqrt{75}}{3\sqrt{5}}$

$= \sqrt{\frac{75}{5}}$

$= \sqrt{15}$

fix this one

4. Expand and Simplify

a) $(x+3)(x+2)$

$= x^2 + 3x + 2x + 6$

$= x^2 + 5x + 6$

b) $(x+3)(x-3)$

$= x^2 + 3x - 3x - 9$

$= x^2 - 9$

c) $\left(3+\sqrt{5}\right)\left(2-\sqrt{5}\right)$

$= 6 - 3\sqrt{5} + 2\sqrt{5} - 5$

$= 1 - \sqrt{5}$

d) $\left(2+\sqrt{5}\right)\left(2-\sqrt{5}\right)$

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

$= 4 - 5$

$= -1$

e) $(x+\sqrt{2})(x-\sqrt{2})$

$= x^2 - (\sqrt{2})^2$

$= x^2 - 4$

5. Rationalize the denominator. (How can you make the root go away in the denominator?)

a) $\frac{1}{\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}}$

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

b) $\frac{5}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}}$

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

c) $\sqrt{\frac{9}{13}}$

$= \frac{\sqrt{9}}{\sqrt{13}} \times \frac{\sqrt{13}}{\sqrt{13}}$

$= \frac{\sqrt{117}}{13}$

d) $\frac{3\sqrt{5}}{2\sqrt{15}}$

$= \frac{3}{2} \cdot \sqrt{\frac{5}{15}}$

$= \frac{3}{2} \cdot \sqrt{\frac{1}{3}}$

$= \frac{3}{2\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}$

$= \frac{3\sqrt{3}}{6}$

$= \frac{\sqrt{3}}{2}$

e) $\frac{-\sqrt{18}}{2\sqrt{10}}$

$= -\frac{\sqrt{9 \times 2}}{2\sqrt{10}}$

$= -\frac{3\sqrt{2}}{2\sqrt{10}} \times \frac{\sqrt{10}}{\sqrt{10}}$

$= -\frac{3\sqrt{20}}{2(10)}$

$= -\frac{3(2\sqrt{5})}{20}$

$= -\frac{6\sqrt{5}}{20}$

$= -\frac{3\sqrt{5}}{10}$

Additional Practise (Optional)

pg 167 # 2, 5, 7,11-13