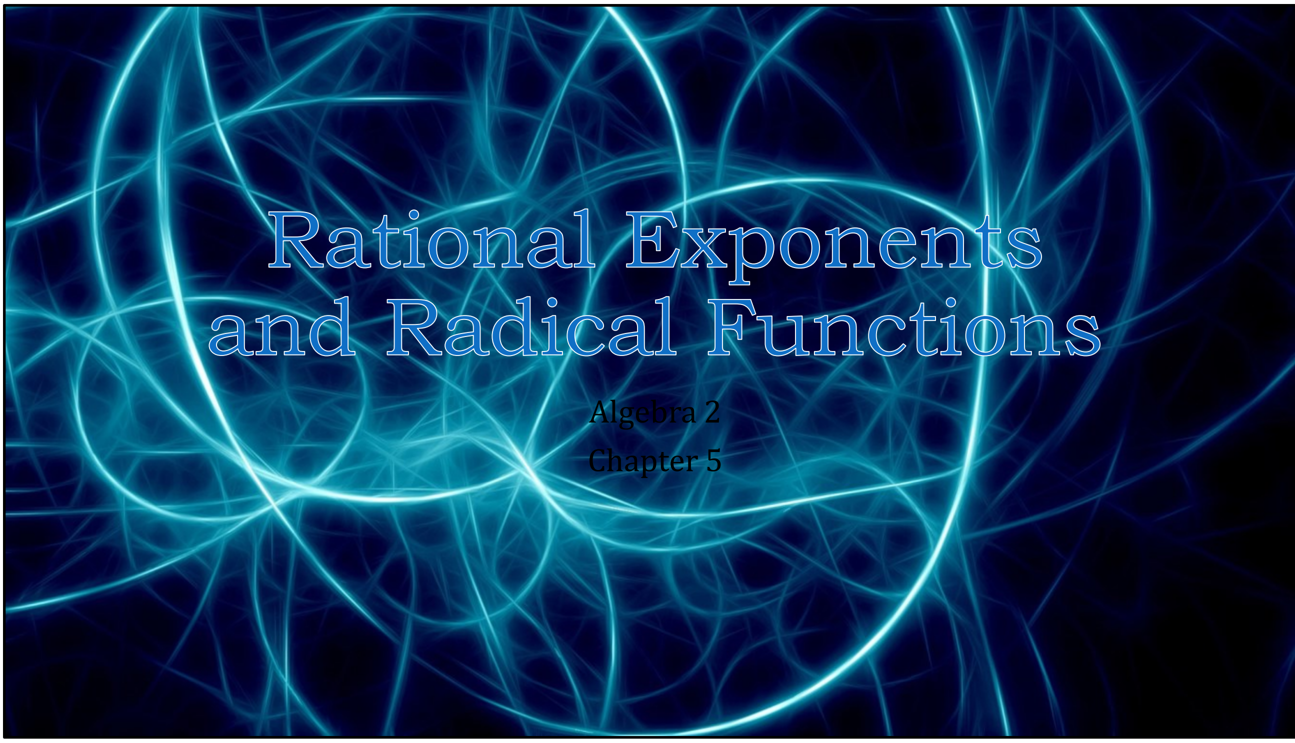
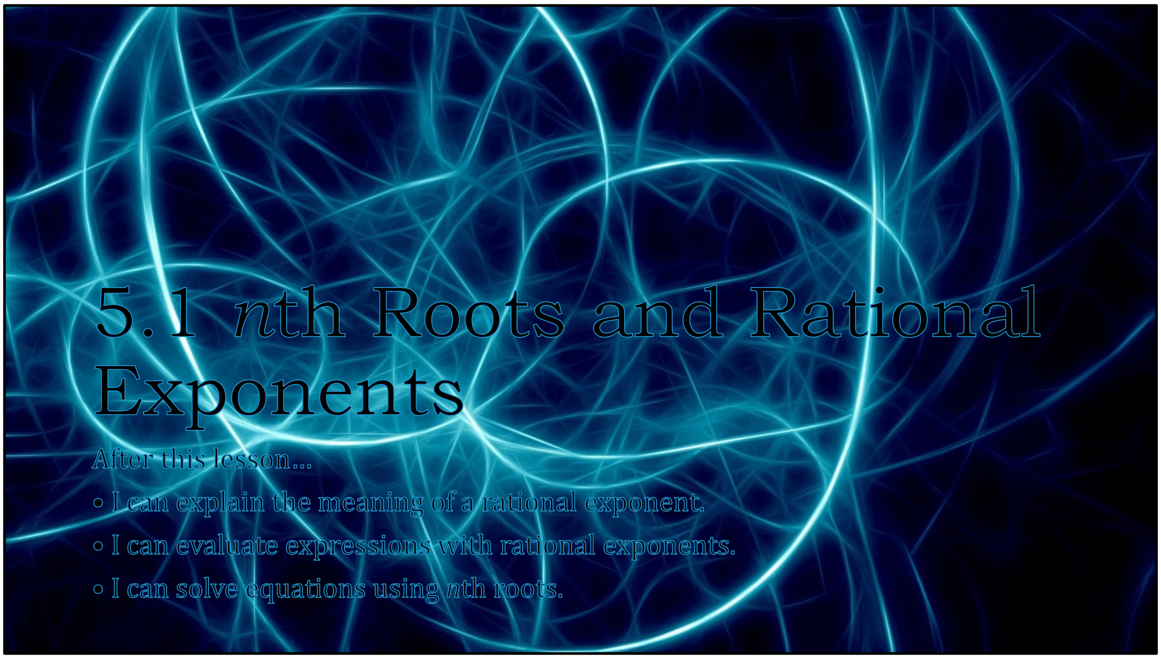

Rational Exponents
and Radical Functions
Algebra 2
Chapter 5

Algebra II 5

$\sqrt{x}$

- This Slideshow was developed to accompany the textbook
  - *Big Ideas Algebra 2*
  - *By Larson, R., Boswell*
  - *2022 K12 (National Geographic/Cengage)*
- Some examples and diagrams are taken from the textbook.

Slides created by
Richard Wright, Andrews Academy
rwright@andrews.edu


5.1 nth Roots and Rational Exponents
After this lesson…
I can explain the meaning of a rational exponent.
I can evaluate expressions with rational exponents.
I can solve equations using nth roots.

5.1 nth Roots and Rational Exponents $\sqrt{x}$

- Root
  - If $a^2 = b$, then a is a square (2^{nd}) root of b
  - If $a^n = b$, then a is the n^{th} root of b
- Parts of a radical

Index → $\sqrt[3]{64}$ ← Radical Sign

Radicand

5.1 nth Roots and Rational Exponents $\sqrt{x}$

- Rational Exponents
  - $b^{1/n} = \sqrt[n]{b}$
  - $b^{m/n} = \sqrt[n]{b^m} = \left(\sqrt[n]{b}\right)^m$

- Evaluate
  - $36^{1/2}$

$\sqrt{36} = 6$

5.1 nth Roots and Rational Exponents $\sqrt{x}$

- $\left(\frac{1}{8}\right)^{-\frac{1}{3}}$
- $27^{\frac{4}{3}}$

$$8^{\frac{1}{3}} = \sqrt[3]{8} = 2$$

$$\left(\sqrt[3]{27}\right)^4 = 3^4 = 81$$

5.1 nth Roots and Rational Exponents $\sqrt{x}$

- Find roots with a calculator
  - The $\sqrt{x}$ or $\sqrt{}$ key is for square roots (either radicand then key or key then radicand depending on calculator)
  - The $\sqrt[x]{y}$ or $\sqrt[y]{x}$ or $\sqrt[x]{}$ is for any root (index → key → radicand OR radicand → key → index)
  - Try it with $\sqrt[4]{100}$

3.16

5.1 nth Roots and Rational Exponents $\sqrt{x}$

- Steps to solve an equation with an exponent

1. Isolate the exponent term
2. Take the root of both sides where the index is the exponent
   - If the index is even, put ±
3. Solve
4. Check your answers!!!

5.1 *n*th Roots and Rational Exponents $\sqrt{x}$

- Solve. Round to two decimal places, if necessary.
- $5x^3 = 320$
- $(x + 3)^4 = 24$
- 235 #7, 9, 11, 13, 15, 17, 19, 21, 23, 27, 31, 35, 37, 39, 43, 47, 49, 51, 53, 55

$$5x^3 = 320$$
$$x^3 = 64$$
$$x = \sqrt[3]{64} = 4$$

$$(x + 3)^4 = 24$$
$$x + 3 = \pm\sqrt[4]{24}$$
$$x = -3 \pm \sqrt[4]{24} \approx -0.79 \; or \; -5.21$$

5-02A Properties of Rational Exponents and Simplifying Radicals

After this lesson...

- I can simplify radical expressions with rational exponents.
- I can simplify variable expressions containing rational exponents and radicals.

5-02A Properties of Rational Exponents and Simplifying Radicals

$\sqrt{x}$

- Using Properties of Rational Exponents
  - $x^m \cdot x^n = x^{m+n}$
  - $(xy)^m = x^m y^m$
  - $(x^m)^n = x^{mn}$
  - $\frac{x^m}{x^n} = x^{m-n}$
  - $\left(\frac{x}{y}\right)^m = \frac{x^m}{y^m}$
  - $x^{-m} = \frac{1}{x^m}$

5-02A Properties of Rational Exponents and Simplifying Radicals

$\sqrt{x}$

- $6^{1/2} \cdot 6^{1/3}$
- $(27^{1/3} \cdot 6^{1/4})^2$

$$6^{\frac{1}{2}+\frac{1}{3}} \rightarrow 6^{\frac{3}{6}+\frac{2}{6}} \rightarrow 6^{\frac{5}{6}}$$

$$\left(27^{\frac{1}{3}}\right)^2 \cdot \left(6^{\frac{1}{4}}\right)^2 \rightarrow 27^{\frac{2}{3}} \cdot 6^{\frac{1}{2}} \rightarrow 9 \cdot 6^{\frac{1}{2}}$$

5-02A Properties of Rational Exponents and Simplifying Radicals

$\sqrt{x}$

- $(4^3 \cdot w^3)^{-1/3}$
- $\dfrac{t}{t^{\frac{3}{4}}}$

$$4^{3 \cdot -\frac{1}{3}} \cdot w^{3 \cdot -\frac{1}{3}} \to 4^{-1} \cdot w^{-1} \to \frac{1}{4} \cdot \frac{1}{w} \to \frac{1}{4w}$$

$$t^{1-\frac{3}{4}} \to t^{\frac{1}{4}}$$

5-02A Properties of Rational Exponents and Simplifying Radicals

$\sqrt{x}$

- Simplifying Radicals
  - Remove any perfect roots
  - Rationalize denominators
- $\sqrt[4]{64}$
- $\sqrt[3]{625x^5}$

$$\sqrt[4]{2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2} = \sqrt[4]{(2 \cdot 2 \cdot 2 \cdot 2) \cdot 2 \cdot 2} = 2\sqrt[4]{4}$$

$$\sqrt[3]{5 \cdot 5 \cdot 5 \cdot 5 \cdot x \cdot x \cdot x \cdot x \cdot x} = \sqrt[3]{(5 \cdot 5 \cdot 5) \cdot 5 \cdot (x \cdot x \cdot x) \cdot x \cdot x} = 5x\sqrt[3]{5x^2}$$

5-02A Properties of Rational Exponents and Simplifying Radicals

- $\sqrt[4]{\frac{7}{8}}$
- $\sqrt[5]{\frac{x^5}{y^8}}$

$$\sqrt[4]{\frac{7}{8}} = \frac{\sqrt[4]{7}}{\sqrt[4]{8}} = \frac{\sqrt[4]{7}}{\sqrt[4]{2\cdot 2\cdot 2}}$$

$$\frac{\sqrt[4]{7}}{\sqrt[4]{2\cdot 2\cdot 2}} \cdot \frac{\sqrt[4]{2}}{\sqrt[4]{2}}$$

$$\frac{\sqrt[4]{14}}{2}$$

$$\frac{\sqrt[5]{x^5}}{\sqrt[5]{y^8}} = \frac{\sqrt[5]{x\cdot x\cdot x\cdot x\cdot x}}{\sqrt[5]{y\cdot y\cdot y\cdot y\cdot y}\sqrt[5]{y\cdot y\cdot y}} = \frac{x}{y\sqrt[5]{y^3}} \cdot \frac{\sqrt[5]{y^2}}{\sqrt[5]{y^2}} = \frac{x\cdot \sqrt[5]{y^2}}{y^2}$$

5-02A Properties of Rational Exponents and Simplifying Radicals

- $\frac{1}{\sqrt{7}-2}$
- $\frac{2}{3+\sqrt{5}}$

$$\frac{1}{\sqrt{7}-2}\cdot\frac{\sqrt{7}+2}{\sqrt{7}+2}$$

$$\frac{\sqrt{7}+2}{7+2\sqrt{7}-2\sqrt{7}-4}$$

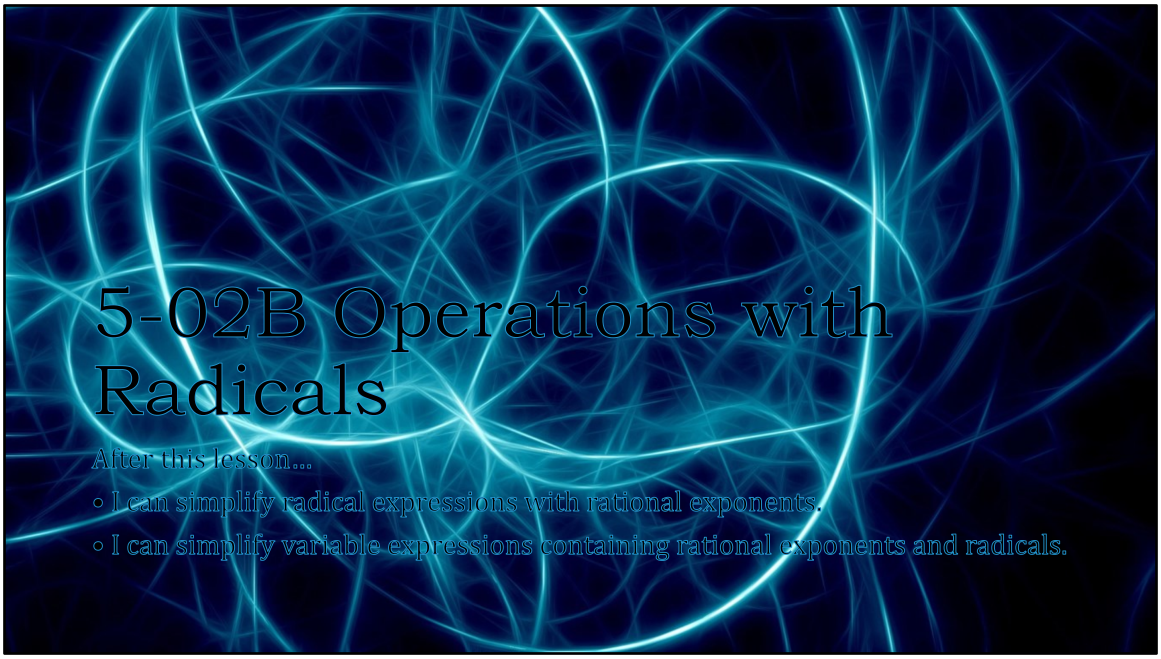
$$\frac{\sqrt{7}+2}{3}$$

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

$$=\frac{6-2\sqrt{5}}{9-3\sqrt{5}+3\sqrt{5}-5}$$

$$=\frac{6-2\sqrt{5}}{4}$$

$$=\frac{3-\sqrt{5}}{2}$$


5-02B Operations with Radicals
After this lesson...
◦ I can simplify radical expressions with rational exponents.
◦ I can simplify variable expressions containing rational exponents and radicals.

5-02B Operations with Radicals $\sqrt{x}$

- Using Properties of Radicals
  - Product Property →
    - $\sqrt[n]{a \cdot b} = \sqrt[n]{a} \cdot \sqrt[n]{b}$
  - Quotient Property →
    - $\sqrt[n]{\frac{a}{b}} = \frac{\sqrt[n]{a}}{\sqrt[n]{b}}$

5-02B Operations with Radicals

- $\sqrt[3]{25} \cdot \sqrt[3]{5}$
- $\dfrac{\sqrt[3]{32x}}{\sqrt[3]{4x}}$

$$\sqrt[3]{25 \cdot 5} = \sqrt[3]{125} = 5$$

$$\sqrt[3]{\frac{32x}{4x}} = \sqrt[3]{8} = 2$$

5-02B Operations with Radicals

$\sqrt{x}$

- Adding and Subtracting Roots and Radicals
  - Simplify the radicals
  - Combine like terms
- $5(4^{3/4}) - 3(4^{3/4})$

$2(4^{3/4})$

5-02B Operations with Radicals $\sqrt{x}$

- $\sqrt[3]{81} - \sqrt[3]{3}$
- $2\sqrt[4]{6x^5} + x\sqrt[4]{6x}$

$$\sqrt[3]{3 \cdot 3 \cdot 3 \cdot 3} - \sqrt[3]{3} = 3\sqrt[3]{3} - \sqrt[3]{3} = 2\sqrt[3]{3}$$

$$2x\sqrt[4]{6x} + x\sqrt[4]{6x} = 3x\sqrt[4]{6x}$$

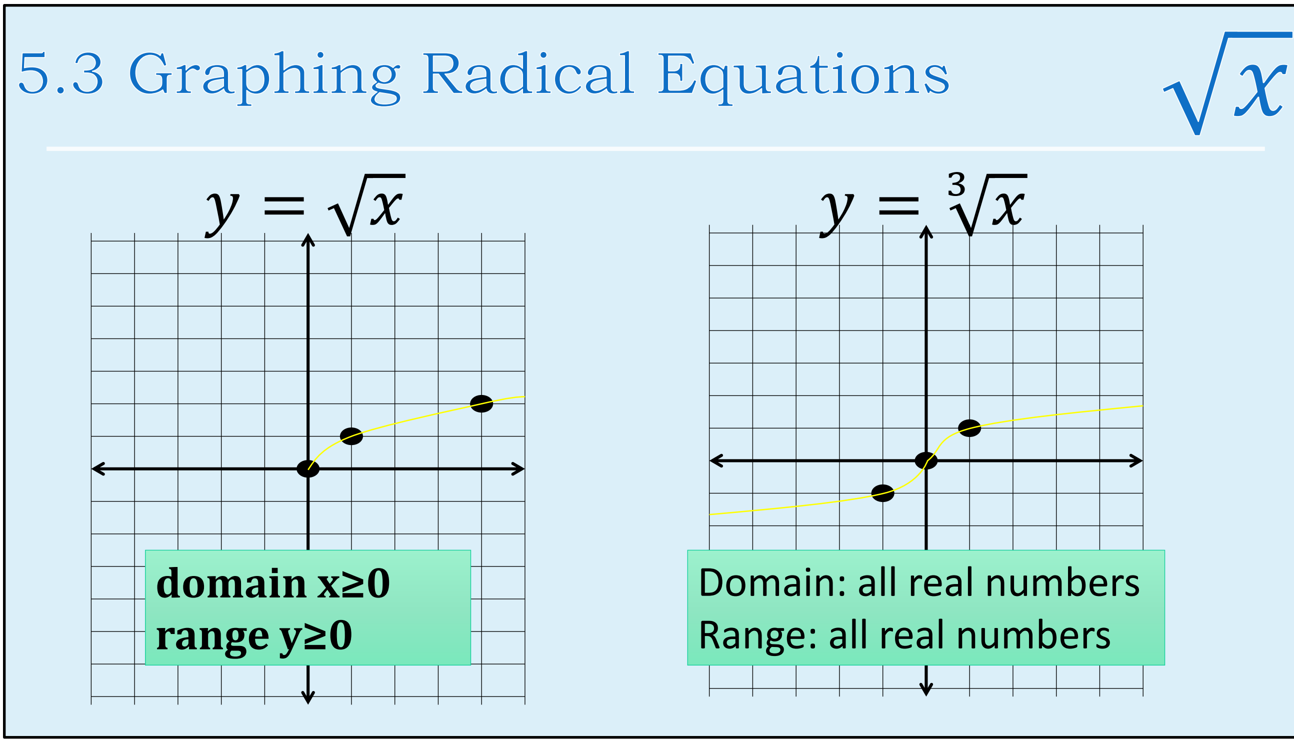
5.3 Graphing Radical Equations

After this lesson…

- I can graph radical functions.
- I can describe transformations of radical functions.
- I can write functions that represent transformations of radical functions.

5.3 Graphing Radical Equations $\sqrt{x}$

- **Work with a partner.**
- Graph each function. How are the graphs alike? How are they different?
- **i.** $f(x) = \sqrt{x}$
- **ii.** $f(x) = \sqrt[3]{x}$
- **iii.** $f(x) = \sqrt[4]{x}$
- **iv.** $f(x) = \sqrt[5]{x}$



$\sqrt{x}$ → domain $x \geq 0$; range $y \geq 0$
$\sqrt[3]{x}$ → domain x all real numbers; range y all real numbers

5.3 Graphing Radical Equations $\sqrt{x}$

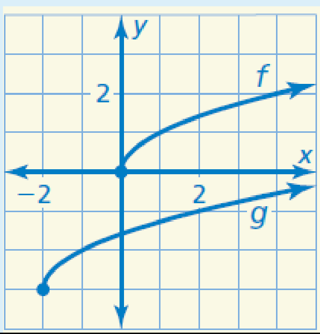
- How graphs transform
  - $y = a\sqrt{b(x-h)} + k$
  - $y = a\sqrt[3]{b(x-h)} + k$

Where
- a vertical stretch by factor of a
- b horizontal shrink by factor of $\frac{1}{b}$
- If a is −, reflection over x-axis
- If b is −, reflection over y-axis
- h translates right
- k translates up

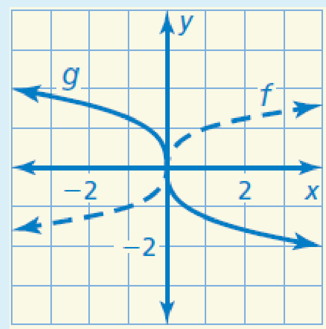
- Graph by making a table of values.

5.3 Graphing Radical Equations

- Describe the transformation of f represented by g. Then graph each function.
- $f(x) = \sqrt{x}$; $g(x) = \sqrt{x+2} - 3$



- $f(x) = \sqrt[3]{x}$; $g(x) = -\sqrt[3]{2x}$



5.3 Graphing Radical Equations

- The function $E(d) = 0.25\sqrt{d}$ approximates the number of seconds it takes a dropped object to fall d feet on Earth. The function $J(d) = 0.63 \cdot E(d)$ approximates the number of seconds it takes a dropped object to fall d feet on Jupiter. How long does it take a dropped object to fall 81 feet on Jupiter?

$$E(81) = 0.25\sqrt{81} = 2.25$$
$$J(81) = 0.63 \cdot E(81) = 0.63 \cdot 2.25 = 1.42\ s$$

5.3 Graphing Radical Equations

$\sqrt{x}$

- Let the graph of g be a horizontal stretch by a factor of 3, followed by a translation 6 units right of the graph of $f(x) = \sqrt[3]{x}$. Write a rule for g.

First $b = \frac{1}{3}$

$$g(x) = \sqrt[3]{\frac{1}{3}x}$$

Second $h = 6$

$$g(x) = \sqrt[3]{\frac{1}{3}(x-6)}$$

$$g(x) = \sqrt[3]{\frac{1}{3}x - 2}$$

5.3 Graphing Radical Equations $\sqrt{x}$

- Graphing horizontal parabolas and circles
  - Solve the equation for y.
  - Create a table of values.
  - Plot the points and draw graph.

- Graph $-\frac{1}{5}y^2 = x$. Identify the vertex and the direction that the parabola opens.

$$-\frac{1}{5}y^2 = x$$
$$y^2 = -5x$$
$$y = \pm\sqrt{-5x}$$

Opens left, vertex (0, 0)

5.3 Graphing Radical Equations

- Graph $x^2 + y^2 = 49$. Identify the radius and the intercepts.

- 250 #1, 5, 9, 13, 17, 21, 25, 29, 33, 37, 39, 41, 45, 49, 59, 67, 69, 71, 73, 79

$$x^2 + y^2 = 49$$
$$y^2 = 49 - x^2$$
$$y = \pm\sqrt{49 - x^2}$$

Radius = 7
x-ints: (±7, 0)
y-ints: (0, ±7)

5.4 Solving Radical Equations and Inequalities

After this lesson…

- I can identify radical equations and inequalities.
- I can solve radical equations and inequalities.
- I can identify extraneous solutions of radical equations.
- I can solve real-life problems involving radical equations.

5.4 Solving Radical Equations and Inequalities

- **Work with a partner.**
- **a.** Two students solve the equation $x + 2 = \sqrt{5x + 16}$ as shown. Justify each solution step in the fi rst student's solution. Then describe each student's method. Are the methods valid? Explain.

Student 1

$x + 2 = \sqrt{5x + 16}$

$(x + 2)^2 = \left(\sqrt{5x + 16}\right)^2$

$x^2 + 4x + 4 = 5x + 16$

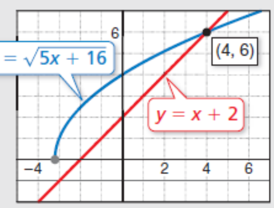
$x^2 - x - 12 = 0$

$(x - 4)(x + 3) = 0$

$x - 4 = 0$ or $x + 3 = 0$

$x = 4$ or $x = -3$

Student 2



The graphs intersect at the point (4, 6). So, the only solution is $x = 4$.

a. Square each side of the equation; Simplify; Combine like terms; Factor; Set each factor equal to 0; Simplify; Student 1 squared each side of the equation and solved algebraically. Student 2 graphed each side of the equation and found the point of intersection; yes; Both methods are mathematically correct.

5.4 Solving Radical Equations and Inequalities

$\sqrt{x}$

- Radical Equation
  - Equation containing a radical

- Steps

1. Isolate the radical
2. Raise both sides to whatever the index is (or the reciprocal of the exponent)
3. Solve
4. Check your answers!!!

5.4 Solving Radical Equations and Inequalities

$\sqrt{x}$

- $5 - \sqrt[4]{x} = 0$
- $3x^{\frac{4}{3}} = 243$

$5 = \sqrt[4]{x} \rightarrow 5^4 = x \rightarrow x = 625$

$x^{\frac{4}{3}} = 81 \rightarrow x = \pm 81^{\frac{3}{4}} = \pm 27$

5.4 Solving Radical Equations and Inequalities

$\sqrt{x}$

- $\sqrt{2x+8} - 4 = 6$
- $\sqrt{4x+28} - 3\sqrt{2x} = 0$

$$\sqrt{2x+8} = 10 \rightarrow 2x + 8 = 100 \rightarrow 2x = 92 \rightarrow x = 46$$

$$\sqrt{4x+28} = 3\sqrt{2x} \rightarrow 4x + 28 = 9(2x) \rightarrow 4x + 28 = 18x \rightarrow 28 = 14x \rightarrow x = 2$$

5.4 Solving Radical Equations and Inequalities

$\sqrt{x}$

- $x + 2 = \sqrt{2x + 28}$

- Check!
- 258 #1, 5, 9, 13, 17, 21, 25, 29, 31, 33, 37, 41, 45, 49, 51, 57, 61, 69, 77, 81

$(x+2)^2 = 2x + 28 \quad x^2 + 4x + 4 = 2x + 28 \rightarrow x^2 + 2x - 24 = 0 \rightarrow (x+6)(x-4) = 0 \rightarrow x = -6, 4$

Check

-6: $-6 + 2 = \sqrt{2(-6) + 28} \rightarrow -4 = \sqrt{-12 + 28} \rightarrow -4 = 4$ False

4: $4 + 2 = \sqrt{2(4) + 28} \rightarrow 6 = \sqrt{36} \rightarrow 6 = 6$ True

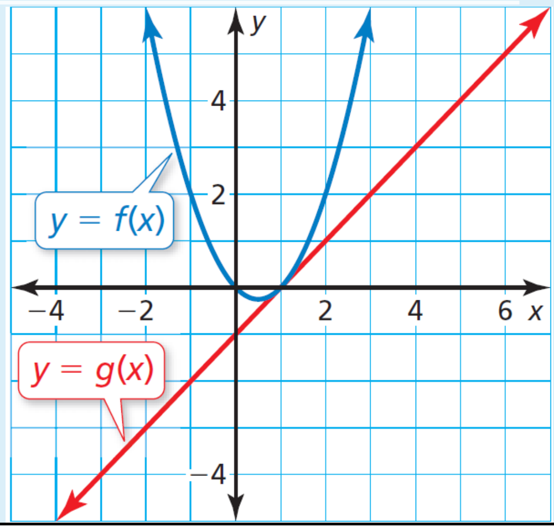
5.5 Performing Function Operations

After this lesson…

- I can explain what it means to perform an arithmetic operation on two functions.
- I can fi nd arithmetic combinations of two functions.
- I can state the domain of an arithmetic combination of two functions.
- I can evaluate an arithmetic combination of two functions for a given input.

5.5 Performing Function Operations $\sqrt{x}$

- **Work with a partner.** Consider the graphs of *f* and *g*.
- **a.** Describe what it means to add two functions. Then describe what it means to subtract one function from another function.



5.5 Performing Function Operations $\sqrt{x}$

- Sometimes for your problems you need to repeat several calculations over and over again (think science class).

- It would be quicker to combine all the equations that you are using into one equation first, so that you only have to do one equation each time instead of many.

5.5 Performing Function Operations

- Ways to combine functions

- Addition: $(f+g)(x) = f(x) + g(x)$

- Subtraction: $(f-g)(x) = f(x) - g(x)$

- Multiplication: $(f \cdot g)(x) = f(x) \cdot g(x)$

- Division: $\left(\frac{f}{g}\right)(x) = \frac{f(x)}{g(x)}$

5.5 Performing Function Operations $\sqrt{x}$

- Given $f(x) = 5\sqrt{x}$ and $g(x) = -8\sqrt{x}$ find
  - $(f + g)(x)$
  - $(f - g)(x)$
  - $(f \cdot g)(x)$
  - $\left(\frac{f}{g}\right)(x)$

$-3\sqrt{x} \quad D:\ x \geq 0$

$13\sqrt{x} \quad D:\ x \geq 0$

$-40x \quad D:\ x \geq 0$

$-\frac{5}{8} \quad D:\ x > 0$

5.5 Performing Function Operations

- Let $f(x) = 2x^3 + 4x^2 - 8x + 4$ and $g(x) = 3x^3 - 5x^2 + 6x - 9$. Find $(f - g)(x)$ and state the domain. Then evaluate $(f - g)(-1)$.

$(f - g)(x) = -x^3 + 9x^2 - 14x + 13$ and the domain is all real numbers; $(f - g)(-1) = 37$

5.5 Performing Function Operations

- Let $f(x) = x^3$ and $g(x) = \sqrt{x}$. Find $(fg)(x)$ and state the domain. Then evaluate $(fg)(4)$.

$$(fg)(x) = (x^3)(\sqrt{x}) = x^3 x^{\frac{1}{2}} = x^{3+\frac{1}{2}} = x^{\frac{7}{2}}$$

$(fg)(x) = x^{\frac{7}{2}}$ and the domain is all nonnegative real numbers; $(fg)(4) = 128$

5.5 Performing Function Operations

$\sqrt{x}$

- From 2010 to 2020, the populations (in thousands) of City M and City N can be modeled by $M(t) = 3.3t^3 + 12.1t^2 - 0.65t + 15.8$ and $N(t) = 2.5t^3 + 7.8t^2 + 0.41t + 11.9$, where t is the number of years since 2010. Find $(M - N)(t)$ and explain what it represents.

- 265 #1, 3, 5, 7, 9, 15, 17, 21, 23, 25, 27, 29, 35, 37, 39

$(M - N)(t) = 0.8t^3 + 4.3t^2 - 1.06t + 3.9$;
Subtracting the populations gives how much greater the population of City M is than the population City N for t years after 2010.

5.6 Composition of Functions

After this lesson…

- I can evaluate a composition of functions.
- I can fi nd a composition of functions.
- I can state the domain of a composition of functions.

5.6 Composition of Functions

$\sqrt{x}$

- **Work with a partner.**
- The formulas below represent the temperature F (in degrees Fahrenheit) when the temperature is C degrees Celsius, and the temperature C when the temperature is K (Kelvin).

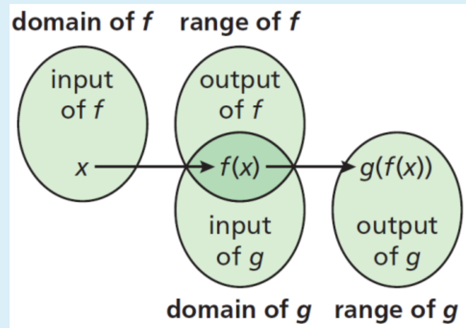
$$F = \frac{9}{5}C + 32 \qquad C = K - 273$$

- **a.** Write an expression for F in terms of K.

$$F = \frac{9}{5}K - \frac{2297}{5}$$

5.6 Composition of Functions

- Composition
  - Put one function into the other. (Like substitution)
  - Written $g(f(\text{x}))$
  - Said "g of f of x"
  - Means that the output (range) of f is the input (domain) of g. Work from the inside out. Do $f(x)$ first then $g(x)$.



  - $f(x)$ gets substituted into $g(x)$

5.6 Composition of Functions

- Let $f(x) = \sqrt{3x - 5}$ and $g(x) = x^2 + 1$.
- Find the indicated value.
- **a.** $g(f(2))$
- **b.** $f(g(3))$
- **c.** $g(g(-3))$

a. $f(2) = \sqrt{3(2) - 5} = 1 \rightarrow g\big(f(2)\big) = g(1) = 1^2 + 1 = 2$

b. $g(3) = 3^3 + 1 = 10 \rightarrow f\big(g(3)\big) = f(10) = \sqrt{3(10) - 5} = 5$

c. $g(-3) = (-3)^2 + 1 = 10 \rightarrow g\big(g(-3)\big) = g(10) = (10)^2 + 1 = 101$

5.6 Composition of Functions

$\sqrt{x}$

- Let $f(x) = 3x^{-1}$ and $g(x) = 4x - 5$. Perform the indicated operation and state the domain.
- **a.** $f(g(x))$
- **b.** $g(f(x))$
- **c.** $f(f(x))$

a. *g* substituted into *f*. $f\big(g(x)\big) = 3(4x-5)^{-1} = \frac{3}{4x-5}$

Domain of *g* is all real numbers. Domain of $f\big(g(x)\big)$ is $4x - 5 \neq 0 \to x \neq \frac{5}{4}$

b. *f* substituted into *g*. $g\big(f(x)\big) = 4(3x^{-1}) - 5 = 12x^{-1} - 5 = \frac{12}{x} - 5$

Domain of *f* is *x*≠0. Domain of $g\big(f(x)\big)$ is also *x*≠0.

c. *f* substituted into *f*. $f\big(f(x)\big) = 3(3x^{-1})^{-1} = 3(3^{-1}x^{1}) = \frac{3x}{3} = x$

Domain of *f* is *x*≠0. Domain of $f\big(f(x)\big)$ is all real numbers except the domain of the original input *f* limits the domain of the composition so the domain of *f*(*f*(*x*)) is *x*≠0.

5.6 Composition of Functions

$\sqrt{x}$

- The function $C(x) = 8.74x$ represents the cost (in dollars) of producing x shirts. The number of shirts produced in t hours is represented by $x(t) = 84t$. (a) Find $C(x(t))$. (b) Evaluate $C(x(40))$ and explain what it represents.

- 271 #1, 5, 9, 13, 17, 21, 25, 31, 33, 37, 43, 45, 47, 49, 51

a. x is substituted into C. $C\big(x(t)\big) = 8.74(84t) = 734.16t$

b. $C\big(x(40)\big) = 734.16(40) = 29366.4$ This is the cost of producing shirts for 40 hours and the cost is $29,366.40

5.7 Inverse of a Function

After this lesson...

- I can explain what inverse functions are.
- I can find inverses of linear and nonlinear functions.
- I can determine whether a pair of functions are inverses.

5.7 Inverse of a Function

$\sqrt{x}$

- **Work with a partner.**
- **a.** Consider each pair of functions, f and g, below. For each pair, create an input-output table of values for each function. Use the outputs of f as the inputs of g. What do you notice about the relationship between the equations of f and g?
- **i.** $f(x) = 4x + 3$; $g(x) = \frac{x-3}{4}$

5.7 Inverse of a Function

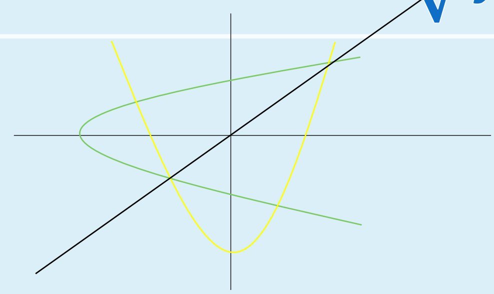
- Sometimes you want to do the opposite operation that a given function or equation gives you.

- To do the opposite, or undo, the operation you need the inverse function.

5.7 Inverse of a Function

$\sqrt{x}$

- Properties of Inverses
  - *x* and *y* values are switched
  - graph is reflected over the line $y = x$



- You can use the Horizontal Line test to determine if the inverse of a function is also a function.
  - If a horizontal line can touch a graph more than once, then the inverse is not a function.

5.7 Inverse of a Function

$\sqrt{x}$

- Definition of inverses
  - Two functions are inverses if and only if
    - $f(g(x)) = x$ and $g(f(x)) = x$

5.7 Inverse of a Function

$\sqrt{x}$

- Verify that $f(x) = 6 - 2x$ and $g(x) = \frac{6-x}{2}$ are inverses.

[f ∘ g](x) = 6 – 2((6 - x)/2) = 6 – 2(3 – x/2) = 6 – 6 + x = x

[g ∘ f](x) = (6 – (6 – 2x))/2 = (6 – 6 + 2x)/2 = 2x/2 = x

yes they are inverses

5.7 Inverse of a Function

$\sqrt{x}$

- Finding inverses
  - Inverses switch the x and y coordinates
  - Switch x and y and solve for y.

- $y = 2x + 7$

$$y = 2x + 7$$
$$x = 2y + 7$$
$$x - 7 = 2y$$
$$\frac{x - 7}{2} = y$$

5.7 Inverse of a Function

$\sqrt{x}$

- Find the inverse
- $f(x) = x^4 + 2, x \leq 0$

Rewrite *f*(*x*) as *y*	$y = x^4 + 2, x \leq 0$
Switch the *x* and *y*	$x = y^4 + 2, y \leq 0$
Solve for *y*	$x - 2 = y^4, y \leq 0$
	$y = \pm\sqrt[4]{x-2}, y \leq 0$
Rewrite *y* as $f^{(-1)}(x)$	$f^{-1}(x) = -\sqrt[4]{x-2}$

5.7 Inverse of a Function

$\sqrt{x}$

- The power (in watts) of a lightbulb that has a resistance of 240 ohms is represented by $f(x) = 240x^2$, where x is the electric current of a lightbulb in amperes. Find and interpret $f^{-1}(60)$.

- 279 #1, 5, 9, 13, 17, 21, 25, 29, 33, 37, 43, 45, 47, 51, 57, 71, 77, 83, 87, 91

$$y = 240x^2$$
$$x = 240y^2$$
$$\frac{x}{240} = y^2$$
$$\pm\sqrt{\frac{x}{240}} = y$$
$$f^{-1}(x) = \sqrt{\frac{x}{240}}$$
$$f^{-1}(60) = \sqrt{\frac{60}{240}} = \frac{1}{2}$$

Current in a lightbulb with 60 watts of power