Name: _____

Date: _____ Class: Math 3 Honors, per: _____

2.1.1 Roots, Radicals & Rational Exponents

Homework

Learning Target: I can evaluate radicals and convert fluently between radical form and rational exponent form.

Problems 1–8: *Evaluate or rewrite as directed. Show your work.*

1. Evaluate $\sqrt{81}$	**2.** Evaluate $\sqrt[3]{-64}$
3. Evaluate $\sqrt[4]{16}$	**4.** Evaluate $27^{2/3}$
5. Evaluate $16^{3/4}$	**6.** Rewrite $\sqrt[3]{x^5}$ using a rational exponent.
7. Rewrite $x^{3/4}$ in radical form.	**8.** Evaluate $32^{-2/5}$

Reasoning and Explanation

9. Explain why $\sqrt[4]{-16}$ is not a real number, but $\sqrt[3]{-16}$ is.
10. Simplify $\left(8x^6\right)^{1/3}$. Assume $x > 0$.
11. Evaluate $\left(\sqrt{49}\right)\left(\sqrt[3]{8}\right)$.
12. Error Analysis: A student says $16^{1/2} = 8$. Explain the mistake and give the correct value.

2.1.2 Simplifying Radical Expressions & Operations

Homework

Learning Target: I can simplify radical expressions and add, subtract, multiply, and rationalise radicals.

Problems 1–8: *Simplify completely. Assume all variables represent positive real numbers.*

1. $\sqrt{50}$	**2.** $\sqrt{72x^3}$
3. $\sqrt[3]{54}$	**4.** $3\sqrt{12}+5\sqrt{27}$
5. $\sqrt{8}\cdot\sqrt{6}$	**6.** $(2\sqrt{5})(3\sqrt{10})$
7. Rationalise: $\dfrac{6}{\sqrt{3}}$	**8.** Rationalise: $\dfrac{4}{\sqrt{5}-1}$

Reasoning and Explanation

9. Explain why $\sqrt{x^2}=|x|$ rather than simply x when x may be any real number.

10. Simplify $\sqrt{48x^5y^2}$.

11. Multiply and simplify: $(\sqrt{7}+2)(\sqrt{7}-2)$.

12. Error Analysis: A student writes $\sqrt{9}+\sqrt{16}=\sqrt{25}=5$. Explain the error and give the correct value.

Name: _____

Date: _____ Class: Math 3 Honors, per: _____

2.1.3 Graphing Square Root Functions

Homework

Learning Target: I can graph square root functions using key points and identify the endpoint and direction of the graph.

Problems 1–4: *List five key points by transforming the parent points* $0,\ 1,\ 4,\ 9,\ 16$.

1. $f(x) = \sqrt{x-2}$	**2.** $f(x) = \sqrt{x} + 3$
3. $f(x) = 2\sqrt{x} - 1$	**4.** $f(x) = -\sqrt{x+4}$

Problems 5–8: *State the endpoint and describe the direction the graph opens.*

5. $f(x) = \sqrt{x-6} + 2$	**6.** $g(x) = -\sqrt{x+1} - 3$
7. $h(x) = 3\sqrt{x+5}$	**8.** $p(x) = -\frac{1}{2}\sqrt{x-4} + 1$

Key Features and Reasoning

9. State the domain and range of the function in Problem 5. D: _____ R: _____

10. Explain why $0,\ 1,\ 4,\ 9,\ 16$ are convenient x-values to use for the square root parent function.

11. Error Analysis: A student says the endpoint of $y = \sqrt{x+3} - 1$ is $(3, -1)$. Correct the error.

Name: _____

Date: _____ Class: Math 3 Honors, per: _____

2.1.4 Graphing Cube Root Functions

Homework

Learning Target: I can graph cube root functions using key points and identify the centre point, domain, and range.

Problems 1–4: *List five key points by transforming the parent points* $-8,\ -1,\ 0,\ 1,\ 8$.

1. $f(x) = \sqrt[3]{x-1}$	**2.** $f(x) = \sqrt[3]{x} + 4$
3. $f(x) = 2\sqrt[3]{x}$	**4.** $f(x) = -\sqrt[3]{x+2}$

Problems 5–8: *State the centre point of the graph.*

5. $y = \sqrt[3]{x-3} + 5$	**6.** $y = -\sqrt[3]{x+1}$
7. $y = 4\sqrt[3]{x-2} - 1$	**8.** $y = \frac{1}{2}\sqrt[3]{x+6} + 3$

Reasoning and Key Features

9. Compare the domain of a square root function with the domain of a cube root function. Explain why they differ.

10. Find the x-intercept of $y = \sqrt[3]{x+5} - 2$.

11. Find the y-intercept of $y = \sqrt[3]{x+5} - 2$.

12. Explain why a cube root graph has no endpoint while a square root graph does.

Name: _____

Date: _____ Class: Math 3 Honors, per: _____

2.1.5 Domain, Range, Intercepts & Intervals

Homework

Learning Target: I can identify the domain, range, intercepts, and increasing/decreasing intervals of radical functions from equations.

Problems 1–4: *Find the domain and range. Write your answers in interval notation.*

1. $f(x) = \sqrt{x-3}+1$	**2.** $g(x) = -\sqrt{x+2}+4$
3. $h(x) = \sqrt{2x-6}$	**4.** $m(x) = \sqrt{10-2x}$

Problems 5–8: *Find the intercepts or intervals as directed.*

5. Find the x- and y-intercepts of $f(x) = \sqrt{x+4}-3$.	**6.** Find the x- and y-intercepts of $p(x) = -2\sqrt{x-1}+6$, if they exist.
7. State the increasing and decreasing intervals of $f(x) = \sqrt{x+7}-2$.	**8.** State the increasing and decreasing intervals of $g(x) = -3\sqrt{x-4}+1$.

Reasoning and Explanation

9. For $r(x) = \sqrt[3]{x+2}-5$, find the domain, range, x-intercept, and y-intercept.
10. Explain why the domain of $y = \sqrt{12-4x}$ is $(-\infty, 3]$ rather than $[3, \infty)$.
11. Explain why $f(x) = \sqrt{x-1}+2$ has no x-intercept.
12. Error Analysis: A student states that the range of $y = -\sqrt{x-5}+2$ is $[2, \infty)$. Correct the error.

2.2.1 Transformations of Radical Functions

Homework

Learning Target: I can analyse and write transformations of radical functions, including shifts, reflections, stretches, and compressions.

Problems 1–8: *Describe every transformation from the given parent function.*

1. $y = \sqrt{x}$ to $y = \sqrt{x - 9}$	**2.** $y = \sqrt{x}$ to $y = \sqrt{x} - 6$
3. $y = \sqrt{x}$ to $y = -\sqrt{x}$	**4.** $y = \sqrt{x}$ to $y = 5\sqrt{x}$
5. $y = \sqrt{x}$ to $y = \sqrt{x + 3} + 7$	**6.** $y = \sqrt{x}$ to $y = -2\sqrt{x - 1} + 4$
7. $y = \sqrt{x}$ to $y = \frac{1}{3}\sqrt{x + 8} - 2$	**8.** $y = \sqrt[3]{x}$ to $y = -3\sqrt[3]{x - 4} + 6$

Problems 9–12: *Write the equation described.*

9. Shift $y = \sqrt{x}$ right 2 and up 5.	**10.** Reflect $y = \sqrt{x}$ over the x-axis, shift left 6 and down 1.
11. Endpoint $(-3, 4)$ with a vertical stretch of 2.	**12.** Endpoint $(5, -2)$, passing through $(9, 6)$.

Reasoning and Explanation

13. Explain how the graph of $y = \sqrt{x - 4}$ differs from the graph of $y = \sqrt{x} - 4$.
14. Error Analysis: A student says $y = -\sqrt{x + 2}$ is the parent graph reflected over the y-axis and shifted right 2. Identify both errors.

2.2.2 Writing Radical Equations from Key Features

Homework

Learning Target: I can write the equation of a radical function given its endpoint, centre, a point on the graph, or a description.

Problems 1–8: *Write the equation of each radical function described.*

1. Square root, endpoint $(2, -1)$, passes through $(11, 5)$.	**2.** Square root, endpoint $(-4, 3)$, passes through $(0, -1)$.
3. Square root, endpoint $(0, 0)$, passes through $(16, -8)$.	**4.** Square root, endpoint $(7, 1)$, opens right and downward.
5. Cube root, centre $(-2, 5)$, vertical stretch of 3.	**6.** Cube root, centre $(1, -4)$, reflected over the x-axis.
7. Square root, endpoint $(-5, 2)$, vertical compression by $\frac{1}{3}$, reflected over the x-axis.	**8.** Square root with domain $[3, \infty)$ and range $(-\infty, 0]$.

Reasoning and Explanation

9. A square root graph has endpoint $(2, 3)$ and opens **left** and upward. Write a possible equation.
10. Explain the difference between the graphs of $y = \sqrt{x - h}$ and $y = \sqrt{h - x}$.
11. A square root function passes through $(0, 1)$ and $(4, 7)$ with endpoint at $x = 0$. Find its equation.
12. Error Analysis: To write a function with endpoint $(-6, 1)$, a student wrote $y = \sqrt{x - 6} + 1$. Correct the error.

Name: _____

Date: _____ Class: Math 3 Honors, per: _____

2.2.3 Solving Radical Equations & Extraneous Solutions

Homework

Learning Target: I can solve radical equations algebraically and check for extraneous solutions.

Problems 1–8: *Solve each equation.* ***Check every candidate*** *and cross out any extraneous solutions.*

1. $\sqrt{x+7}=5$	**2.** $\sqrt{3x-2}=4$
3. $\sqrt{x-1}+3=9$	**4.** $2\sqrt{x+5}-4=6$
5. $\sqrt[3]{x-4}=2$	**6.** $\sqrt{x+12}=x$
7. $\sqrt{2x+3}=x$	**8.** $\sqrt{3x+1}-\sqrt{x+4}=1$

Reasoning and Application

9. Explain why squaring both sides of an equation can introduce solutions that do not work in the original equation.

10. Solve and check: $(x+3)^{1/2}=x-3$.

11. Error Analysis: To solve $\sqrt{x}+2=5$, a student squared both sides to get $x+4=25$. Explain the error and solve correctly.

12. The period of a pendulum is $T=2\pi\sqrt{\dfrac{L}{32}}$, where L is in feet. Find L when $T=2$ seconds. Round to the nearest hundredth.

2.2.4 Radical Inequalities

Homework

Learning Target: I can solve radical inequalities while accounting for the domain of the radical expression.

Problems 1–8: *Solve each inequality. Remember to include the domain restriction. Write answers in interval notation.*

1. $\sqrt{x} < 5$	**2.** $\sqrt{x-3} \leq 4$
3. $\sqrt{x+1} > 3$	**4.** $\sqrt{2x-4} \geq 6$
5. $-\sqrt{x+2}+7 \geq 4$	**6.** $3\sqrt{x-1} < 12$
7. $\sqrt{x+6} \geq x$	**8.** $\sqrt{x-2} < x-4$

Graphing, Reasoning, and Application

9. Graph the solution to Problem 2 on the number line below.



10. Explain why the domain restriction must be included in the final answer to a radical inequality.

11. Explain why $\sqrt{x+5} < -2$ has no solution.

12. A safety rule requires that $\sqrt{2d} \leq 10$, where d is a distance in metres. Find all acceptable distances.

Name: _____

Date: _____ Class: Math 3 Honors, per: _____

2.2.5 Inverses & Compositions of Radical Functions

Homework

Learning Target: I can find the inverse of a radical function, state its domain, and compose radical functions.

Problems 1–4: *Find the inverse and state the domain of the inverse.*

1. $f(x) = \sqrt{x-4}+1$	**2.** $f(x) = 3\sqrt{x+2}-5$
3. $f(x) = \sqrt[3]{x-7}$	**4.** $f(x) = x^2+3, \quad \text{for } x \geq 0$

Problems 5–8: *Find* $(f \circ g)(x)$ *and state its domain.*

5. $f(x) = \sqrt{x+1}, \quad g(x) = x^2-1$	**6.** $f(x) = \sqrt{x-2}, \quad g(x) = x+6$
7. $f(x) = \sqrt{x}, \quad g(x) = \sqrt{x-5}$	**8.** $f(x) = \sqrt{x+3}, \quad g(x) = \sqrt{x-1}$

Reasoning and Explanation

9. Verify that $f(x) = \sqrt{x-2}$ and $g(x) = x^2+2$ (for $x \geq 0$) are inverses by showing $f(g(x)) = x$.
10. Explain why the domain of f^{-1} is the range of f.
11. Describe the geometric relationship between the graph of a function and the graph of its inverse.

2.2.6 Applications of Radical Functions

Homework

Learning Target: I can evaluate and interpret radical function models and state a contextual domain.

Problems 1–6: *Solve each application. Include units in your answer.*

1. A pendulum's period is $T = 2\pi\sqrt{\frac{L}{32}}$ seconds. Find T when $L = 8$ ft. Leave your answer in terms of π and as a decimal.	**2.** A dropped object falls for $t = \sqrt{\frac{d}{16}}$ seconds. Find t when $d = 256$ ft.
3. The radius of a sphere is $r(V) = \sqrt[3]{\frac{3V}{4\pi}}$. Find r when $V = 288\pi$ cubic units.	**4.** A car's speed from skid marks is $s = \sqrt{30fd}$ mph. Find s when $f = 0.7$ and $d = 120$ ft. Round to the nearest tenth.
5. The distance to the horizon is $d = 1.22\sqrt{h}$ miles, where h is height in feet. Find d for $h = 100$ ft.	**6.** Using $t = \sqrt{\frac{d}{16}}$, find the distance d an object falls in 5 seconds.

Interpreting and Communicating

7. State the contextual domain of $t = \sqrt{\frac{d}{16}}$ and explain why it differs from the mathematical domain.
8. In $d = 1.22\sqrt{h}$, explain what happens to d when h is multiplied by 4.
9. A square garden has side length $s(x) = \sqrt{x+5}$ metres. Find the contextual domain and solve $s(x) = 9$.
10. Error Analysis: A student says that doubling the length L of a pendulum doubles its period T. Explain why this is incorrect.

2.2.7 Unit 2 Mixed Review

Review

Learning Target: I can apply everything from Unit 2: radicals and rational exponents, graphs, transformations, equations, inequalities, inverses, and applications.

Problems 1–4: *Simplify or evaluate.*

1. $\sqrt{98x^4}$	**2.** $81^{3/4}$
3. $2\sqrt{18} - \sqrt{50}$	**4.** Rationalise $\dfrac{10}{\sqrt{2}}$

Problems 5–8: *Analyse each function as directed.*

5. Domain and range of $f(x) = -\sqrt{x+6} + 2$.	**6.** Describe the transformations from $y = \sqrt{x}$ to $y = \frac{1}{2}\sqrt{x-3} - 8$.
7. Write the square root function with endpoint $(-1, -4)$ passing through $(8, 2)$.	**8.** x- and y-intercepts of $g(x) = \sqrt{x+9} - 4$.

Problems 9–12: *Solve. Check for extraneous solutions where necessary.*

9. $\sqrt{4x-3} = 5$	**10.** $\sqrt{x+20} = x$
11. $\sqrt{x-2} \leq 5$	**12.** Find the inverse of $f(x) = \sqrt{x+1} - 6$ and state its domain.

Reasoning and Application

13. Explain how you can tell, without solving, that $\sqrt{x-4} + 9 = 3$ has no solution.
14. The time for an object to fall is $t = \sqrt{\dfrac{d}{16}}$. How far does an object fall in 3 seconds?