REVIEW FOR RADICALS TEST NAME: ______________

SECTION 1: Inverses

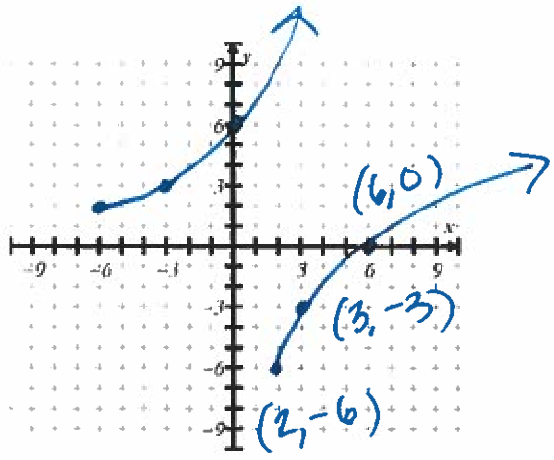
Find the inverse function

1. $y = 2x + 4$ $x = 2y + 4$ $-4 \quad -4$ $\frac{x-4}{2} = \frac{2y}{2}$ $\frac{1}{2}x - 4 = y$ $y = \frac{1}{2}x - 4$	2. $f(x) = -\frac{2}{3}x + 5$ $y = -\frac{2}{3}x + 5$ $x = -\frac{2}{3}y + 5$ $-5 \quad -5$ $-\frac{3}{2}(x-5) = \left(-\frac{2}{3}y\right)\left(-\frac{3}{2}\right)$ $-\frac{3}{2}x + \frac{15}{2} = y$ $f^{-1}(x) = -\frac{3}{2}x + \frac{15}{2}$
3. $f(x) = \frac{1}{2}x^2 + 5$ $y = \frac{1}{2}x^2 + 5$ $x = \frac{1}{2}y^2 + 5$ $-5 \quad -5$ $2(x-5) = \left(\frac{1}{2}y^2\right) \cdot 2$ $\sqrt{2x-10} = \sqrt{y^2}$ $\sqrt{2x-10} = y$ $f^{-1}(x) = \sqrt{2x-10}$	4. $y = (x+4)^3 - 2$ $x = (y+4)^3 - 2$ $+2 \quad +2$ $\sqrt[3]{x+2} = \sqrt[3]{(y+4)^3}$ $\sqrt[3]{x+2} = y + 4$ $-4 \quad -4$ $\sqrt[3]{x+2} - 4 = y$ $y = \sqrt[3]{x+2} - 4$

Verify the inverses.

5. $f(x) = x^2$ $\quad g(x) = \sqrt{x}$ $f(g(x)) = (\sqrt{x})^2$ $f(g(x)) = x$ ✓ $g(f(x)) = \sqrt{x^2}$ $g(f(x)) = x$ ✓	6. $f(x) = 2x - 8$ $\quad g(x) = \frac{1}{2}x + 4$ $f(g(x)) = 2\left(\frac{1}{2}x + 4\right) - 8$ $= x + 8 - 8$ $= x$ ✓ $g(f(x)) = \frac{1}{2}(2x-8) + 4$ $= x - 4 + 4$ $= x$ ✓
7. $f(x) = (x-5)^3$ $\quad g(x) = \sqrt[3]{x} + 5$ $f(g(x)) = (\sqrt[3]{x} + 5 - 5)^3$ $= (\sqrt[3]{x})^3$ $= x$ ✓ $g(f(x)) = \sqrt[3]{(x-5)^3} + 5$ $= x - 5 + 5$ $= x$ ✓	8. $f(x) = 3x^2 + 4$ $\quad g(x) = \sqrt{\frac{1}{3}x - \frac{4}{3}}$ $f(g(x)) = 3\sqrt{\frac{1}{3}x - \frac{4}{3}}^{\,2} + 4$ $= 3\left(\frac{1}{3}x - \frac{4}{3}\right) + 4$ $= x - 4 + 4$ $= x$ ✓ $g(f(x)) = \sqrt{\frac{1}{3}(3x^2+4) - \frac{4}{3}}$ $= \sqrt{x^2 + \frac{4}{3} - \frac{4}{3}}$ $= \sqrt{x^2}$ $= x$ ✓

9. Graph the inverse on the same graph.



10. Does the table represent a function?

x	-3	-1	0	4	10
y	2	3	1	3	0

yes

11. Find the inverse. Is the inverse a function?

x	2	3	1	3	0
y	-3	-1	0	4	10

No

SECTION 2: Domain of Radical Functions

Find the domain of each function.

1. $f(x)=x^2+4$

$\mathbb{R}$

or

$(-\infty,\infty)$

2. $f(x)=\sqrt{x} \geq 0$

$x \geq 0$

3. $f(x)=\sqrt{x-1}+4$ ≥ 0

$x-1 \geq 0$
$+1 \quad +1$

$x \geq 1$

4. $f(x)=\sqrt{2x-3} \geq 0$

$2x-3 \geq 0$
$+3 \quad +3$

$\frac{2x}{2} \geq \frac{3}{2}$

$x \geq \frac{3}{2}$

5. $f(x)=(5x-3)^{\frac{1}{2}}$

$f(x) = \sqrt{5x-3} \geq 0$

$5x-3 \geq 0$
$+3 \quad +3$

$\frac{5x}{5} \geq \frac{3}{5}$

$x \geq \frac{3}{5}$

6. $f(x)=x^{\frac{1}{3}}$

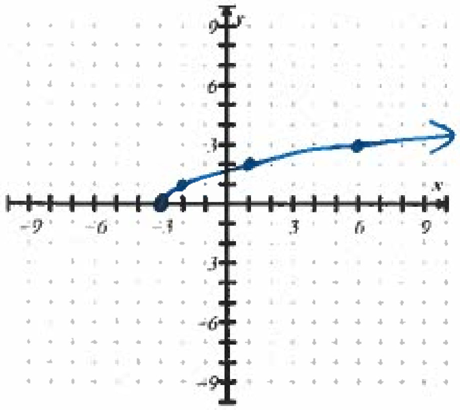
$f(x) = \sqrt[3]{x}$

$\mathbb{R}$

SECTION 3: Graphing Radical Functions

1. $f(x)=\sqrt{x+3}$

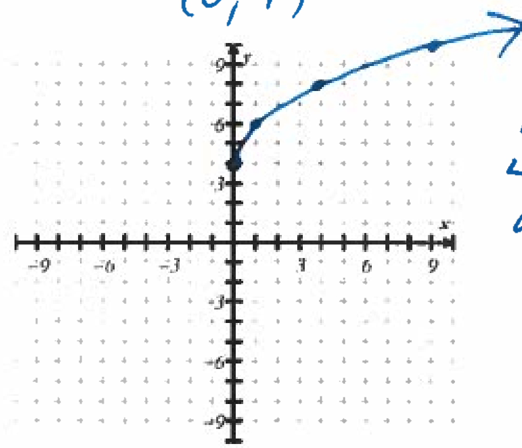
(-3, 0)



1 1
4 2
9 3

2. $f(x)=2\sqrt{x}+4$

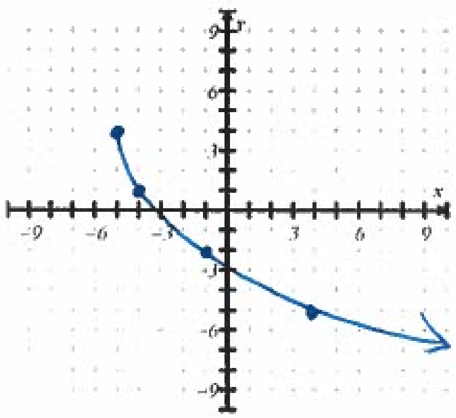
(0, 4)



1 ~~1~~ 2
4 ~~2~~ 4
9 ~~3~~ 6

3. $f(x)=-3\sqrt{x+5}+4$

(-5, 4)



1 ~~1~~ -3
4 ~~2~~ -6
9 ~~3~~ -9

4. Key Features of Graph #3. Round to 2 decimals

Initial Point (h, k): (-5, 4)

x-intercept: (-3.22, 0)

y-intercept: (0, -2.708)

Domain: [-5, ∞)

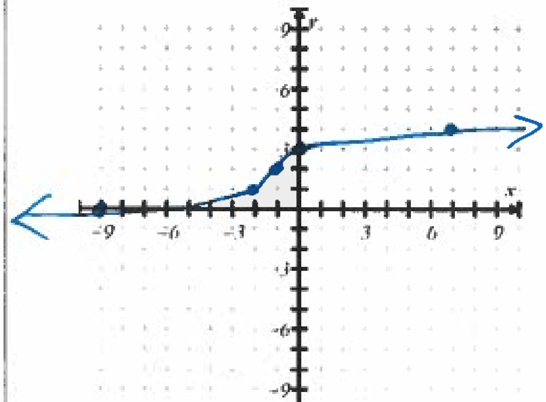
Range: (-∞, 4]

Increasing: None

Decreasing: (-5, ∞)

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

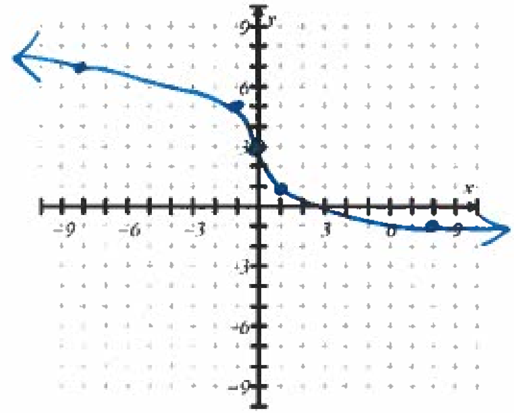
(-1, 2)



1 1
8 2

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

(0, 3)



1 ~~1~~ -2
8 ~~2~~ -4

SECTION 4: Simplifying Radicals

Convert the radical form to exponential form and vice versa.

1. $x^{1/9} =$ $\sqrt[9]{x}$	2. $\sqrt{x^6} =$ $x^{6/2}$	3. $x^{2/3} =$ $\sqrt[3]{x}^{2}$

Convert and evaluate.

7. $81^{1/4}$ $\sqrt[4]{81} = 3$	8. $(-64)^{2/3}$ $\sqrt[3]{-64}^{2}$ $(-4)^2 = 16$	9. $196^{1/2}$ $\sqrt{196}$ 14
10. $125^{-2/3}$ $\left(\frac{1}{125}\right)^{2/3}$ $\frac{1}{\sqrt[3]{125}^{2}} = \frac{1}{5^2} = \frac{1}{25}$	11. $-32^{2/5}$ $-\sqrt[5]{32}^{2}$ $-2^2 = -4$	12. $\left(\frac{121}{4}\right)^{-1/2} = \left(\frac{4}{121}\right)^{1/2}$ $= \frac{2}{11}$

Simplify the nth roots.

13. $\sqrt{-50}$ $\sqrt{-25}\,\sqrt{2}$ $5i\sqrt{2}$	14. $\sqrt[3]{-128}$ $\sqrt[3]{-64}\,\sqrt[3]{2}$ $-4\sqrt[3]{2}$	15. $\sqrt[4]{64}$ $\sqrt[4]{16}\,\sqrt[4]{4}$ $2\sqrt[4]{4}$
16. $(\sqrt[5]{-64})^2$ $(\sqrt[5]{-32}\,\sqrt[5]{2})^2$ $(-2\sqrt[5]{2})^2$ $4\sqrt[5]{4}$	17. $\sqrt[3]{108}$ $\sqrt[3]{27}\,\sqrt[3]{4}$ $3\sqrt[3]{4}$	18. $\sqrt[3]{135}$ $\sqrt[3]{27}\,\sqrt[3]{5}$ $3\sqrt[3]{5}$

Simplify the nth roots (with variables).

19. $\sqrt[3]{108x^7y^{10}}$ $\sqrt[3]{27x^6y^9}\,\sqrt[3]{4xy}$ $3x^2y^3\sqrt[3]{4xy}$	20. $\sqrt[4]{48x^7y^{13}}$ $\sqrt[4]{16x^4y^{12}}\,\sqrt[4]{3x^3y}$ $2xy^3\sqrt[4]{3x^3y}$	21. $\sqrt[3]{-8a^6b^7}\cdot\sqrt[3]{7a^2b^{14}}$ $\sqrt[3]{-56a^8b^{21}}$ $\sqrt[3]{-8a^6b^{21}}\,\sqrt[3]{7a^2}$ $-2a^2b^7\sqrt[3]{7a^2}$

SECTION 5: Operations with Nth Roots

Multiply/Divide.

1. $\sqrt[4]{2} \cdot \sqrt[4]{5}$ $\sqrt[4]{10}$	2. $\sqrt[5]{\frac{-128}{4}} = \sqrt[5]{-32}$ $= -2$
3. $2\sqrt[3]{6x^2} \cdot \sqrt[3]{4x^5}$ $2\sqrt[3]{24x^7}$ $2\sqrt[3]{8x^6}\ \sqrt[3]{3x} \rightarrow 2(2x^2)\sqrt[3]{3x}$ $= 4x^2\sqrt[3]{3x}$	4. $\frac{\sqrt[3]{-256}}{\sqrt[3]{2}} = \sqrt[3]{-128}$ $\sqrt[3]{-64}\ \sqrt[3]{2}$ $-4\sqrt[3]{2}$
5. $10\sqrt[5]{8} \cdot 3\sqrt[5]{-8}$ $30\sqrt[5]{-64}$ $30\sqrt[5]{-32}\ \sqrt[5]{2}$ $30(-2)\sqrt[5]{2}$ $-60\sqrt[5]{2}$	6. $\frac{\sqrt{84x^5y^3}}{\sqrt{7}}$ $\sqrt{12x^5y^3} \rightarrow \sqrt{4x^4y^2}\ \sqrt{3xy}$ $2x^2y\sqrt{3xy}$

Add/Subtract.

7. $4\sqrt[3]{10}+2\sqrt[3]{10}$ $6\sqrt[3]{10}$	8. $2\sqrt{7}+5\sqrt{7}+\sqrt{7}$ $8\sqrt{7}$
9. $\sqrt[3]{5}-19\sqrt[3]{5}$ $-18\sqrt[3]{5}$	10. $\sqrt[3]{128}-\sqrt[3]{250}$ $\sqrt[3]{64}\ \sqrt[3]{2} - \sqrt[3]{125}\ \sqrt[3]{2}$ $4\sqrt[3]{2} - 5\sqrt[3]{2}$ $-\sqrt[3]{2}$
11. $5a\sqrt[4]{32a^5}-\sqrt[4]{2a^9}$ $5a\sqrt[4]{16a^4}\ \sqrt[4]{2a} - \sqrt[4]{a^8}\ \sqrt[4]{2a}$ $5a(2a)\sqrt[4]{2a} - a^2\sqrt[4]{2a}$ $10a^2\sqrt[4]{2a} - a^2\sqrt[4]{2a}$ $9a^2\sqrt[4]{2a}$	12. $5\sqrt{20}-5\sqrt{45}+\sqrt{125}$ $5\sqrt{4}\sqrt{5} - 5\sqrt{9}\sqrt{5} + \sqrt{25}\sqrt{5}$ $5(2)\sqrt{5} - 5(3)\sqrt{5} + 5\sqrt{5}$ $10\sqrt{5} - 15\sqrt{5} + 5\sqrt{5}$ 0

SECTION 6: Rationalize the Denominator

Rationalize the denominator.

1. $\frac{7}{\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}} = \frac{7\sqrt{2}}{2}$

2. $\frac{-2}{5\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{-2\sqrt{3}}{5(3)} = \frac{-2\sqrt{3}}{15}$

3. $\frac{1}{\sqrt[4]{6}} \cdot \frac{\sqrt[4]{6^3}}{\sqrt[4]{6^3}} = \frac{\sqrt[4]{216}}{\sqrt[4]{6^4}}$

$= \frac{\sqrt[4]{216}}{6}$

4. $\frac{3}{5\sqrt[3]{2}} \cdot \frac{\sqrt[3]{2^2}}{\sqrt[3]{2^2}} = \frac{3\sqrt[3]{4}}{5\sqrt[3]{2^3}}$

$= \frac{3\sqrt[3]{4}}{5(2)}$

$= \frac{3\sqrt[3]{4}}{10}$

5. $\frac{10}{\sqrt[4]{5^2}} \cdot \frac{\sqrt[4]{5^2}}{\sqrt[4]{5^2}} = \frac{10\sqrt[4]{25}}{\sqrt[4]{5^4}}$

$= \frac{10\sqrt[4]{25}}{5}$

$= 2\sqrt[4]{25}$

6. $\frac{2}{\sqrt[3]{4^2}} \cdot \frac{\sqrt[3]{4}}{\sqrt[3]{4}} = \frac{2\sqrt[3]{4}}{\sqrt[3]{4^3}}$

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

$= \frac{1}{2}\sqrt[3]{4}$

7. $\frac{1}{9-\sqrt{2}} \cdot \frac{(9+\sqrt{2})}{(9+\sqrt{2})}$

$\frac{9+\sqrt{2}}{81+9\sqrt{2}-9\sqrt{2}-\sqrt{2}\sqrt{2}} = \frac{9+\sqrt{2}}{81-2}$

$= \frac{9+\sqrt{2}}{79}$

Review – simplify the exponents!

9. $\left(x^{2/3}\right)\left(x^{4/5}\right)$

$x^{\frac{2}{3}+\frac{4}{5}}$

$x^{22/15}$

$\frac{5\cdot 2}{5\cdot 3} + \frac{4\cdot 3}{5\cdot 3}$

$\frac{10}{15} + \frac{12}{15}$

$\frac{22}{15}$

10. $\frac{x^{1/4}}{x^{3/5}}$

$x^{\frac{1}{4}-\frac{3}{5}}$

$x^{2/5}$

$\frac{5\cdot 1}{5\cdot 4} - \frac{3\cdot 4}{5\cdot 4}$

$\frac{5}{20} - \frac{12}{20}$

$\frac{8}{20}$

$\frac{2}{5}$

11. $\left(x^{2/3}\right)^{6/7}$

$x^{\frac{2}{3}\cdot\frac{6}{7}}$

$x^{4/7}$

$\frac{2}{3}\cdot\frac{6}{7}$

$\frac{12}{21}$

$\frac{4}{7}$

SECTION 7: Solve Power Equations

5. $\frac{5x^4}{5} = \frac{405}{5}$

$\sqrt[4]{x^4} = \sqrt[4]{81}$

$x = \pm 3$

6. $-8\left(\frac{-1}{8}x^3\right) = 2 \cdot (-8)$

$\sqrt[3]{x^3} = \sqrt[3]{-16}$

$x = \sqrt[3]{-8}\,\sqrt[3]{2}$

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

7. $2x^2 + 12 = -150$

$\quad -12 \quad -12$

$\frac{2x^2}{2} = \frac{-162}{2}$

$\sqrt{x^2} = \sqrt{-81}$

$x = \pm 9i$

8. $\sqrt[5]{(x+1)^5} = \sqrt[5]{30}$

$x+1 = \sqrt[5]{30}$

$\quad -1 \quad -1$

$x = -1 + \sqrt[5]{30}$

9. $(x-2)^3 + 13 = -112$

$\quad -13 \quad -13$

$\sqrt[3]{(x-2)^3} = \sqrt[3]{-125}$

$x - 2 = -5$

$\quad +2 \quad +2$

$x = -3$

10. $2(x-2)^2 - 7 = -107$

$\quad +7 \quad +7$

$\frac{2(x-2)^2}{2} = \frac{-100}{2}$

$\sqrt{(x-2)^2} = \sqrt{-50}$

$x - 2 = \pm\sqrt{-25}\sqrt{2}$

$x - 2 = \pm 5i\sqrt{2}$

$\quad +2 \quad +2$

$x = 2 \pm 5i\sqrt{2}$

11. $\frac{1}{5}(x-1)^4 + 5 = 130$

$\quad -5 \quad -5$

$\frac{1}{5}(x-1)^4 = 125$

$\sqrt[4]{(x-1)^4} = \sqrt[4]{625}$

$x - 1 = \pm 5$

$\quad +1 \quad +1$

$x = 1 \pm 5$

$x = 6, -4$

12. $-\frac{4}{3}\left(-\frac{3}{4}x^5\right) = 96 \cdot \left(\frac{-4}{3}\right)$

$\sqrt[5]{x^5} = \sqrt[5]{-128}$

$x = \sqrt[5]{-32}\,\sqrt[5]{4}$

$x = -2\sqrt[5]{4}$

SECTION 8: Solve Radical Equations

1. $\sqrt{6x+1}+10=17$

$-10 \quad -10$

$\sqrt{6x+1}^2 = 7^2$

$6x+1 = 49$

$-1 \quad -1$

$6x = 48$

$x = 8$

2. $2\sqrt[3]{x-5}+15=5$

$-15 \quad -15$

$\frac{2\sqrt[3]{x-5}}{2} = \frac{-10}{2}$

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

$x-5 = -125$

$x = -120$

3. $(3\sqrt{x})^2=(\sqrt{5x+27})^2$

$9x = 5x+27$

$-5x \quad -5x$

$\frac{4x}{4} = \frac{27}{4}$

$x = 27/4$

4. $x^{\frac{1}{3}}=16$

$(\sqrt[3]{x})^3 = 16^3$

$x = 4096$

5. $\sqrt{3x^2-2}-1=3$

$+1 \quad +1$

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

$3x^2-2 = 16$

$+2 \quad +2$

$3x^2 = 18$

$x^2 = 6$

$x = \pm\sqrt{6}$

6. $\sqrt{\frac{x}{3}}+11=13$

$-11 \quad -11$

$(\sqrt{\frac{x}{3}})^2 = 2^2$

$3 \cdot \frac{x}{3} = 4 \cdot 3$

$x = 12$

7. $\sqrt[4]{4x-17}^4=\sqrt[4]{3x+3}^4$

$4x-\cancel{17} = 3\cancel{x}+3$

$-3x+\cancel{17} \quad -\cancel{3x}+17$

$x = 20$

8. $-2(x-4)^{1/2}=-5$

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

$(\sqrt{x-4})^2 = (\frac{5}{2})^2$

$x-4 = \frac{25}{4}$

$+4 \quad +4$

$x = \frac{25}{4}+4$

$x = \frac{25}{4}+\frac{16}{4}$

$x = \frac{41}{4}$

9. $\sqrt{21x+1}^2=(x+5)^2$

$21x+1 = (x+5)(x+5)$

$\cancel{21}x+\cancel{1} = x^2+10x+25$

$-\cancel{21}x-1 \quad -21x-1$

$0 = x^2-11x+24$

$0 = (x-8)(x-3)$

$x = 3, 8$

10. $\sqrt{7x+15}^2=(x+1)^2$

$7x+15 = (x+1)(x+1)$

$7x+15 = x^2+2x+1$

$-7x-15 \quad -7x-15$

$0 = x^2-5x-14$

$0 = (x-7)(x+2)$

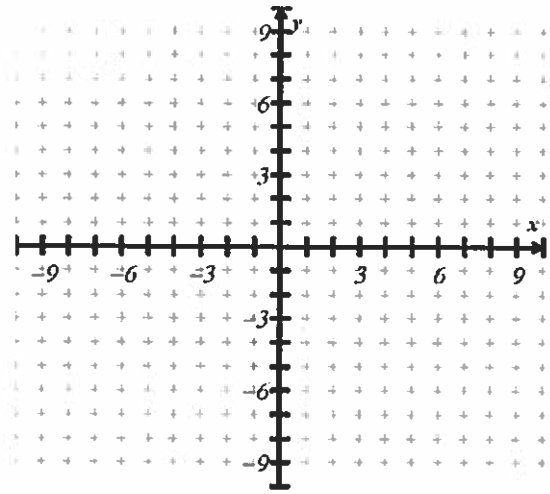
$x = 7, \cancel{-2}$ ext

$x = 7$

1. Simplify Nth Roots a) Convert: b) Evaluate: c) Simplify: d) Simplify with variables:	**2. Operations with Nth Roots** a) Multiply/Divide: b) Add/Subtract: c) Rational Exponent Properties
3. Rationalize Nth Roots: a) Monomial Denominator	b) Binomial Denominator
4. Solve Power Equations a) Isolate the power. b) nth root both sides. c) Even roots need $\pm$. Odd roots do not need $\pm$.	**5. Solve Radical Equations** a) Isolate the radical. b) Raise both sides to the nth power.

6. Domain

7. Graphing Square Root Functions



8. Inverses

9. Graphing Cube Root Functions