

Variable Exponents & Higher Roots

Notes, Examples, and Practice Questions

Topics include rational exponents, exponential equations, using absolute value, negative exponents, and more.

Write the following in b^n form (if possible)

Look for common exponent....

Example: $7^3 \cdot 3^6$

$$7^3 \cdot (3^2)^3 = \sqrt[3]{7^3 \cdot 9^3} = 63^3$$

Look for common base....

Example: $3^6 \cdot 9^7$

$$\sqrt{} \quad 9^3 \cdot 9^7 = 9^{10}$$

Note:

Simplify the following

Sometimes using exponent form is better

Example: $\sqrt[3]{7} \cdot \sqrt{7} \Rightarrow 7^{1/3} \cdot 7^{1/2} = 7^{5/6}$

Sometimes using root form is better

Example: $\frac{90^{1/2}}{10^{1/2}} \Rightarrow \frac{\sqrt{90}}{\sqrt{10}} = \sqrt{9} = 3$

Example:

$$\sqrt[4]{\frac{c}{32b^3}} = \frac{\sqrt[4]{c}}{2\sqrt[4]{2b^3}} \cdot \frac{\sqrt[4]{2^3b}}{\sqrt[4]{2^3b}} = \frac{\sqrt[4]{8bc}}{4b} \Rightarrow \frac{\sqrt[4]{8bc}}{4|b|}$$

But, wait!! it should be

why the absolute value?

Applying an absolute value to simplified expression

suppose $b = -3$ and $c = -5$

$\sqrt[4]{\frac{c}{32b^3}}$	$\frac{\sqrt[4]{8bc}}{4b}$	$\frac{\sqrt[4]{8bc}}{4 b }$
$\sqrt[4]{\frac{-5}{32(-27)}}$	$\frac{\sqrt[4]{120}}{-12}$	$\frac{\sqrt[4]{120}}{12}$
original (positive value)	1st simplified this is not equivalent because it is negative!	correction (positive value)

Simplify: (assume positive OR negative variables)

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$$1) \sqrt[3]{6} \cdot \sqrt{2}$$

$$2) \sqrt[3]{ab^2} \cdot \sqrt{ab}$$

$$3) \frac{\sqrt[3]{x+y} \cdot \sqrt[4]{(x+y)^2}}{\sqrt{(x+y)^3}}$$

$$4) \frac{\sqrt[3]{3}}{\sqrt[3]{25m}}$$

$$5) \frac{\sqrt[3]{9}}{2 + \sqrt[4]{9}}$$

$$6) \sqrt[4]{x^6 y^4 z^3}$$

$$7) \sqrt[5]{x} \cdot \sqrt[4]{x}$$

$$8) \frac{2 + \sqrt[5]{2}}{\sqrt[5]{9}}$$

$$9) \sqrt[3]{16x^5 y^{-2}}$$

$$10) \sqrt[3]{\frac{27^5}{9^2 \cdot 81^{-1}}}$$

$$11) \frac{\sqrt[3]{4}}{\sqrt[5]{8}}$$

$$12) \frac{\sqrt[5]{x^3}}{\sqrt[7]{x^4}}$$

Simplify the radicals...

$$1) \sqrt[5]{-64}$$

$$4) \sqrt[4]{162}$$

$$2) \sqrt[3]{375}$$

$$5) \sqrt[3]{192}$$

$$3) \sqrt[5]{128}$$

$$6) \sqrt[4]{363}$$

Write any and all solutions:

$$x^{\frac{3}{5}} = -27$$

$$x^{\frac{2}{3}} = 49$$

$$x^{\frac{4}{3}} = -16$$

$$x^{\frac{3}{2}} = 8$$

$$x^{\frac{3}{4}} = -8$$

Solve for x...

$$1) 3^{3x} = 9$$

$$4) \sqrt[4]{125} = 5^{7x+2}$$

$$2) 4^{3x-1} = 8^{2x+7}$$

$$5) 3 \cdot 9^{x+2} = \sqrt[4]{27}$$

$$3) \frac{16^x}{4^{3x}} = 8^{6x}$$

$$6) 8^{x+3} = \frac{1}{32}$$

Simplify the following:

Exponents and Higher Roots

$$1) \sqrt[3]{24x^6y^7z^8}$$

$$2) \sqrt[4]{32p^4r^8s^9}$$

$$3) \frac{7}{\sqrt[5]{8x^3y^5z^7}}$$

$$4) \left(\frac{9a^3b^2c}{16a^{-3}b^4c^5} \right)^{(-1/2)}$$

$$5) \frac{\sqrt[3]{500a^4b^2c}}{(2a^{-3}b^5c^7)^{1/3}}$$

$$6) \frac{2\sqrt[3]{5}}{\sqrt[3]{16xy^3}}$$

$$7) \sqrt[4]{\frac{x^3y^2z^{-1}}{8x^{-1}y^{-5}z}}$$

$$8) (16x^4y^6z^{-8})^{(3/2)}$$

$$9) \frac{6}{4 + \sqrt{7}}$$

$$10) \frac{\sqrt{x} + 9}{\sqrt{x} - 9}$$

$$11) \frac{5}{8 + i}$$

$$12) \frac{3 - 2i}{4 + i}$$

$$13) \sqrt[3]{-16m^7p^6q^{-2}}$$

$$14) (81x^5y^{-7}z^9)^{(2/3)}$$

$$15) \frac{\sqrt[3]{16a^2b}}{\sqrt[5]{8a^3b^4}}$$

Solve (and assume variables may be positive OR negative)

$$1) (4x)^{-2} = 100$$

$$2) \frac{1}{x - 3x^{\frac{1}{2}}} = 4$$

$$3) \frac{3}{x^4} = 27$$

$$4) \frac{3}{x^4} = -27$$

$$5) 4^x - 2^x - 2 = 0$$

$$6) (3^x)^{x-5} = 1$$

$$7) \frac{A^2}{A^{-x}} = A^3 \cdot A^{-x}$$

$$8) \frac{7^{-3x+2}}{343^x} = 49^{-2x-1}$$

$$9) \frac{2}{x + 7x^{\frac{1}{3}}} + \frac{1}{10x^{\frac{1}{3}}} = 0$$

$$10) 5^x + 125(5^{-x}) = 30$$

$$11) \left(\frac{7^{4x-3}}{7^{2x-3}} \right)^{x-7} = 1$$

$$12) \frac{-1}{x^2} + 2x^{\frac{1}{2}} + x^{\frac{3}{2}} = 0$$

A) Solve the system

$$\begin{aligned} 3^x - 2^y &= 23 \\ 3^{x+1} + 2^{y+1} &= 89 \end{aligned}$$

B) Write as b^n , where b and n are positive integers...

$$4^3 \cdot 5^2 =$$

C) Simplify. (Assume variables are negative or positive).

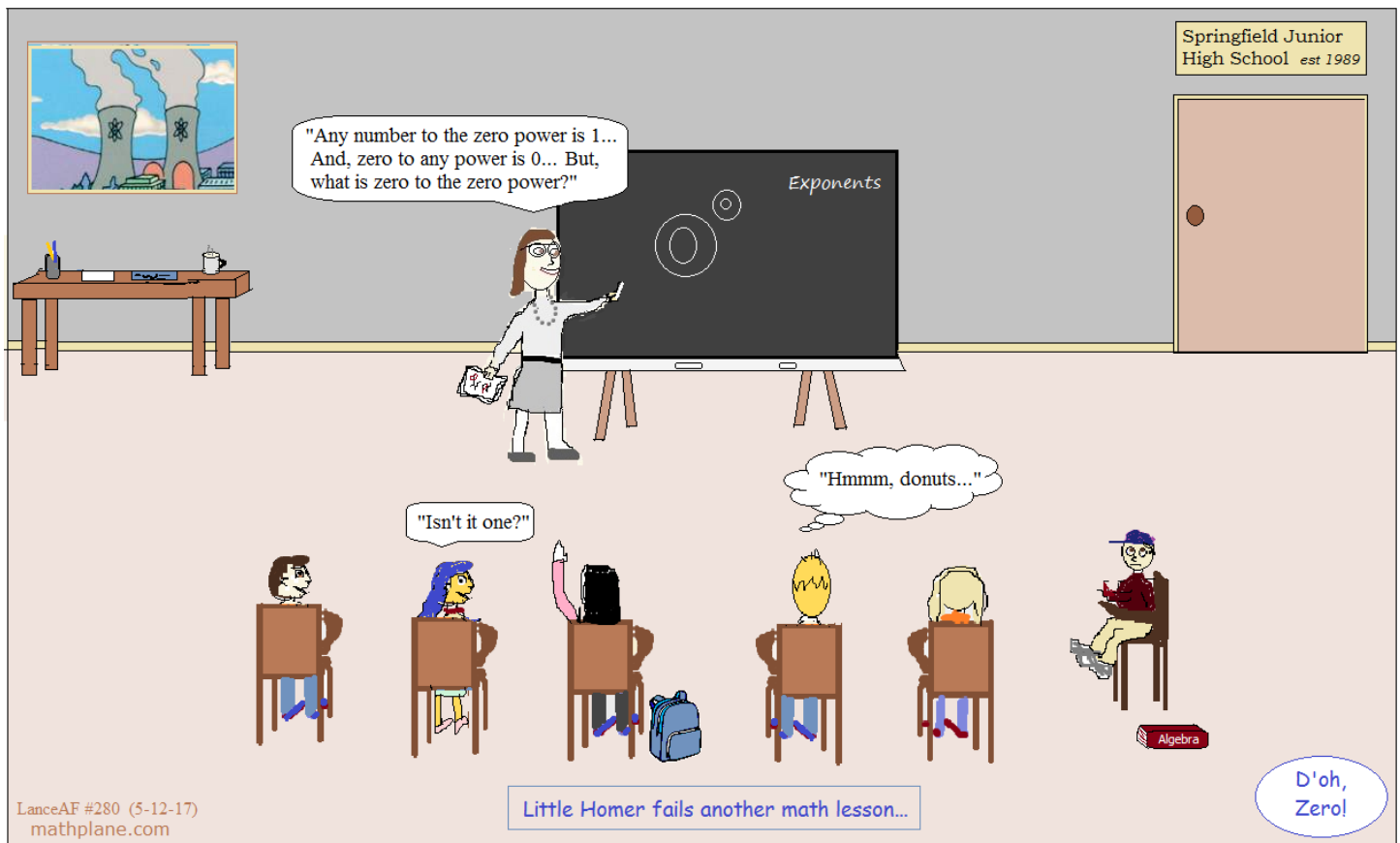
$$\sqrt[4]{\frac{c^2}{24a^3c^{-2}}}$$

D) Evaluate...

$$-5^{-2} =$$

$$(0.6)^{-1} =$$

$$\left(\frac{4}{9}\right)^{\frac{2}{3}} =$$



SOLUTIONS-→

Simplify: (assume positive OR negative variables)

SOLUTIONS

1) $\sqrt[3]{6} \cdot \sqrt{2}$

$$\frac{1}{6^{\frac{1}{3}}} \cdot \frac{1}{2^{\frac{1}{2}}}$$

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

$$\sqrt[6]{6^2} \cdot \sqrt[6]{2^3} = \sqrt[6]{288}$$

2) $\sqrt[3]{ab^2} \cdot \sqrt[4]{ab}$

$$(ab^2)^{\frac{1}{3}} \cdot (ab)^{\frac{1}{4}}$$

$$(ab^2)^{\frac{2}{6}} \cdot (ab)^{\frac{3}{6}}$$

$$\sqrt[6]{a^2 b^4} \cdot \sqrt[6]{a^3 b^3}$$

$$\sqrt[6]{a^5 b^7}$$

$$|b| \sqrt[6]{a^5 b}$$

3) $\frac{\sqrt[3]{x+y} \cdot \sqrt[4]{(x+y)^2}}{\sqrt{(x+y)^3}}$

$$\frac{(x+y)^{\frac{1}{3}} \cdot (x+y)^{\frac{2}{4}}}{(x+y)^{\frac{3}{2}}}$$

$$(x+y)^{\frac{1}{3} + \frac{2}{4} - \frac{3}{2}} = (x+y)^{-\frac{2}{3}} = \frac{\sqrt[3]{(x+y)}}{(x+y)}$$

4) $\frac{\sqrt[3]{3}}{\sqrt[3]{25m}}$

$$\frac{\sqrt[3]{3}}{\sqrt[3]{5 \cdot 5 \cdot m}} \cdot \frac{\sqrt[3]{5m^2}}{\sqrt[3]{5m^2}}$$

$$\frac{\sqrt[3]{15m^2}}{5m}$$

5) $\frac{\sqrt[3]{9}}{2 + \sqrt[4]{9}} \cdot \frac{2 - \sqrt[4]{9}}{2 - \sqrt[4]{9}}$

$$\frac{\frac{1}{9^{\frac{1}{3}}} \cdot \frac{1}{9^{\frac{1}{4}}}}{9^{\frac{7}{12}}}$$

$$= \sqrt[12]{9^7}$$

$$\frac{2\sqrt[3]{9} - \sqrt[12]{9^7}}{4 - \sqrt[4]{81}}$$

 $\rightarrow 1$

$$2\sqrt[3]{9} - \sqrt[12]{9^7}$$

6) $\sqrt[4]{x^6 y^4 z^3}$

$$\sqrt[4]{x^4 \cdot x^2 \cdot y^4 \cdot z^3}$$

$$|x||y| \sqrt{x^2 y^3}$$

7) $\sqrt[5]{x} \cdot \sqrt[4]{x}$

$$x^{\frac{1}{5}} \cdot x^{\frac{1}{4}}$$

$$x^{\frac{1}{5}} + \frac{1}{4}$$

$$x^{\frac{9}{20}}$$

$$\sqrt[20]{x^9}$$

8) $\frac{2 + \sqrt[5]{2}}{\sqrt[5]{9}}$

$$\frac{2 + \sqrt[5]{2}}{\sqrt[5]{3 \cdot 3}} \cdot \frac{\sqrt[5]{3 \cdot 3 \cdot 3}}{\sqrt[5]{3 \cdot 3 \cdot 3}}$$

$$\frac{2\sqrt[5]{27} + \sqrt[5]{54}}{3}$$

9) $\sqrt[3]{16x^5 y^{-2}} = \frac{\sqrt[3]{8 \cdot 2 \cdot x^3 \cdot x^2}}{\sqrt[3]{y^2}}$

then, rationalize denominator...

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

$$\frac{2x\sqrt[3]{2x^2 y}}{y}$$

10) $\sqrt[3]{\frac{27^5}{9^2 \cdot 81^{-1}}}$

$$\sqrt[3]{\frac{(3^3)^5}{(3^2)^2 \cdot (3^4)^{-1}}} = \sqrt[3]{\frac{3^{15}}{3^4 \cdot 3^{-4}}}$$

$$= \sqrt[3]{3^{15}} = 3^5 = 243$$

11) $\frac{\sqrt[2]{4}}{\sqrt[5]{8}} = \frac{4^{\frac{1}{2}}}{8^{\frac{1}{5}}} = \frac{(2^2)^{\frac{1}{2}}}{(2^3)^{\frac{1}{5}}}$

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

$$2^{\frac{1}{15}}$$

12) $\frac{\sqrt[5]{x^3}}{\sqrt[7]{x^4}} = \frac{x^{\frac{3}{5}}}{x^{\frac{4}{7}}}$

$$\frac{1}{x^{\frac{1}{35}}}$$

Simplify the radicals...

$$1) \sqrt[5]{-64} \quad \sqrt[5]{-32} \cdot \sqrt[5]{2}$$

$$\boxed{-2\sqrt[5]{2}}$$

$$4) \sqrt[4]{162} \quad \sqrt[4]{2 \cdot 81} = \boxed{3\sqrt[4]{2}}$$

$$2) \sqrt[3]{375} \quad \sqrt[3]{125} \cdot \sqrt[3]{3}$$

$$\boxed{5\sqrt[3]{3}}$$

$$5) \sqrt[3]{192} \quad \sqrt[3]{3 \cdot 64} = \boxed{4\sqrt[3]{3}}$$

$$3) \sqrt[5]{128} \quad \sqrt[5]{2^7}$$

$$2\sqrt[5]{2^2} = \boxed{2\sqrt[5]{4}}$$

$$6) \sqrt[5]{363} \quad \sqrt[5]{3 \cdot 121} = \boxed{11\sqrt[5]{3}}$$

SOLUTIONS

Write any and all solutions:

$$x^{\frac{3}{5}} = -27 \quad \boxed{-243} \quad \text{odd radicals can have negatives}$$

$$x^{\frac{2}{3}} = 49 \quad \boxed{343, -343}$$

$$x^{\frac{4}{3}} = -16 \quad \boxed{\text{no solution}} \quad \text{any value to the 4th power will be positive}$$

$$x^{\frac{3}{2}} = 8 \quad \boxed{4} \quad (-4 \text{ is NOT a solution})$$

$$x^{\frac{3}{4}} = -8 \quad \boxed{\text{no solution}}$$

(If you check, you'll see that neither 16 nor -16 are solutions)

Solve for x...

Find common roots (bases)..
Then, drop bases to solve..

$$1) 3^{3x} = 9 \quad 3^{3x} = 3^2$$

$$3x = 2 \quad \boxed{x = 2/3}$$

$$4) \sqrt[5]{125} = 5^{7x+2} \quad 5^1 \cdot 5^{\frac{1}{2}} = 5^{7x+2}$$

$$\frac{3}{2} = 7x+2 \quad \boxed{x = \frac{-1}{14}}$$

$$2) 4^{3x-1} = 8^{2x+7} \quad 2^{6x-2} = 2^{6x+21}$$

$$6x-2 = 6x+21 \quad \boxed{\text{no solution}}$$

$$5) 3 \cdot 9^{x+2} = \sqrt[3]{27} \quad 3^1 \cdot 3^{2x+4} = 3^{\frac{3}{2}}$$

$$\frac{2x+5}{3} = \frac{3}{2} \quad 2x+5 = \frac{3}{2}$$

$$\boxed{x = \frac{-7}{4}}$$

$$3) \frac{16^x}{4^{3x}} = 8^{6x} \quad \frac{2^{4x}}{2^{6x}} = 2^{18x}$$

$$2^{-2x} = 2^{18x}$$

$$\boxed{x = 0}$$

$$6) 8^{x+3} = \frac{1}{32}$$

$$2^{3x+9} = 2^{-5}$$

$$3x+9 = -5 \quad \boxed{x = \frac{-14}{3}}$$

Simplify the following:

SOLUTIONS

Exponents and Higher Roots

$$1) \sqrt[3]{24x^6y^7z^8}$$

$$2) \sqrt[3]{3}$$

$$2x^2 \sqrt[3]{3}$$

$$2x^2y^2 \sqrt[3]{3y} \Rightarrow 2x^2y^2z^2 \sqrt[3]{3yz^2}$$

$$2) \sqrt[4]{32p^4r^8s^9}$$

$$2pr^2s^2 \sqrt[4]{2s}$$

Note: if $p < 0$, the simplified version is not equal to expression!
To correct, we'll add absolute value..

$$2|p|r^2s^2 \sqrt[4]{2s}$$

$$3) \frac{7}{\sqrt[5]{8x^3y^5z^7}} \cdot \frac{\sqrt[5]{4x^2z^3}}{\sqrt[5]{4x^2z^3}}$$

$$\frac{7 \sqrt[5]{4x^2z^3}}{\sqrt[5]{32x^5y^5z^{10}}} = \frac{7 \sqrt[5]{4x^2z^3}}{2xyz^2}$$

$$4) \left(\frac{9a^3b^2c}{16a^{-3}b^4c^5} \right)^{-1/2}$$

$$\left(\frac{9a^6}{16b^2c^4} \right)^{(-1/2)} \Rightarrow \left(\frac{16b^2c^4}{9a^6} \right)^{1/2} = \frac{4|b|c^2}{3|a|^3}$$

$$5) \frac{\sqrt[3]{500a^4b^2c}}{(2a^{-3}b^5c^7)^{1/3}}$$

combine terms first... and, simplify...

$$\sqrt[3]{\frac{250a^7}{b^3c^6}} \Rightarrow \frac{5a^2}{bc^2} \sqrt[3]{2a}$$

$$6) \frac{2 \sqrt[3]{5}}{\sqrt[3]{16xy^3}} \cdot \frac{\sqrt[3]{2^2x^2}}{\sqrt[3]{2^2x^2}}$$

rationalize the denominator first...

$$\frac{2 \sqrt[3]{20x^2}}{\sqrt[3]{2^6x^3y^3}} = \frac{2 \sqrt[3]{20x^2}}{4xy} = \frac{\sqrt[3]{20x^2}}{2xy}$$

$$7) \sqrt[4]{\frac{x^3y^2z^{-1}}{8x^{-1}y^{-5}z}}$$

combine terms, then simplify...

$$\frac{\sqrt[4]{x^4y^7}}{\sqrt[4]{8z^2}} \cdot \frac{\sqrt[4]{2z^2}}{\sqrt[4]{2z^2}} = \frac{\sqrt[4]{2x^4y^7z^2}}{\sqrt[4]{16z^4}} = \frac{|x|y \sqrt[4]{2y^3z^2}}{2|z|}$$

$$8) (16x^4y^6z^{-8})^{(3/2)}$$

$$64x^6y^9z^{-12} =$$

$$\frac{64x^6y^9}{z^{12}}$$

$$9) \frac{6}{4 + \sqrt{7}}$$

rationalize the denominator

$$\frac{6}{4 + \sqrt{7}} \cdot \frac{4 - \sqrt{7}}{4 - \sqrt{7}} = \frac{24 - 6\sqrt{7}}{16 - 7} = \frac{8 - 2\sqrt{7}}{3}$$

$$10) \frac{\sqrt{x+9}}{\sqrt{x-9}}$$

$$\frac{\sqrt{x+9}}{\sqrt{x-9}} \cdot \frac{\sqrt{x+9}}{\sqrt{x+9}}$$

$$\frac{x + 18\sqrt{x+9} + 81}{x - 81}$$

$$11) \frac{5}{8+i}$$

Simplified form is $a + bi$

$$\frac{5}{8+i} \cdot \frac{8-i}{8-i} = \frac{40 - 5i}{64 + 8i - 8i - i^2}$$

$$\frac{40}{65} - \frac{5}{65}i = \frac{8}{13} - \frac{1}{13}i$$

$$12) \frac{3-2i}{4+i} \cdot \frac{(4-i)}{(4-i)}$$

$$\frac{12 - 8i - 3i + 2i^2}{16 + 4i - 4i - i^2}$$

$$\frac{12 - 11i - 2}{16 + 1} = \frac{10 - 11i}{17}$$

$$13) \sqrt[3]{-16m^7p^6q^{-2}}$$

simplify... and, rationalize..

$$\frac{-2m^2p^2 \sqrt[3]{2m}}{\sqrt[3]{q^2}} \cdot \frac{\sqrt[3]{q}}{\sqrt[3]{q}}$$

$$\frac{-2m^2p^2 \sqrt[3]{2mq}}{q}$$

$$14) (81x^5y^{-7}z^9)^{(2/3)}$$

$$\frac{81^{(2/3)} x^{(10/3)} z^{(18/3)}}{y^{(14/3)}} =$$

$$\frac{9x^3z^6 \sqrt[3]{9x}}{y^4 \sqrt[3]{y^2}} \cdot \frac{\sqrt[3]{y}}{\sqrt[3]{y}}$$

$$\frac{9x^3z^6 \sqrt[3]{9xy}}{y^5}$$

$$15) \frac{\sqrt[3]{16a^2b}}{\sqrt[5]{8a^3b^4}}$$

change to exponential form...

$$\frac{16^{(1/3)} a^{(2/3)} b^{(1/3)}}{8^{(1/5)} a^{(3/5)} b^{(4/5)}} = \frac{2^{(4/3)} a^{(10/15)} b^{(5/15)}}{2^{(3/5)} a^{(9/15)} b^{(12/15)}} = \frac{2^{(11/15)} a^{(1/15)} b^{(-7/15)}}{1}$$

change back to radical form...

$$\frac{\sqrt[15]{2^{11}ab^8}}{b}$$

Solve (and assume variables may be positive OR negative)

SOLUTIONS

1) $(4x)^{-2} = 100$

$$\frac{1}{16x^2} = 100$$

$$1 = 1600x^2$$

$$x^2 = \frac{1}{1600}$$

$$x = 1/40 \text{ or } -1/40$$

2) $x - 3x^{\frac{1}{2}} = 4$

$$x - 4 = 3x^{\frac{1}{2}} \quad (\text{square both sides})$$

$$x^2 - 8x + 16 = 9x$$

$$(x-1)(x-16) = 0$$

$$x = 1, 16$$

1 is extraneous...

$$\text{So } x = 16$$

3) $\frac{3}{x^4} = 27$

$$\frac{\frac{4}{3}}{x^{\frac{3}{4}}} = \frac{\frac{4}{3}}{27}$$

$$x = 81$$

4) $\frac{3}{x^4} = -27$

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

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

No solution (because the 1/4 root of a number is positive)

5) $4^x - 2^x - 2 = 0$

equal $\left\{ \begin{array}{l} (2^2)^x - 2^x - 2 = 0 \\ (2^x)^2 - 2^x - 2 = 0 \end{array} \right.$

$$A^2 - A - 2 = 0$$

$$(A-2)(A+1) = 0$$

$$A = 2 \text{ or } -1$$

$$2^x = 2 \text{ or } -1$$

$$x = 1$$

6) $(3^x)^{x-5} = 1$

$$3^{x^2-5x} = 3^0$$

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

$$x = 0 \text{ or } 5$$

7) $\frac{A^2}{A^{-x}} = A^3 \cdot A^{-x}$

$$A^{2+x} = A^{3-x}$$

$$2+x = 3-x$$

$$x = 1/2$$

8) $\frac{7^{-3x+2}}{343^x} = 49^{-2x-1}$

$$\frac{7^{-3x+2}}{7^{3x}} = 7^{-4x-2}$$

$$7^{-6x+2} = 7^{-4x-2}$$

$$-6x+2 = -4x-2$$

$$x = 2$$

9) $x + 7x^{\frac{2}{3}} + 10x^{\frac{1}{3}} = 0$

$$\text{Let } A = x^{\frac{1}{3}}$$

$$A^3 + 7A^2 + 10A = 0$$

$$A(A^2 + 7A + 10) = 0$$

$$A(A+2)(A+5) = 0$$

$$A = 0, -2, -5$$

$$x = 0, -8, -125$$

10) $5^x + 125(5^{-x}) = 30$

$$5^x + 125(5^{-x}) - 30 = 0$$

multiply by 5^x

$$5^{2x} + 125 - 30(5^x) = 0$$

$$\text{let } A = 5^x$$

$$A^2 - 30A + 125 = 0$$

$$(A-5)(A-25) = 0$$

$$A = 5, 25$$

$$5^x = 5 \quad x = 1$$

$$5^x = 25 \quad x = 2$$

11) $\left(\frac{7^{4x-3}}{7^{2x-3}}\right)^{x-7} = 1$

$$\left(7^{2x}\right)^{x-7} = 1$$

$$7^{2x^2-14x} = 7^0$$

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

$$x = 0 \text{ or } 7$$

12) $\frac{-1}{x^2} + 2x^{\frac{1}{2}} + x^{\frac{3}{2}} = 0$

$$x^{\frac{-1}{2}} \cdot \left(1 + 2x + x^2\right) = 0$$

$$x^{\frac{-1}{2}} \cdot (x+1)(x+1) = 0$$

$$x^{\frac{-1}{2}} = 0 \Rightarrow \frac{1}{\sqrt{x}} = 0 \quad \text{no solutions.}$$

$$(x+1)(x+1) = 0 \Rightarrow x = -1$$

$$\text{but, if } x = -1, \text{ then } 2x^{\frac{1}{2}} = 2(-1)^{\frac{1}{2}}$$

however, $2\sqrt{-1}$ is not real

A) Solve the system

$$\begin{aligned} 3^x - 2^y &= 23 \\ 3^{x+1} + 2^{y+1} &= 89 \end{aligned}$$

$2 \cdot 3^x - 2 \cdot 2^y = 46$

$$\begin{aligned} 2 \cdot 3^x - 2^{y+1} &= 46 \\ 3^{x+1} + 2^{y+1} &= 89 \end{aligned}$$

$$2 \cdot 3^x + 3 \cdot 3^x = 135$$

$$5 \cdot 3^x = 135$$

SOLUTIONS

$$x = 3$$

$$\text{If } x = 3, \text{ then } y = 2$$

B) Write as b^n , where b and n are positive integers...

$$4^3 \cdot 5^2 =$$

$$64 \cdot 5^2 = 8^2 \cdot 5^2 = 40^2$$

C) Simplify. (Assume variables are negative or positive).

$$\sqrt[4]{\frac{c^2}{24a^3c^{-2}}} = \sqrt[4]{\frac{c^4}{2 \cdot 2 \cdot 2 \cdot 3 \cdot a^3}} \cdot \frac{\sqrt[4]{2 \cdot 3 \cdot 3 \cdot 3 \cdot a}}{\sqrt[4]{2 \cdot 3 \cdot 3 \cdot 3 \cdot a}} = \frac{|c| \sqrt[4]{54a}}{6a}$$

since original has a^3 , absolute value isn't necessarysince original had c^2 and c^{-2} , absolute value of c must be maintained to keep expressions equal!

D) Evaluate...

$$-5^{-2} = (-1)(5)^{-2} = (-1)\left(\frac{1}{5^2}\right) = \frac{-1}{25}$$

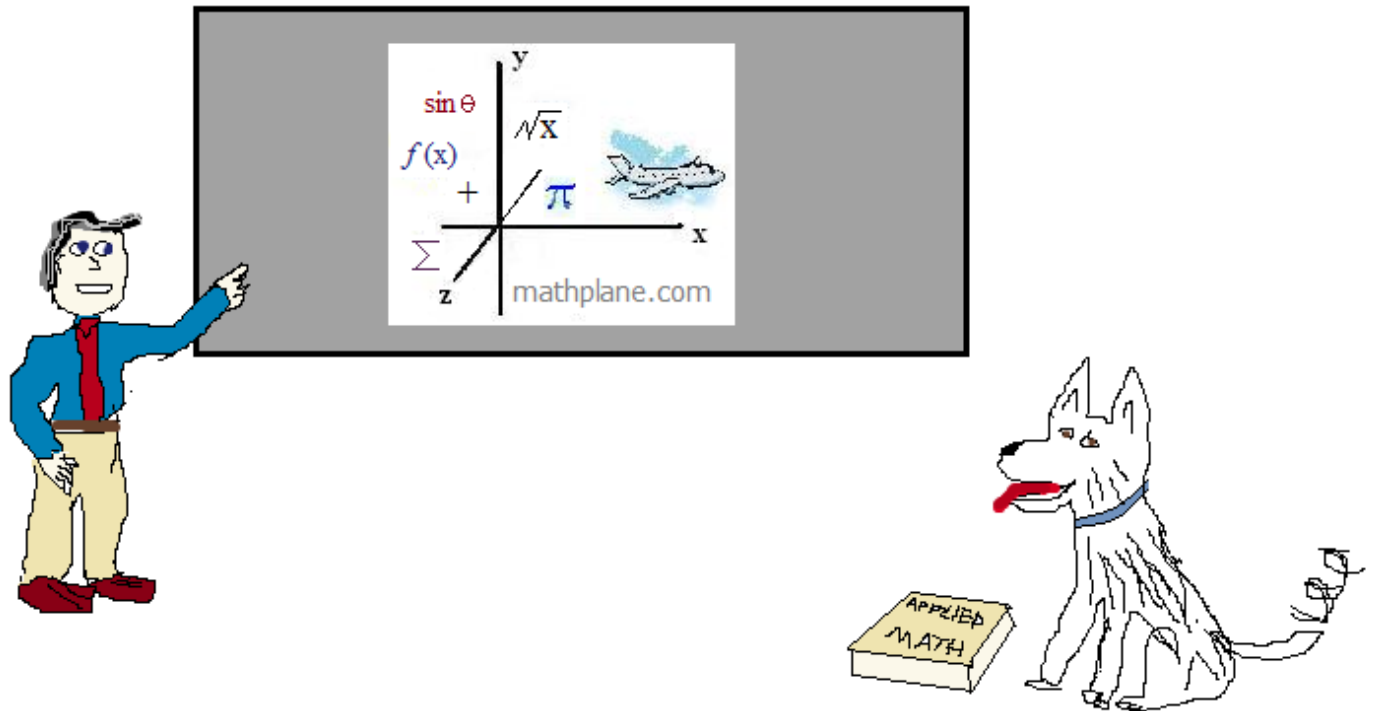
$$(0.6)^{-1} = (3/5)^{-1} = 5/3$$

$$\left(\frac{4}{9}\right)^{\frac{2}{3}} \quad \text{It's not } \frac{8}{27}!! \quad \left(\left(\frac{4}{9}\right)^2\right)^{\frac{1}{3}} = \sqrt[3]{\frac{16}{81}} = \frac{\sqrt[3]{16}}{\sqrt[3]{9 \cdot 9}} \cdot \frac{\sqrt[3]{9}}{\sqrt[3]{9}} = \frac{\sqrt[3]{16 \cdot 9}}{9}$$

Thanks for visiting. (Hope it helped!)

If you have questions, suggestions, or requests, let us know.

Cheers



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