

## WARM-UP: Simplify...

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$$a) -27^{-\frac{2}{3}}$$

$$-\frac{1}{27^{2/3}} = -\frac{1}{9}$$

$$(x)^{1/2} = 9^{1/2}$$

$$x = 3$$

$$b) (a^{5/4})^{5/4} = 16$$

$$a = 16^{5/4}$$

$$a = 32$$

$$c) \frac{3^{7/12}}{3^{1/4} \cdot 3^{1/3}}$$

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

$$d) \left(\frac{2a}{b}\right)^{-3} (2ab^2)^2$$

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

$$= \left(\frac{b^3}{8a^3}\right) \frac{4a^2b^4}{1}$$

$$= \frac{4a^2b^7}{8a^3}$$

$$= \frac{1}{2} a^{-1} b^7$$

$$= \frac{b^7}{2a}$$

$$① (2^{-1} + 3^{-1})^2$$

$$\left(\frac{1}{2} + \frac{1}{3}\right)^2$$

$$\left(\frac{3}{6} + \frac{2}{6}\right)^2$$

$$\left(\frac{5}{6}\right)^2$$

$$\frac{25}{36}$$

$$② \frac{(3x^3y^2)^4(-4x^6y)^2}{2x^{-3}(x^{-2}y^5)^3}$$

$$\frac{(81x^{12}y^8)(16x^{12}y^2)}{2x^{-3}(x^{-6}y^{15})}$$

$$\frac{1296x^{24}y^{10}}{2x^{-9}y^{15}}$$

$$648x^{33}y^{-5}$$

$$\frac{648x^{33}}{y^5}$$

## Equations involving Rational Exponents...

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$$a) \left(x^{\frac{5}{2}}\right)^{\frac{4}{5}} = 32$$

$$x^1 = 4$$

$$b) \left(a^{\frac{2}{3}}\right)^{\frac{3}{2}} = 49$$

$$a = 343$$

$$c) \frac{2a^{-\frac{3}{2}}}{2} = \frac{128}{2}$$

$$\left(a^{-\frac{3}{2}}\right)^{-\frac{2}{3}} = 64^{-\frac{2}{3}}$$

$$a = \frac{1}{\left(\sqrt[3]{64}\right)^2}$$
$$= \frac{1}{16}$$

## Re-writing Bases

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$$2^? = 8$$

$$2^3 = 8$$

$$3^? = 81$$

$$3^4 = 81$$

$$\left(\frac{1}{16}\right) = 2^?$$

$$\frac{1}{2^4} = 2^{-4}$$

$$4^? = 2^?$$

$$(2^2)^3 = 2^6$$

$$\left(\frac{1}{64}\right)^2 = 4^?$$

$$\left(\frac{1}{4^3}\right)^2$$

$$\frac{1}{4^6}$$

$$4^{-6}$$

$$\underline{125}^x = 5^?$$

$$(5^3)^x$$

$$5^{3x}$$

$$32^{3x+1} = 2^?$$

$$(2^5)^{3x+1}$$

$$2^{15x+5}$$

Which is biggest number?

A/  $16^{355}$   
 $(2^4)^{355}$   
 $= 2^{1420}$

B/  $32^{284}$   
 $(2^5)^{284} = 2^{1420}$

C/  $2^{709}$

D/  $8^{475}$   
 $(2^3)^{475}$   
 $2^{1425}$

$2^{10}$   
 $2^{12}$   
 $2^{17}$   
 $2^8$

## Solving Exponential Equations

STEPS:

- 1) Write each side with the same base
- 2) Compare exponents
- 3) Solve equation

a)  $5^x = \frac{1}{25}$

$$5^x = \frac{1}{5^2}$$

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

$$x = -2$$

$$5^{x+2} = 5^7$$

b)  $81 = 27^{3x-1}$

$$3^4 = (3^3)^{3x-1}$$

$$3^4 = 3^{9x-3}$$

$$\therefore 4 = 9x - 3$$

$$7 = 9x$$

$$x = \frac{7}{9}$$

c)  $5^{x^2-3x} = 5^{2x-4}$

$$\therefore x^2 - 3x = 2x - 4$$

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

$$(x-4)(x-1) = 0$$

$$x = 4, 1$$

Now, your turn...

$$a) (2^{x+1})(4^{x+1})(8^{x+1}) = 128$$

$$(2^{x+1})(2^{2x+2})(2^{3x+3}) = 2^7$$

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

$$\therefore 6x+6=7$$

$$6x = 1$$

$$x = \frac{1}{6}$$

$$b) \left(\frac{1}{9}\right)^{x-2} = \left(\frac{1}{27}\right)^{x+2}$$

$$(3^{-2})^{x-2} = (3^{-3})^{x+2}$$

$$3^{-2x+4} = 3^{-3x-6}$$

$$\therefore -2x+4 = -3x-6$$

$$x = \underline{-10}$$