Warm Up Questions:

As a power

As a radical

Express as a radical: $\frac{1}{2}$

a) $8^{\frac{1}{4}}$ b) $25^{0.5}$ c) $100^{\frac{3}{4}}$

$= \sqrt[4]{8}$ $= \sqrt{25}$ $= \left(\sqrt[4]{100}\right)^3$

Express as a power:

a) $\sqrt{67}$ b) $\sqrt[3]{40}^{\,2}$ c) $\sqrt[4]{16}^{\,3}$

$= 67^{\frac{1}{2}}$ $= 40^{\frac{2}{3}}$ $= 16^{\frac{3}{4}}$

Evaluate without the use of a calculator :

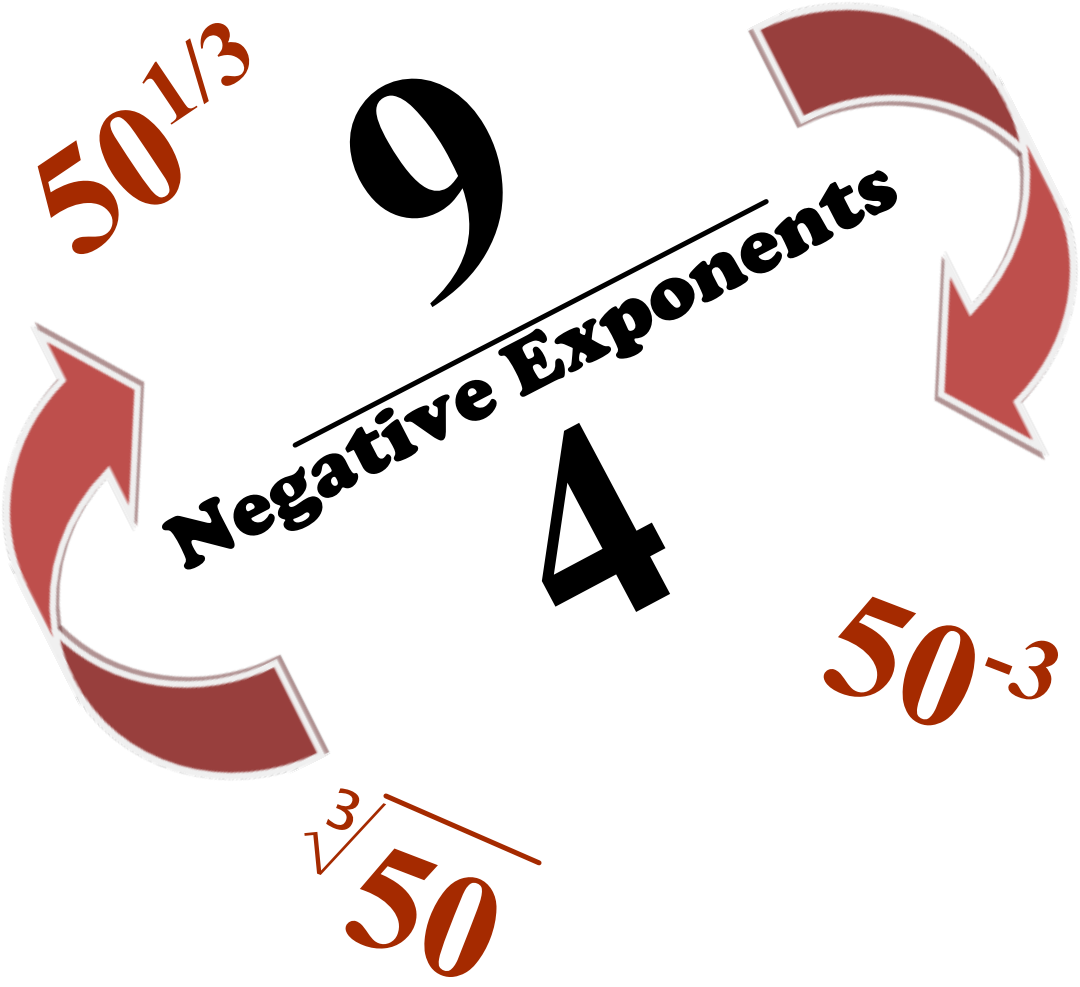
a) $25^{3/2}$ b) $100^{0.5}$

$= \left(\sqrt{25}\right)^3$ $= 100^{\frac{1}{2}}$

$= (5)^3$ $= \sqrt{100}$

$= 5 \times 5 \times 5$ $= 10$

$= 125$


$50^{1/3}$
9
Negative Exponents
4
50^{-3}
$\sqrt[3]{50}$

What do negative exponents represent??

$\frac{8^5}{8^3}$ LOOK $\frac{8^3}{8^5}$

$\frac{8\cdot8\cdot8\cdot8\cdot8}{8\cdot8\cdot8}$ $\frac{8\cdot8\cdot8}{8\cdot8\cdot8\cdot8\cdot8}$

8^2 8^{-2}

$\frac{64}{1}$ Reciprocal $\frac{1}{64}$

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

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

$8^{-2} = \left(\frac{1}{8}\right)^2 = \frac{1^2}{8^2} = \frac{1\cdot1}{8\cdot8} = \frac{1}{64}$

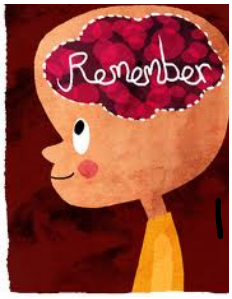
$3^{-3} = \left(\frac{1}{3}\right)^3 = \frac{1^3}{3^3} = \frac{1\cdot1\cdot1}{3\cdot3\cdot3} = \frac{1}{27}$

$8^2 = 8\cdot8 = 64$

$\left(\frac{2}{5}\right)^{-2} = \left(\frac{5}{2}\right)^2 = \frac{5^2}{2^2} = \frac{5\cdot5}{2\cdot2} = \frac{25}{4}$

$\left(\frac{2}{5}\right)^2 = \frac{4}{25}$

When dividing powers, subtract the exponents.



a) $\frac{15^{11}}{15^{9}}$

$= 15^{11-9}$

$= 15^{2}$

$= 225$

b) $\frac{9^{15}}{9^{20}}$

$= 9^{15-20}$

$= 9^{-5}$

$= \left(\frac{1}{9}\right)^{5}$

$= \frac{1^5}{9^5}$

$= \frac{1}{59049}$

c) $26^{15} \div 26^{32}$

$= 26^{15-32}$

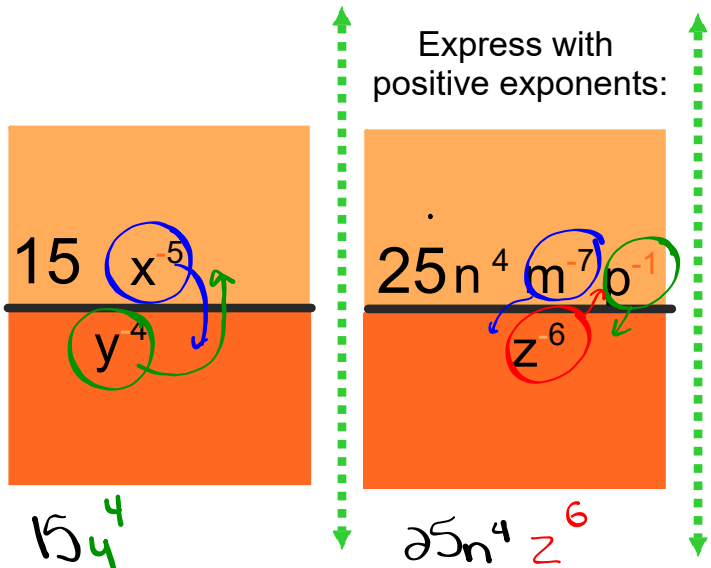
$= 26^{-17}$

$= \left(\frac{1}{26}\right)^{17}$

$= \frac{1^{17}}{26^{17}}$

$= \frac{1}{26^{17}}$

if you have a negative exponent you flip the base and make exponent positive



$\frac{15y^4}{x^5}$ $\frac{25n^4z^6}{m^7p}$

Express with positive exponents:

$12a^{-2}b^5c^{-7}$

$\frac{12b^5}{a^2c^7}$

$15 \cdot x^{-5} \div y^{-4}$

$15 \cdot \left(\frac{1}{x}\right)^5 \div \left(\frac{1}{y}\right)^4$

$15 \cdot \frac{(1)^5}{(x)^5} \div \frac{(1)^4}{(y)^4}$

$15 \cdot \frac{1}{x^5} \div \frac{1}{y^4}$

$15 \cdot \frac{1}{x^5} \cdot \frac{y^4}{1}$

$\frac{15y^4}{x^5}$

$\left(\frac{4}{9}\right)^{-2}$ ← negative exponent "flip base"

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

$= \frac{9^2}{4^2}$

$= \frac{9 \cdot 9}{4 \cdot 4}$

$= \frac{81}{16}$

Let's Give it a Try!

Evaluate: All negative exponents "flip base"

a) 3^{-2}

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

$= \frac{1^2}{3^2}$

$= \frac{1}{9}$

b) $(4/5)^{-2}$

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

$= \frac{5^2}{4^2}$

$= \frac{25}{16}$

c) $(1/2)^{-2}$

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

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

$= 4$

Express with positive exponents:

d) $(-5)^{-3}$

$= \left(-\frac{1}{5}\right)^{3}$

e) $8^{-2/3}$

$= \left(\frac{1}{8}\right)^{2/3}$

$= \frac{1^{2/3}}{8^{2/3}}$

$= \frac{\left(\sqrt[3]{1}\right)^{2}}{\left(\sqrt[3]{8}\right)^{2}}$

$= \frac{(1)^{2}}{(2)^{2}}$

$= \frac{1}{4}$

f) $(1/9)^{-3/2}$

$= (9)^{3/2}$

Evaluate:

g) $(8/27)^{-2/3}$

$= \left(\frac{27}{8}\right)^{\frac{2}{3}}$

$= \frac{27^{2/3}}{8^{2/3}}$

$= \frac{\left(\sqrt[3]{27}\right)^2}{\left(\sqrt[3]{8}\right)^2}$

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

$= \frac{9}{4}$

h) $(-125)^{-1/3}$

$= \left(\frac{-1}{125}\right)^{\frac{1}{3}}$

$= \frac{(-1)^{1/3}}{(125)^{1/3}}$

$= \frac{\sqrt[3]{-1}}{\sqrt[3]{125}}$

$= \frac{-1}{5}$

i) $(-14/5)^0$

$= 1$

Try These

a) $144^{-1/2}$

$= \left(\frac{1}{144}\right)^{1/2}$ ← index is 2

$= \frac{\sqrt{1}}{\sqrt{144}}$

$= \frac{1}{12}$

b) $(9/64)^{-1/2}$

$= \left(\frac{64}{9}\right)^{1/2}$ ← index is 2

$= \frac{\sqrt{64}}{\sqrt{9}}$

$= \frac{8}{3}$

c) $81^{-3/2}$

$= \left(\frac{1}{81}\right)^{3/2}$ ← index

$= \frac{(\sqrt{1})^3}{(\sqrt{81})^3}$

$= \frac{(1)^3}{(9)^3}$

$= \frac{1}{729}$

d) $(-64)^{-1/3}$

$= \left(\frac{-1}{64}\right)^{1/3}$ ← index is 3

$= \frac{\sqrt[3]{-1}}{\sqrt[3]{64}}$

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

e) $(100/49)^{-3/2}$

$= \left(\frac{49}{100}\right)^{3/2}$ ← index is 2

$= \frac{(\sqrt{49})^3}{(\sqrt{100})^3}$

$= \frac{(7)^3}{(10)^3}$

$= \frac{343}{1000}$

f) $0.36^{-1/2}$

$= \left(\frac{36}{100}\right)^{-1/2}$

$= \left(\frac{100}{36}\right)^{1/2}$

$= \frac{\sqrt{100}}{\sqrt{36}}$

$= \frac{10}{6}$

$= \frac{5}{3}$

Check out page 233

Questions:6, 7, 8, 9b,d,f,h, 12

Answers on 489

⑧ f) $\frac{1}{5^{-3}}$

$= \left(\frac{1}{5}\right)^{-3}$

$= (5)^{3}$

$= 125$

Powers with Negative Exponents

$x^{-n} = 1/x^n$ AND $1/x^n = x^{-n}$ $x \neq 0$

Flip It and Turn the Exponent Positive