Negative Exponents

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- A negative exponent is sometimes called integral exponent.

Consider the patterns:

$10^3 = 1000$ ↓ ÷10

$10^2 = 100$ ↓ ÷10

$10^1 = 10$ ↓ ÷10

$10^0 = 1$ ↓ ÷10

$10^{-1} = \frac{1}{10} = \frac{1}{10^1}$

$10^{-2} = \frac{1}{100} = \frac{1}{10^2}$

$10^{-3} = \frac{1}{1000} = \frac{1}{10^3}$

$2^3 = 8$

$2^2 = 4$

$2^1 = 2$

$2^0 = 1$

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

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

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

Ex. Rewrite with positive exponents:

a) $10^{-7} = \frac{1}{10^7}$ b) $3^{-5} = \frac{1}{3^5}$ c) $x^{-4} = \frac{1}{x^4}$

Negative Exponent Law

$$a^{-n} = \frac{1}{a^n}$$ and $$\frac{1}{a^{-n}} = a^n \quad a \neq 0$$

Simplify, then express with positive exponents:

① $5^{-3} \cdot 5^1$

5^{-2}

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

② $a^{-8} \cdot a^5$

a^{-3}

$\frac{1}{a^3}$

③ $\frac{x^4}{x^6}$ $4-6=-2$

x^{-2}

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

$\frac{1}{5^2}$ $\qquad$ $\frac{1}{a^3}$ $\qquad$ x

evaluate: $\frac{1}{25}$ $\qquad$ $\frac{1}{x^2}$

④ $6m^2 \div 2m^7 \qquad 2-7=-5$

stays put → $3(m^{-5})$ ← only m moves to denominator because the neg. exp. only attached to the m.

$\frac{3}{m^5}$

⑤ $\frac{1}{x^{-3}} = x^3$

⑥ $\frac{1}{2y^{-5}} = \frac{1y^5}{2} = \frac{y^5}{2}$ (stays; ↖ neg exp!)

Fractions with negative exponents: $\left(\frac{a}{b}\right)^{-n} = \left(\frac{b}{a}\right)^{n}$

Ex. Evaluate:

$\left(\frac{3}{2}\right)^{-4} = \left(\frac{2}{3}\right)^{4} = \frac{2^4}{3^4} = \frac{16}{81}$

Fraction flips
Exp. sign change