Negative exponent

$$a^{-n} = \frac{1}{a^n}$$

Link to division of powers

$$\frac{3^5}{3^3} = 3^{5-3} = 3^2 \qquad \frac{3 \cdot 3 \cdot \cancel{3} \cdot \cancel{3} \cdot \cancel{3}}{\cancel{3} \cdot \cancel{3} \cdot \cancel{3}}$$

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

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

Zero exponent

$a^0 = 1$

Link to:

$$\frac{3^5}{3^5} = 3^{5-5} = \boxed{3^0}$$

$$\frac{3^5}{3^5} = \boxed{1}$$

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

$$3x+6 \downarrow 3(x+2)$$

$$\boxed{3(x+2)(x+2)}$$

$$\frac{2}{3(x+2)} \cdot \frac{(x+2)}{(x+2)} - \frac{5x}{(x+2)^2} \cdot \frac{3}{3}$$

$$\frac{2(x+2) - 15x}{3(x+2)^2}$$

$$\frac{2}{15} \cdot \frac{2}{2} - \frac{3}{10} \cdot \frac{3}{3}$$

$$15 \downarrow 3 \cdot 5 \qquad 10 \downarrow 2 \cdot 5$$

$$\boxed{3 \cdot 2 \cdot 5 = 30}$$

$$\frac{4}{30} - \frac{9}{30}$$

$$-\frac{5}{30}$$

$$-\frac{1}{6}$$

inverse of a matrix A (square)

A^{-1}

$$A^{-1} \cdot A = A \cdot A^{-1} = I$$

inverse of a number
(reciprical)

$$\frac{3}{4} \rightarrow \frac{4}{3} \qquad \frac{3}{4} \cdot \frac{4}{3} = 1$$

all real no. (except 0) have an inverse

related concepts
division of fractions

$$\frac{3}{2} \div \frac{3}{4} \qquad \left(\frac{3}{2} \times \frac{4}{3}\right) \div \left(\frac{3}{4} \times \frac{4}{3}\right)$$

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Solving a SLE

$$\frac{Ax}{A} = \frac{b}{A^{-1}} \qquad A^{-1} \cdot x = A^{-1} b$$

$$x = A^{-1} \cdot b$$

How to explain $0! = 1$?

$\boxed{{}_nP_n = n!}$

A, B, C

ABC ACB
BAC BCA
CAB CBA

$(3)(2)(1) = 3!$

${}_nP_r$ $n = 4$
$r = 2$

A, B, C, D

AB AC AD
BA BC BD
CA CB CD
DA DB DC

$(4)(3) = 12$

$\boxed{{}_nP_r = \dfrac{n!}{(n-r)!}} = \dfrac{4!}{(4-2)!} = \dfrac{4!}{2!}$

$$\frac{(4)(3)\cancel{(2)}\cancel{(1)}}{\cancel{(2)}\cancel{(1)}}$$

$${}_nP_n = \frac{n!}{(n-n)!} = \frac{n!}{0!}$$