INDEX LAWS FOR MULTIPLICATION AND DIVISION

$a^n \times a^m = a^{n+m}$

examples: $3^2 \times 3^4 = 3 \times 3 \times 3 \times 3 \times 3 \times 3 = 3^6$

$2^3 \times 2^5 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 2^8$

$a^n \div a^m = a^{n-m}$

example:

$3^4 \div 3^2 = 3 \times 3 \times 3 \times 3 \div 3 \div 3 = 3^{4-2} = 3^2$

EXAMPLES

$5^3 \times 5^7 \times 5^2 = 5^{12}$

$3 + 7 + 2 = 12$, so the base 5 appears 12 times, giving 5^{12}.

$5^3 \times 5^4 = 5^7$

$3 + 4 = 7$, so $5^3 \times 5^4 = 5^7$.

$6^5 \times 6 \times 6^3 = 6^5 \times 6^1 \times 6^3 = 6^9$

Write 6 as 6^1, then add the powers.
$5 + 1 + 3 = 9$, so the final result is 6^9.

$\frac{5^7}{5^3} = 5^4$

Considering $\frac{5^7}{5^3} = \frac{5 \times 5 \times 5 \times 5 \times \cancel{5} \times \cancel{5} \times \cancel{5}}{\cancel{5} \times \cancel{5} \times \cancel{5}}$

$= 5^4$

or just $7 - 3 = 4$.

$\frac{6^{20}}{6^5} = 6^{15}$

Use the second index law, so $20 - 5 = 15$.

$\frac{10 \times 5^6}{4 \times 5^2} = \frac{10}{4} \times \frac{5^6}{5^2}$

First separate the numbers into a separate fraction.

$= \frac{5}{2} \times \frac{5^4}{1}$

Cancel the common factor of 2 and use the second index law.

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

Combine the result as a single fraction.

SIMPLIFYING EXPRESSIONS WITH INDICES

$$\frac{a\,b^2\,c^3\,d^4\,e^5}{b\,c^2\,d^3\,e^4} = a\,b\,c\,d\,e$$

$$\frac{5^3x^4y^7 \times 5^{10}x\,y^3}{5^2\,x\,y \times 5\,x^3\,y^7 \times 5^7} = \frac{5^{13}x^5y^{10}}{5^{10}\,x^4\,y^8} = 5^3\,x\,y^2$$