Laws of Indices

Laws of Indices:

To manipulate math expressions, we can consider using the Law of Indices. These laws only apply to expressions with the same base, for example, 3^4 and 3^2 can be manipulated using the Law of Indices, but we cannot use the Law of Indices to manipulate the expressions 4^5 and 9^7 as their base differs (their bases are 4 and 9, respectively).

Rule 1: $a^0 = 1$

Rule 2: $a^{-m} = \frac{1}{a^m}$

Rule 3: $a^m \times a^n = a^{m+n}$

Rule 4: $a^m \div a^n = a^{m-n}$

Rule 5: $(a^m)^n = a^{mn}$

Rule 6: $a^{m/n} = \sqrt[n]{a^m} = \left(\sqrt[n]{a}\right)^m$

Example for 6 rules of the Law of Indices

Example for Rule 1: $a^0 = 1$

Simplify 2^0

$$2^0 = 1$$

Example for Rule 2: $a^{-m} = \frac{1}{a^m}$

Simplify 2^{-2}

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

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

Example for Rule 3: $a^m \times a^n = a^{m+n}$

Simplify 5×5^3

$$5^1 \times 5^3 = 5^{1+3}$$

$$= 5^4$$

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

$$= 625$$

Example for Rule 4: $a^m \div a^n = a^{m-n}$

Simplify $5(y^9 \div y^5)$

$$5(y^9 \div y^5) = 5(y^{9-5})$$

$$= 5y^4$$

Example for Rule 5: $(a^m)^n = a^{mn}$

Simplify $(y^2)^6$

$$(y^2)^6 = y^{2\times 6}$$

$$= y^{12}$$

Example for Rule 6: $a^{m/n} = \sqrt[n]{a^m} = \left(\sqrt[n]{a}\right)^m$

Simplify $125^{2/3}$

$$125^{2/3} = \left(\sqrt[3]{125}\right)^2$$

$$= 5^2$$

$$= 25$$

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