GRADE 8

MATHEMATICS

TOPIC: EXPONENTS

Introduction

Repeated multiplication of the same factor can be expressed more efficiently in exponential form.

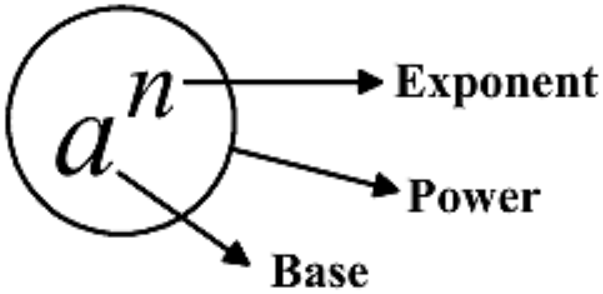
E.G:

- $7 = 7^1$
- $2 \times 2 \times 2 = 2^3$
- $t \times t \times t \times t \times t \times t \times t = t^7$

Definition:

$a^n = a \times a \times a \times \ldots n$ factors

Basic terminology:



Activity 1

Express the following in exponential form:

a) $7 \times 7 \times 7 \times 7$

b) $k \times k \times k \times k \times k$

Activity 2

Express the following in expanded form

a) 3^4

b) m^7

Multiplication of powers with the same base

1.1 Given: $5^3 \times 5^6$

a) Express the given expression in expanded form

b) Express expanded form in exponential form

1.2 Given: $y^2 \times y^4 \times y^5$

a) Express the given expression in expanded form

b) Express expanded form in exponential form

1.3 What do you notice about the relationship between the final exponent and exponents of the original question?

LAW 1: $a^m \times a^n = a^{m+n}$

Activity 3

Simplify the following, leave your answer in exponential form

a) $3^{11} \times 3^{24}$

b) $m^{17} \times m^{10} \times m^2$

c) $2x^2 \times 3x^4 \times 4x^5$

d) $-2a^2b^7 \times 7a^4b^2 \times a^7b$

Division of powers with the same base

1.1 Given: $\frac{5^6}{5^4}$

a) Express the given expression in expanded form

b) Express expanded form in exponential form

1.2 Given: $\frac{k^7}{k^3}$

a) Express the given expression in expanded form

b) Express expanded form in exponential form

1.3 Given: $\frac{m^5}{m^5}$

a) Express the given expression in expanded form

b) Express expanded form in exponential form

1.4 What do you notice about the relationship between the final exponent and exponents of the original question?

LAW 2: $a^m \div a^n = a^{m-n}$

Definition: $a^0 = 1$

Activity 4

Simplify the following, leave your answer in exponential form

a) $3^{24} \div 3^{11}$

b) $\frac{m^9}{m^5}$

c) $\frac{24x^{15}y^{20}}{6x^{10}y^{19}}$

Raising a power/product/quotient to a power

1.1 Given: $(7^3)^4$

a) Express the given expression in expanded form

b) Express expanded form in exponential form

1.2 Given: $(x^3y^2)^5$

a) Express the given expression in expanded form

b) Express expanded form in exponential form

1.3 Given: $\left(\frac{a^3}{b^2}\right)^4$

a) Express the given expression in expanded form

b) Express expanded form in exponential form

1.3 What do you notice about the relationship between the final exponent and exponents of the original question?

LAW 3: $(a^m)^n = a^{m\times n}$

LAW 4: $(ab)^m = a^m b^m$

LAW 5: $\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$

Activity 5

a) $(5^3)^4$

b) $(p^{15}q^{11})^3$

c) $(-3k^7)^2$

d) $(2x^3y^5)^5$

e) $\left(\frac{m^4}{n^7}\right)^9$

f) $\left(\frac{15x^4y^5}{20a^3b^2}\right)^2$

Answers

Activity 1

Express the following in exponential form:

a) $7 \times 7 \times 7 \times 7$

$= 7^4$

b) $k \times k \times k \times k \times k$

$= k^5$

Activity 2

Express the following in expanded form

a) 3^4

$= 3 \times 3 \times 3 \times 3$

b) m^7

$= m \times m \times m \times m \times m \times m \times m$

Activity 3

Simplify the following, leave your answer in exponential form

a) $3^{11} \times 3^{24}$

$= 3^{11+24}$

$= 3^{35}$

b) $m^{17} \times m^{10} \times m^2$

$= m^{17+10+2}$

$= m^{29}$

c) $2x^2 \times 3x^4 \times 4x^5$

$= 24x^{2+4+5}$

$= 24x^{11}$

d) $-2a^2b^7 \times 7a^4b^2 \times a^7b$

$= -14a^{2+4+5}b^{7+2+1}$

$= -14a^{11}b^{10}$

Activity 4

Simplify the following, leave your answer in exponential form

a) $3^{24} \div 3^{11}$

$= 3^{24-11}$

$= 3^{13}$

b) $\frac{m^9}{m^5}$

$= m^{9-5}$

$= m^4$

c) $\frac{24x^{15}y^{20}}{6x^{10}y^{19}}$

$= 4x^{15-10}y^{20-19}$

$= 4x^5y$

Activity 5

a) $(5^3)^4$

$= 5^{3\times4}$

$= 5^{12}$

b) $(p^{15}q^{11})^3$

$= p^{15\times3}q^{11\times3}$

$= p^{45}q^{33}$

c) $(-3k^7)^2$

$= (-3)^{1\times2}k^{7\times2}$

$= (-3)^2k^{14}$

$= 9k^{14}$

d) $(2x^3y^5)^5$

$= 2^5x^{3\times5}y^{5\times5}$

$= 32x^{15}y^{25}$

e) $\left(\frac{m^4}{n^7}\right)^9$

$= \frac{m^{4\times 9}}{n^{7\times 9}}$

$= \frac{m^{36}}{n^{63}}$

f) $\left(\frac{15x^4y^5}{20a^3b^2}\right)^2$

$= \left(\frac{3x^4y^5}{4a^3b^2}\right)^2$

$= \frac{3^2x^{4\times 2}y^{5\times 2}}{4^2a^{3\times 2}b^{2\times 2}}$

$= \frac{9x^8y^{10}}{16a^6b^4}$