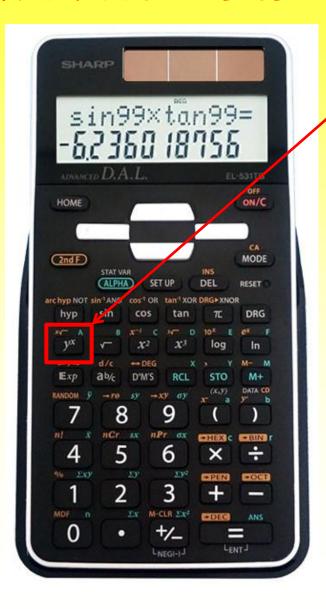
## ST. JEAN DE BREBEUF MATHEMATICS



# CHAPTER STATES

#### KNOW YOUR CALCULATOR



#### **EXPONENT KEY**

→ Raises a number to an exponent

**EXAMPLE**:

Evaluate  $2^3$ Press  $2 \rightarrow y^x \rightarrow 3 \rightarrow =$ 



**FUNDAMENTALS** 

## EXPONENT LAWS

1. EXPONENT LAW FOR MULTIPLICATION (PRODUCT LAW)

Write  $2^3 \times 2^4$  as a single power and evaluate

$$2^{3} \times 2^{4}$$
 $= 2^{3+4}$ 
 $= 2^{7}$ 

GENERAL FORMULA FOR MULTIPLYING POWERS

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

Rule: When multiplying powers of the same base, you keep the base and ADD the exponents.

## CHAPTER OF EXPONENT LAN

## 

1. EXPONENT LAW FOR MULTIPLICATION (PRODUCT LAW)

#### PRACTICE

1. 
$$2^{-4} \times 2^{6}$$
 2.  $5^{-2} \times 5^{7}$ 

$$=2^{-4+6}$$

$$=5^{-2+7}$$

$$=2^{2}$$

$$=5^{5}$$

$$=4$$

$$=3125$$

3. 
$$2^{7} \times 2^{-3}$$

$$= 2^{7} \times 2^{-3}$$

$$= 2^{7-3}$$

$$=2^{4}$$

#### GENERAL FORMULA FOR MULTIPLYING POWERS

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

Rule: When multiplying powers of the same base, you keep the base and ADD the exponents.



2. EXPONENT LAW FOR DIVISION (QUOTIENT LAW)

#### **EXAMPLE:**

Write  $7^4 \div 7^2$  as a single power and evaluate

$$7^{4} \div 7^{2}$$

$$= 7^{4-2}$$

$$= 7^{2}$$

$$= 49$$

GENERAL FORMULA FOR DIVIDING POWERS

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

Rule: When dividing powers of the same base, you keep the base and SUBTRACT the exponents.



## EXPONENT LAWS

2. EXPONENT LAW FOR DIVISION (QUOTIENT LAW)

#### PRACTICE:

1. 
$$5^{5} \div 5^{2}$$
 2.  $\frac{3^{2}}{3^{-7}}$ 

$$= 5^{5-2} = 3^{2(-7)} = 19683$$

$$= 5^{3} = 3^{2+7}$$

 $=3^{9}$ 

$$=125$$

3. 
$$\frac{7^{-3}}{7^{-5}} = 7^{-3+5}$$
  
=  $7^{2}$   
=  $7^{-3-5}$ 

GENERAL FORMULA FOR DIVIDING POWERS

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

Rule: When dividing powers of the same base, you keep the base and SUBTRACT the exponents.



#### 3. POWER OF A POWER LAW

#### **EXAMPLE:**

Express  $(9^2)^3$  as a single power and evaluate

$$(9^{2})^{3}$$

$$= 9^{2 \times 3}$$

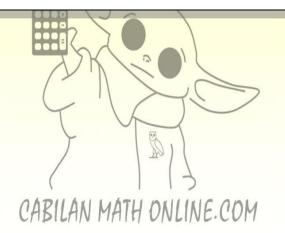
$$= 9^{6}$$

$$= 531441$$

## GENERAL FORMULA FOR POWER LAW

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

Rule: When evaluating powers within brackets, you MULTIPLY the exponents.



## CHAPTER 6.1 EXPONENT LAV 4 (PO) 1 4 / T L. 1 / S

#### 3. POWER OF A POWER LAW

#### PRACTICE:

1. 
$$(2^3)^4$$

$$= 2^{3\times4}$$

$$= 2^{12}$$

2. 
$$(4^{5})^{2}$$
  
=  $4^{5\times2}$   
=  $4^{10}$   
=  $1048576$ 

#### GENERAL FORMULA FOR **POWER LAW**

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

Rule: When evaluating powers within brackets, you MULTIPLY the exponents.



#### 4. POWER OF A PRODUCT LAW

Simplify (4a<sup>3</sup>)<sup>2</sup>

$$(4a^3)^2 = (4)^2 (a^3)^2$$

 $=16a^{3\times 2}$ 

 $=16a^{6}$ 

\*Apply the exponent to both the coefficient and the variable

GENERAL FORMULA FOR POWER OF A PRODUCT LAW

 $(ab)^n = a^nb^n$ 

Rule: When a co-efficient and a variable are inside the brackets, you must distribute the exponent

## BHAPIER BEXPONENT LAV

#### 4. POWER OF A PRODUCT LAW

Simplify the following:

(a) 
$$(3x^2)^5$$

$$=(3)^5(x^2)^5$$

$$=243x^{2\times 5}$$

$$=243x^{10}$$

(b) 
$$(-5y^3)^4$$

$$= (-5)^4 (y^3)^4$$
$$= 625 y^{3\times4}$$

$$=625 y^{3\times4}$$

$$=625 y^{12}$$

GENERAL FORMULA FOR POWER OF A PRODUCT LAW

$$(ab)^n = a^nb^n$$

Rule: When a co-efficient and a variable are inside the brackets, you must distribute the exponent

#### 5 The Zero Exponent Law

Use a calculator to evaluate the following:

a) 
$$7^{\circ} = \frac{1}{1}$$

b) 
$$(-3)^0 = \frac{1}{}$$

c) 
$$k^0 = \frac{1}{1}$$

#### THE EXPONENT ZERO

Any base raised to the exponent zero always equals
ONE (1)



#### 6. Negative Exponents

**EXAMPLE:** 

Express 4-3 as a single power and evaluate

$$4^{-3}$$

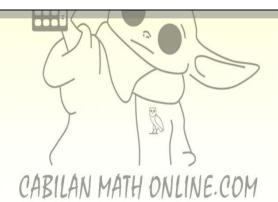
$$= \left(\frac{1}{4}\right)^3$$

$$=\frac{(1)^3}{(4)^3}$$

$$=\frac{1}{64}$$

#### STEPS:

- 1. Write the base as a reciprocal (ie. "flip" the base)
- 2. Make the exponent **positive**
- 3. Raise the numerator and denominator by the exponent



#### 6. Negative Exponents

#### PRACTICE:

Express each as a single power and evaluate

1. 
$$3^{-5}$$

$$= \left(\frac{1}{3}\right)^{5}$$

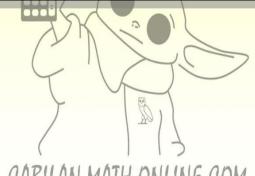
$$= \frac{(1)^{5}}{(3)^{5}}$$

$$=\frac{1}{243}$$

2. 
$$\frac{4^{3}}{4^{5}}$$
 \*Subtract exponents first!
$$=4^{3-5}$$
$$=4^{-2}$$
$$=\left(\frac{1}{4}\right)^{2}$$
$$=\frac{(1)^{2}}{(4)^{2}}$$
$$=\frac{1}{16}$$

#### STEPS:

- 1. Write the base as a reciprocal (ie. "flip" the base)
- 2. Make the exponent **positive**
- 3. Raise the numerator and denominator by the exponent



#### 6. Negative Exponents

#### PRACTICE:

Express each as a single power and evaluate

3. 
$$(2^{-2})^3$$
 \*Multiply exponents first!

$$= 2^{-2 \times 3}$$
$$= 2^{-6}$$

$$=\left(\frac{1}{2}\right)^6$$

$$=\frac{(1)^6}{(2)^6}$$

$$=\frac{1}{64}$$

#### STEPS:

- 1. Write the base as a reciprocal (ie. "flip" the base)
- 2. Make the exponent **positive**
- 3. Raise the numerator and denominator by the exponent



**END OF DAY 1** 

#### OPERATION 2 Simplifying Expressions

- a) (29<sup>5</sup>)0 \*Multiply the exponents first!
  - $=29^{5\times0}$
  - =1

b)  $\frac{6^8 \times 6^{-2}}{(6^2)^2} \leftarrow \text{*Multiply}$ exponents

$$=\frac{6^{8+(-2)}}{6^{2\times 2}}$$

$$=\frac{6^{8-2}}{6^4}$$

\*Add exponents

$$=\frac{6^{6}}{6^{4}}$$

$$=6^{6-4}$$

$$=6^{2}$$



c) 
$$k^{-5} \times k^3$$
 \*Add exponents! d)

$$=k^{-5+3}$$
$$=k^{-2}$$

$$= \left(\frac{1}{k}\right)^{2} \text{ *Flip the base}$$
\*Make exponent positive

$$=\frac{(1)^2}{(k)^2}$$

Raise numerator  $\overline{(k)^2}$  and denominator by the exponent

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

$$\frac{n^{3} \times n^{3}}{(n^{4})^{2}} = \frac{n^{3+3}}{n^{4\times 2}}$$

$$= \frac{n^{6}}{n^{8}}$$

$$= n^{6-8}$$

$$= n^{-2}$$

$$= \left(\frac{1}{n}\right)^{2}$$

$$= \frac{(1)^{2}}{(n)^{2}}$$

\*Add exponents!

$$= \frac{n^{3+3}}{n^{4+2}}$$
\*Multiply exponents!

$$= \frac{n^{6}}{n^{8}}$$
\*Subtract exponents!

$$= n^{6-8}$$

$$= n^{-2}$$
\*Flip the base
$$= (\frac{1}{n})^{2}$$
\*Make exponent positive

$$= (1)^{2}$$
Raise numerator and denominator by the exponent
$$= \frac{1}{n^{2}}$$
\*CABILAN MATH ONLINE.COM

\*Add the exponents

$$=\frac{42m^{-2+5}}{2m}$$

$$=\frac{42m^3}{2m}$$

\*Divide the coefficients

\*Subtract the exponents

$$=21m^{3-1}$$

$$=21m^2$$



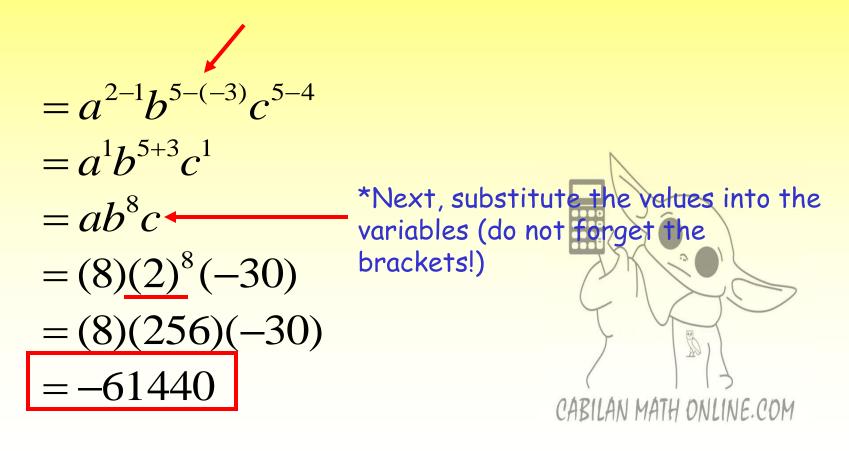
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#### OPERATION 3

Using exponent laws, simplify the expression  $\frac{a^2b^5c^5}{ab^{-3}c^4}$  and evaluate for a = 8, b = 2 and c = -30

#### SOLUTION

First, subtract the exponents for each variable separately!



#### **EXAMPLE 4**

The sound produced in the first row of a rock concert is 110 dB and the sound produced from a CD player is 60 dB.

a) If 80 dB can be expressed as  $10^8$ , re-write the decibel readings as powers with base 10.

$$110dB$$
  $60dB$   
=  $10^{11}$  =  $10^{6}$ 

b) Calculate how many times louder the rock concert is compared to the CD player.

$$\frac{10^{11}}{10^{6}}$$

$$= 10^{11-6}$$

$$= 10^{5}$$

$$= 100000$$

Therefore, the rock concert is 100 000 times louder than the CD player.

### HOMEWORK

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(Day 1) #1ac, 3, 4bd, 5ad

(Day 2) 7abc, 9acd, 10ab, 12adef