Basic Mathematics_Code:22103_CO1_UO1

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MSBTE LEAD

Algebra

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Logarithm

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UO1_ Solve the given simple problem based on laws of logarithm

What we will learn today

1. **Logarithmic form**
2. **Conversion of index form to log form**
3. **Laws of logarithm**
4. **Solve problems using laws of logarithm**

Key takeaways

Logarithmic form, laws of logarithm

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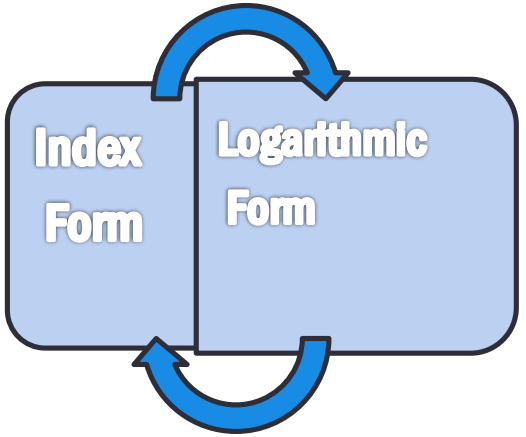
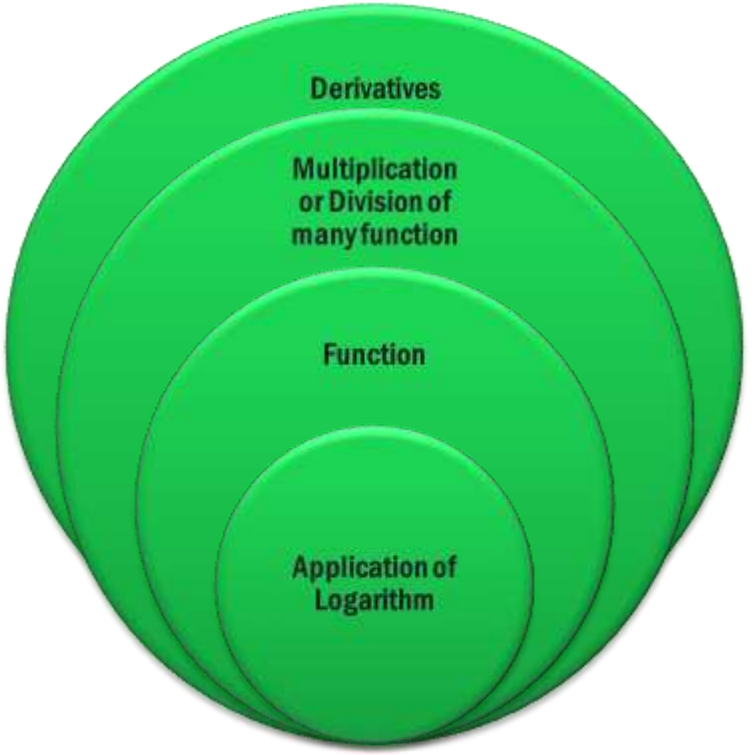
Concept Map


Index
Form
Logarithmic
Form


Derivatives
Multiplication
or Division of
many function
Function
Application of
Logarithm

Definition

Logarithm:

If $y = a^x$, $a > 0$, $a \neq 1$, $a \in R$, then x is called logarithm of y to the base a and it is written as $x = \log_a y$.

For example,

1) If $9 = 3^2$ then $2 = \log_3 9$

2) If $2^4 = 16$ then $\log_2 16 = 4$

Note:

- $a^0 = 1 \quad \therefore \log_a 1 = 0$
- $a^1 = a \quad \therefore \log_a a = 1$
- $a^{\log_a x} = x$
- $\log_{10} x$ is called common logarithm
- $\log_e x$ is called natural logarithm

LAWS OF LOGARITHM:

- $\log_a(m \times n) = \log_a m + \log_a n$
- $\log_a\left(\frac{m}{n}\right) = \log_a m - \log_a n$
- $\log_a(m)^n = n \log_a m$
- $\log_n m = \frac{\log_a m}{\log_a n}$

Evaluate:

1. $\log_2 8 + \log_2 3 - \log_2 6$

Solution: Using laws of logarithm

$$\log_2 8 + \log_2 3 - \log_2 6$$

$$= \log_2 \left(\frac{8 \times 3}{6}\right)$$

$$= \log_2 4$$

$$= \log_2 (2^2)$$

$$= 2 \times \log_2 2$$

$$= 2 \times 1 = 2$$

2. Simplify : $\log_3 25 \times \log_5 27$

Solution: Using change of base we get

$$\log_3 25 \times \log_5 27$$

$$= \frac{\log 25}{\log 3} \times \frac{\log 27}{\log 5}$$

$$= \frac{\log 5^2}{\log 3} \times \frac{\log 3^3}{\log 5}$$

$$= \frac{2 \log 5}{\log 3} \times \frac{3 \log 3}{\log 5}$$

$$= 6$$

3. Find x if $\log_3 (x^2+2) = 3$

Solution: $\log_3 (x^2+2) = 3$

$3^3 = x^2+2$

$27 = x^2+2$

$25 = x^2$

$\therefore x = 5 \text{ or } -5$

Quiz

Evaluate the following

1. $\log_2 \sqrt{2}$
2. $\log_2 128$
3. $\log_{10} \sqrt[3]{1000}$
4. $\log_{16} 2$
5. $\log_{\sqrt{3}} 9$

Key: 1. ½

2. 7
3. 1
4. ¼
5. 4

Quiz

Find x if :

1. $\log_4 x = \frac{1}{2}$
2. $\log_x 125 = 3$
3. $\log_2(x + 5) = 4$
4. $\log_4(2x + 3) = 0$
5. $\log_2(\sqrt[4]{2}) = x$

Key:

1. 2
2. 5
3. 9
4. -1
5. ¼