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Learning outcomes

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After completing this section, you will inshaAllah be able to

1. find derivatives of expressions involving $\ln u$

2. find derivatives of expressions involving $\log_b u$

3. explain what is logarithmic differentiation

4. find derivatives using method of logarithmic differentiation

5. differentiate functions of the form u^v

Recall the following properties
which are needed for this section

- $\ln(xy) = \ln x + \ln y$
- $\ln\left(\dfrac{x}{y}\right) = \ln x - \ln y$
- $\ln(x^r) = r \ln x$

Derivatives of functions involving $\ln u$

Differentiation formula for $\ln u$

$$\frac{d(\ln u)}{du} = \frac{1}{u} \cdot \frac{du}{dx}$$

Derivatives of functions involving $\log_b u$

Differentiation formula for $\log_b u$

$$\frac{d(\log_b u)}{du} = \frac{1}{\ln b}\left(\frac{1}{u} \cdot \frac{du}{dx}\right)$$

How?

Using $\log_b u = \dfrac{\ln u}{\ln b}$

See examples 1, 2, 3, 4, 5 done in class

How to perform logarithmic differentiation of _f(x)_?

Suitable when f(x) involves

products, quotients or powers

Main idea

- Simplify before differentiating

How?

- Aim: To differentiate y=f(x)   (1)

- If f(x) involves products, quotients or powers then

  o take 'ln' on both sides of (1)

  o simplify using properties of 'ln'

  o differentiate after simplification

- We learn more with the help of example.

See example 6 done in class

Important application of logarithmic differentiation

Differentiating functions of the form

u^v where both _u_ and _v_ are functions of _x_

See examples 7, 8 done in class

End of 3.6