

Section 5.6 *The logarithmic defined as an integral*

5.6₁

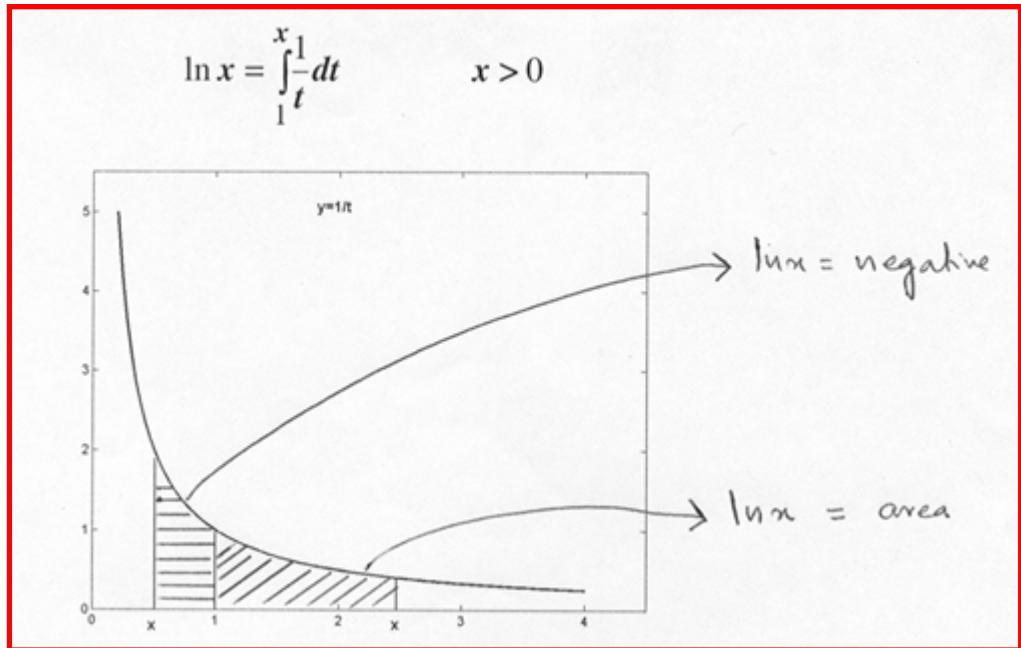
Learning outcomes

After completing this section, you will inshaAllah be able to

1. know how $y = \ln x$ is defined as an integral
2. recall *properties* of $y = \ln x$
3. recall relation between $y = \ln x$ and exponential function

Definition and basic properties

Definition



Direct properties

- Defined for $x > 0$. Domain $(0, \infty)$
- Range $(-\infty, \infty)$
- Negative for $0 < x < 1$
- Positive for $1 < x < \infty$
- $\ln 1 = 0$

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

Inverse of \ln $f(x) = e^x$

- $e^{\ln x} = x$
- $\ln(e^x) = x$
- $a^r = e^{r \ln a} \quad (a > 0)$

Example: If $f(x) = e^{-2x}$ then $f(\ln 3) = e^{-2 \ln 3} = e^{\ln 3^{-2}} = 3^{-2} = \frac{1}{9}$.

Example: $\ln(xe^x) = \ln x + x$.

End of Section 5.6