3.1. The Constant e and Continuous Compound Interest

Definition 3.1.1. *Recall from 1.5: An ________________________________ is a function of the form $f(x) = a^x$ where a is a real number with $a > 0$ and $a \neq 0$.*

Remark 3.1.1. *We will primarily deal with the exponential function $f(x) = e^x$.*

Recall from section 1.6: The functions $\ln x$ and e^x are inverses of each other.

Example 3.1.1. *Simplify* $e^{\ln 3 + \ln 4}$

Example 3.1.2. *Simplify* $\ln(e^2 e^- 5)$

Interest Continuously Compounded

The ________________________________, A, is amount in account at the end of given time period of an account.

The ________________________________ or ________________________, P, is the amount initially deposited.

The ____ or ________________________________, r, is the rate for the full year in decimal form.

t is the number of years the account is held.

FORMULA for A:

Example 3.1.3. *If* $\$4,765$ *is invested at* 9.8% *compounded continuously, what is the amount in 5 years?*

(1) $\frac{4765}{e^{0.49}}$

(2) $4765e^{4.9}$

(3) $4765e^{0.49}$

(4) $\frac{4765}{e^{4.9}}$

(5) none of these

Example 3.1.4. *What continuously compounded interest rate will double an investment in 8 years?*

(1) $\ln\frac{1}{4}$

(2) $\ln 4$

(3) $\frac{\ln 2}{8}$

(4) $\frac{\ln 8}{2}$

(5) none of these

Example 3.1.5. *What interest rate, compounded continuously, will take an investment of* $\$10,000$ *to* $\$40,000$ *in 5 years?*

Example 3.1.6. *How long will it take* $\$85,000$ *to grow to* $\$100,000$ *at* 7% *annual interest compounded continuously?*