Math 142 Lecture Notes
Section 5.1 – The Constant e and Continuous Compound Interest

Definition: The Number e
\[ e = \lim_{n \to \infty} \left(1 + \frac{1}{n}\right)^n \quad \text{and is approximately 2.718281828459…} \]

Note: The number e is an irrational number. An alternate form of the definition is:
\[ e = \lim_{s \to 0} (1 + s)^{1/s} \]

Continuous Compound Interest:
\[ A = P \cdot e^{rt} \]
where \( A \) = the amount accumulated at time \( t \),
\( P \) = the principal amount of money,
\( r \) = the annual interest rate (expressed as a decimal),
\( t \) = the time expressed in years.

Sample problems:

1. If $3500 is invested at 8.25% compounded continuously for 3 years, how much to the nearest cent will be in the account?

2. If $400 is invested at \( 5 \frac{3}{4} \)\% compounded continuously for 6 months, how much to the nearest cent will be in the account?

3. How long will it take an investment of $1200 to grow to $5000, if invested at 7\% compounded continuously?

4. Which is the better option to borrow $24,000 to buy a new truck?
   A. Bank A which offers \( 7 \frac{1}{4} \)\% interest compounded continuously for six years, or
   B. Bank B which offers \( 6 \frac{1}{2} \)\% interest compounded semiannually for seven years.