

## Natural Logarithms 55

A very important function is the exponential function,  $f(x) = e^x$ .

The number  $e = 2.718\dots$

This function can be used to calculate the amount of money  $A$ , accumulated in an account after a time  $t$ , if the interest rate is  $r$ , and the compounding is continuous.

$$A = P \cdot e^{rt}$$

Natural logarithms are logarithms to the base  $e$ . We write  $\log_e x$  as  $\ln x$ . These functions appear frequently in mathematical formulas.

Example:

Use your calculator to find the following.

- a)  $e^6$                       b)  $e^{-2}$

Answers: a) 403.4, b) 0.135.

Example:

Find the amount of money in an account after five years, if the principal is \$5700 and the interest (3.5%) is compounded continuously.

$$A = 5700 e^{0.035 \times 5} = \$6,790.10.$$

Example:

Find the natural logarithms. Use your calculator.

- a) 820                      b) 0.0029

Answers: a) 6.71, b) -5.84

Questions:

1) Evaluate the following. Express as a decimal number to 2 decimal places.

a)  $e^5$

b)  $e^{-2}$

c)  $e^{3.8}$

d)  $e^{-1.5}$

2) Use the continuous compounding formula to answer the following questions.

a) Find the amount of money (to the nearest penny) in an account if the principal is \$2800, the time is 7 years, and the annual interest rate is 5.5%.

b) Find the amount of money (to the nearest penny) in an account if the principal is \$1200, the time is 10 years, and the annual interest rate is 8.2%.

3) Use your calculator to evaluate the following.

a)  $\ln e$

b)  $\ln e^{-7}$

c)  $\ln 100$

d)  $\ln 0.60$

Answers: 1)a) 148.41, b) 0.14, c) 44.70, d) 0.22, 2)a) 4114.92, b) 2724.60, 3)a) 1.00, b) -7.00, c) 4.61, d) -0.51.