

4.1 - Exponential Functions

Skills

- Sketch the graph of an exponential function
 - Solve word problems involving exponential functions (especially exponential growth and compound interest)
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Exponential Functions

$$y = n^x$$

We require n to be a positive real number (not equal to 1).

Features of Exponential Functions

Domain

Range

Intercepts

Horizontal Asymptote

Transforming Graphs

$$y = a \cdot n^{b(x-c)} + d$$

(everything does exactly what it did in unit 1)

Example

$$y = 2^{x+3} - 4$$

Example

$$y = 2 \cdot 3^x - 1$$

Example

$$y = \left(\frac{1}{2}\right)^{x-3}$$

Exponential Growth/Decay

$$A(t) = A_0 (1 \pm R)^{\frac{t}{\lambda}}$$

Growth/Decay Rate

Time required for
this growth/decay
to occur

Example

A culture of 680 bacteria doubles in size every two hours.

- Write a function that models the size of the culture as a function of time.
- Find the size of the culture after 5 hours and 45 minutes.

Compound Interest

Principal

Annual Percentage Rate

$$V(t) = P_0 \left(1 + \frac{r}{k} \right)^{kt}$$

Example

Loren wants to invest \$6500 into an account that earns 7.5% annual interest compounded monthly. How long will it take for the investment to have a value of \$7850?

Continuous Interest

If we let the number of compound periods increase to infinity ($k = \infty$), we get a slightly different version of the exponential growth formula:

$$A(t) = A_0 e^{rt}$$

Example

If \$2000 is invested at 2% APR compounded continuously for 20 years, what is the value of the investment at maturity?
