Exponential Population Model

If a population P is changing at a constant percentage rate r each year, then

$$P(t) = P_0(1 + r)^t,$$

where P_0 is the initial population, r is expressed as a decimal, and t is time in years.

If r > 0, then _____

If r < 0, then _____

Example 1) Tell whether the function is an exponential growth or exponential decay function, and find the constant percentage rate of growth or decay.

a) $P(t) = 78{,}963 \bullet 0.968^t$

b) $f(x) = 247 \bullet 2^x$

Example 2) Determine the exponential function that satisfies the given conditions

a) Initial value=5, increasing at a rate of 17% per year

b) Initial population=28,900, decreasing at a rate of 2.6% per year

Example 3)

a) Find the ratio of output values that correspond to increases of 1 in the input value in order to determine the growth or decay factor
b) Determine the percent change
c) Identify or determine the value of the function when x=0
d) Use the information in parts (a) through (c) to define a function formula for the relationship.

x	0	1	2	3
f(x)	16	4	1	0.25

x	1	2	3	8
g(x)	260	299	343.85	691.605

Example 4) Let $f(x) = 34(1.19)^x$

A) What does the 34 represent?

B) What does the 1.19 represent?

C) Fill in the blank: Whenever x increases by 1, the new output value is _____% of the old output value

D) What is the percent change?

Example 5) Let $f(x) = 1.578(0.68)^x$

A) What does the 1.578 represent?

B) What does the 0.68 represent?

C) Fill in the blank: Whenever x increases by 1, the new output value is _____% of the old output value

D) What is the percent change?