

Exponential and Logarithmic Functions

Exponential Functions

• An exponential growth or decay function is a function that grows or shrinks at a constant percent growth (pos or neg) rate.

$$\text{Equation: } f(x) = a(1+r)^x \text{ or } f(x) = ab^x; b = (1+r)$$

a = starting value
 r = rate, % as a decimal
 x = time

$b = (1+r)$ ← rate as decimal
 $b > 1$ growth
 $b < 1$ decay

Example 1

In year 1, a family of 8 mice move into Bob's basement. Bob ignores it and they are multiplying at a rate of 75% per year. How many mice are there in year 5?

$a = 8$
 $r = 75\% \rightarrow .75$
 $x = 5$
 $b = 1.75$

$$f(x) = ab^x$$

$$f(5) = 8(1.75)^5$$

$$f(5) = 131.3 \rightarrow 131 \text{ mice}$$

Example 2

A colony of 5000 ants is infected with a virus where 18% of them are dying each day. Approx how many ants will be left after the 13th day?

$a = 5000$
 $r = 18\% \rightarrow .18$
 $x = 13$
 $b = .82$

$$f(13) = 5000(.82)^{13}$$

$$= 378.9 \approx 379 \text{ ants}$$

Example 3

Currently in 2019 approx 32% of cell phone calls are scams. If the U.S. Cellular companies expect a growth of 26% per year, how many calls will be scanned scams in 2022?

$$a = 32$$

$$r = 26\% \rightarrow .26$$

$$x = 3$$

$$b = 1.26$$

$$f(x) = ab^x$$

$$f(3) = 32(1.26)^3$$

= 64% of calls will be
scams.

Example 4

Big\$\$ Balboni is a loan shark that will lend you money at 5% interest per day. If you borrow \$500 and take 20 days to pay her back, how much do you owe?

$$a = 500$$

$$r = 5\% \rightarrow .05$$

$$x = 20$$

$$b = 1.05$$

$$f(x) = ab^x$$

$$f(20) = 500(1.05)^{20}$$

$$=$$

$$= 1326.64$$

Example 5

Polar bears are my favorite! There are 600 polar bears in a particular region but due to global warming their population is decreasing by 8%. How many polar bears in 9 years?

$$a = 600$$

$$r = 8\% \rightarrow -.08$$

$$x = 9$$

$$b = .92$$

$$f(9) = 600(.92)^9$$

≈ 283 polar bears