GUIDED NOTES: Exponential Functions

An exponential function is a function in the general form $a = pb^t$

where x is a real number | a = final amount

p = initial amount b = growth/decay factor t = time period

Growth: b > 1 (adding 1)

Decay: 0 < b < 1 (subtracting from 1)

EX1. Suppose two mice live in a barn. If the number of mice quadruples every 3 months, how many mice will be in the barn after 2 years?

4

2 years

every 3 months.

How many months in 2yrs?

$2(12) = 24$

a: ?

p: 2

b: 4

t: $24/3 = 8$

$a = 2 \cdot 4^8$

$a = \boxed{131{,}072 \text{ mice!}}$

EX2. The value of an iPad decreases at 35% per year. If the starting price of the iPad is $500, how much will the iPad be worth after 5 years?

$1 - .35 = .65$

how much its worth after each year (what I have left)

How much I'm losing.

a: ?

p: 500

b: .65

t: 5

$a = 500(.65^5)$

$a = 58.01$

$\boxed{\$58.01}$

When can you buy the iPad for $5?

$\frac{5}{500} = \frac{500(.65)^t}{500}$

$.01 = .65^t$

$\ln .01 = \ln .65^t$

$\frac{\ln .01}{\ln .65} = \frac{t \ln .65}{\ln .65}$

$10.69 = t$

$\boxed{10.69 \text{ years}}$

a: 5

p: 500

b: .65

t: ?

EX3. Suppose the acreage of forest is decreasing by 2% per year because of development. After 6 years of development, there is 4,000,000 acres of forest remaining. How many acres were originally in the forest?

$1 - .02 = .98$

a: 4,000,000

p: ?

b: .98

t: 6

$4{,}000{,}000 = p(.98)^6$

$\frac{4{,}000{,}000}{.89} = \frac{p(.89)}{.89}$

$p = \boxed{4494{,}382.02 \text{ acres}}$

EX4. Find a bank account balance to the nearest dollar, if the account starts with $100, has an annual interest rate of 4%, and the money is left in the account for 12 years.

grow

$1 + .04 = 1.04$

a: ?
p: 100
b: 1.04
t: 12

$a = 100(1.04)^{12}$

$a = \$160$

If you wanted to buy a new gaming system for $250, when will you have enough? Need to find time

a: 250
p: 100
b: 1.04
t: ?

$\frac{250}{100} = \frac{100(1.04)^t}{100}$

$2.5 = 1.04^t$

$\frac{\ln 2.5}{\ln(1.04)} = \frac{t \ln(1.04)}{\ln(1.04)}$

$t = \boxed{23.36 \text{ years}}$

EX5. The pesticide DDT was widely used in the United States until its ban in 1972. If the half-life of DDT is 15 years for 100 grams, how much DDT would be remaining after 45 years?

$\frac{1}{2} = .5$

a: ?
p: 100
b: .5
t: 3

$a = 100(.5)^3$

$\boxed{a = 12.5 \text{ grams}}$

After 45 years but decrease every 15 years.

$\frac{45}{15} = 3$