Day 84

8.1 Exponential Models

Standard Form: $y = ab^x$

x: usually (time)
a: initial value
b: growth or decay factor

if $b > 1$, exponential growth

if $b < 1$, exponential decay

Ex. Decide if its growth or decay.

① $y = 72(1.6)^x$ growth $1.6 > 1$

② $y = 24(.8)^x$ decay $.8 < 1$

③ $y = 3\left(\frac{6}{5}\right)^x$ growth $\frac{6}{5} > 1$

Use these equations in the word problems.

$y = a(1+R)^x$ growth

$y = a(1-R)^x$ decay

R = Rate of increase or decrease as a decimal

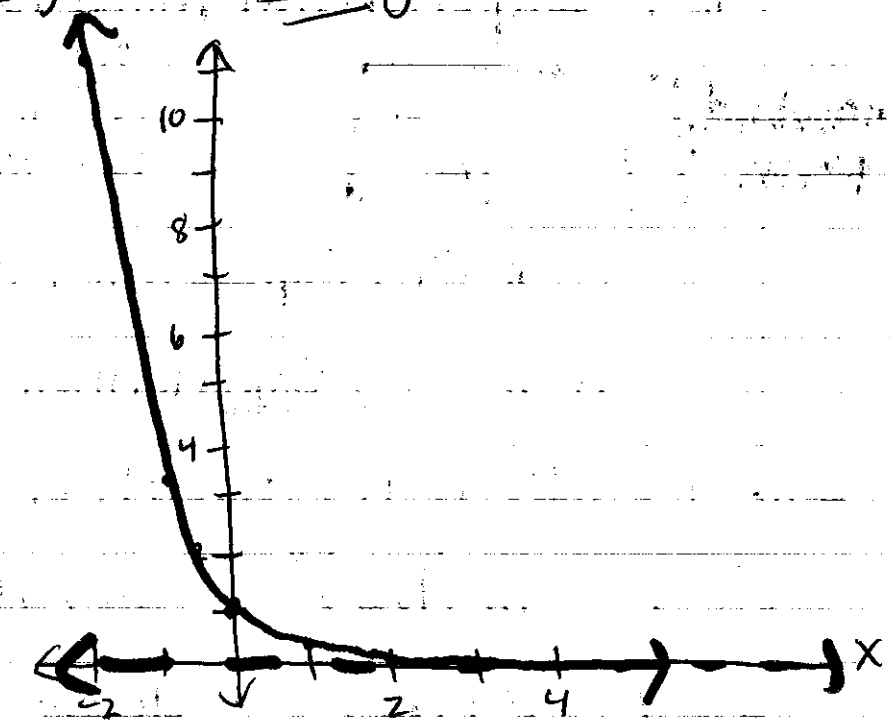
% → 3.2% = .032

[Y=1573(1.02)^1 (bears 1

Graphing.

① $y = (0.3)^x$ Decay

x	y
-2	11.1
-1	3.3
0	1
1	.3
2	.09

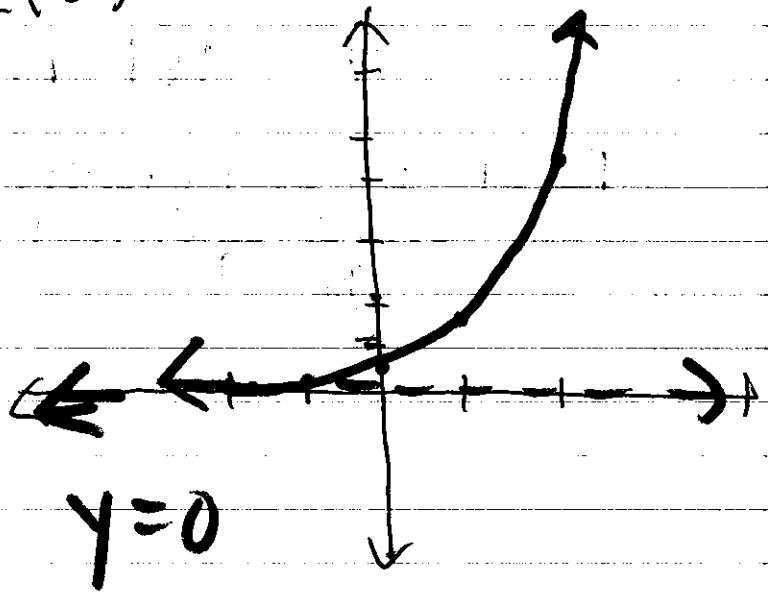


(x-axis) $y = 0$

Asymptote: A line the graph approaches but almost always Never crosses

② $y = \frac{1}{2}(3)^x$ Growth

x	y
-2	.06
-1	.17
0	.5
1	1.5
2	4.5



$y = 0$

Name _____ Block _____ Date _____

Practice 8-1

Exploring Exponential Models

Without graphing, determine whether each equation represents exponential growth or exponential decay.

1. $y = 72(1.6)^x$
2. $y = 24(0.8)^x$
3. $y = 3\left(\frac{6}{5}\right)^x$
4. $y = 7\left(\frac{2}{3}\right)^x$

Sketch the graph of each function. Identify the horizontal asymptote.

5. $y = (0.3)^x$
6. $y = 3^x$
7. $y = 2\left(\frac{1}{5}\right)^x$
8. $y = \frac{1}{2}(3)^x$

25% = .25

9. A new car that sells for \$18,000 depreciates 25% each year. Write a function that models the value of the car. Find the value of the car after 4 yr.

(a) $y = 18{,}000(1-.25)^x$

$y = 18000(.75)^x$

(b) $y = 18000(.75)^4$

$y = \$5695.31$

10. A new truck that sells for \$29,000 depreciates 12% each year. Write a function that models the value of the truck. Find the value of the truck after 7 yr.

(a) $y = 29000(1-.12)^x$

$y = 29000(.88)^x$

(b) $y = 29000(.88)^7$

\$11,851.59

11. The bear population increases at a rate of 2% per year. There are 1573 bears this year. Write a function that models the bear population. How many bears will there be in 10 yr?

Growth $R = .02$

$y = 1573(1+.02)^x$

$y = 1573(1.02)^x$

$y = 1573(1.02)^{10}$

$y = 1917$ bears

$r = .125$

12. An investment of \$75,000 increases at a rate of 12.5% per year. Find the value of the investment after 30 yr.

$y = 75000(1+.125)^x$ $\quad y = 75000(1.125)^{30}$

$y = 75000(1.125)^x$ $\quad \$2,568,247.87$

13. The population of an endangered bird is decreasing at a rate of 0.75% per year. There are currently about 200,000 of these birds. Write a function that models the bird population. How many birds will there be in 100 yr?

Write an exponential function $y = ab^x$ for a graph that includes the given points.

14. (0, 2), (1, 1.3) **15.** (−1, 12.5), (4, 4.096) **16.** (1, 0.84), (2, 1.008)

Stat edit

L_1 (x's)	L_2 (y's)
0	2
1	1.3

$y = 2(.65)^x$

Stat: calc

$y = 10(.8)^x$

For each annual rate of change, find the corresponding growth or decay factor.

17. +45% G **18.** −10% D **19.** −40% D **20.** +200% G

$1+.45$ $\quad y = (1.45)^x$ $\quad 1-.10$ $\quad 1-.40$ $\quad 1+2.00$

1.45 growth factor $\quad$ .90 decay factor $\quad$ .60 decay factor $\quad$ 3 growth factor

For each function, find the annual percent increase or decrease that the function models.

21. $y = 1700(0.75)^x$ D **22.** $y = 30.698\left(\frac{5}{8}\right)^x$ D **23.** $y = 984.5(1.73)^x$ G

$\frac{5}{8} = .625$

1st: Decide if growth or decay.

$1-.75 = .25$ $\quad 1-.625 = .375$ $\quad 1.73-1 = .73$

−25% $\quad$ −37.5% $\quad$ +73%

24. The value of a piece of equipment has a decay factor of 0.80 per year. After 5 yr, the equipment is worth \$98,304. What was the original value of the equipment?

$y = ab^x$

$\frac{98304}{(.80^5)} = \frac{a(.80)^5}{.80^5}$ $\quad a = 300{,}000$