

The Natural Base e

Lesson 6.2



Bison

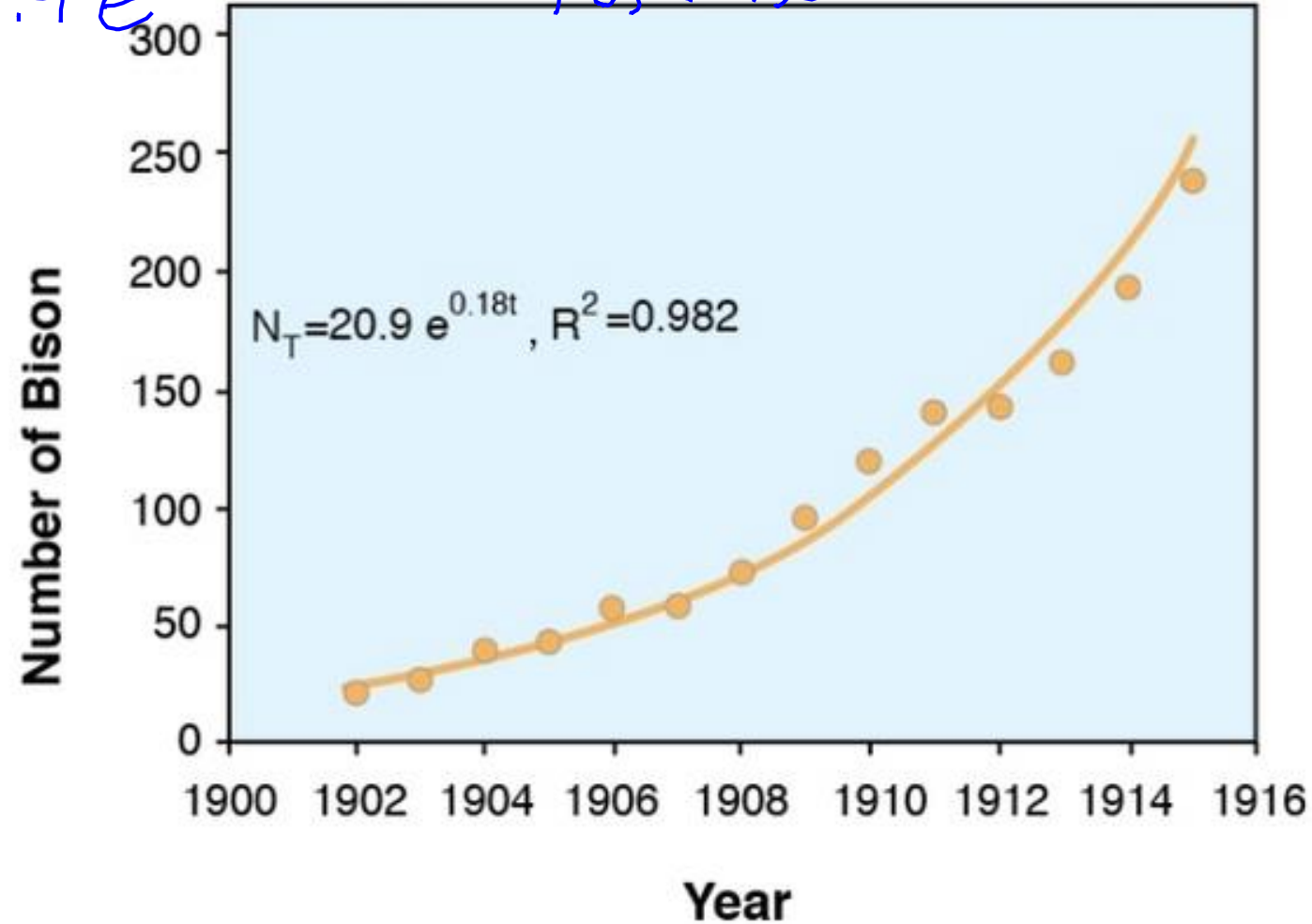


<http://www.nps.gov/yell/learn/photosmultimedia/indepth-bison.htm>

$$N = 20.9e^{0.18t}$$

$$20.9 e^{0.18(50)}$$
$$20.9 e^{0.18(75)}$$

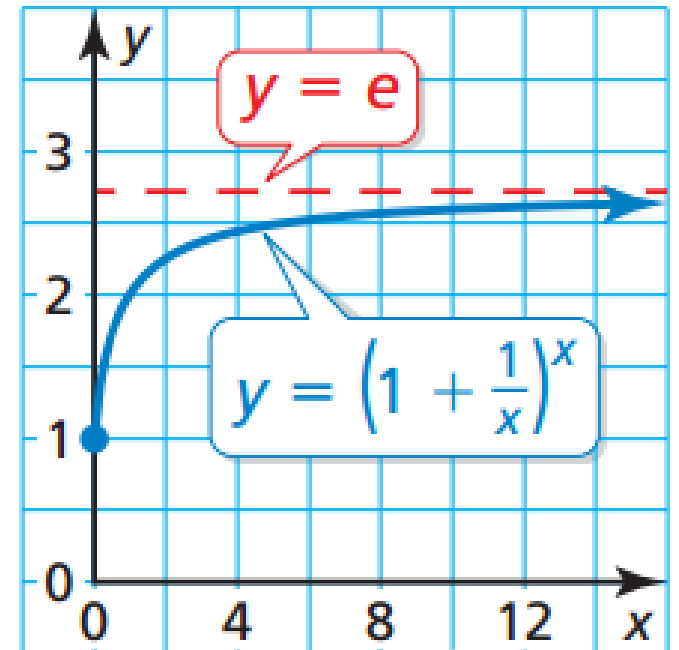
169,354
15,244,802



The Natural Base e

x	10^1	10^2	10^3	10^4	10^5	10^6
$\left(1 + \frac{1}{x}\right)^x$	2.59374	2.70481	2.71692	2.71815	2.71827	2.71828

$$e \approx 2.71828182846$$



Simplify each expression.

a. $e^2 \cdot e^9$

$$e^{2+9} = e^{11}$$

b. $\frac{25e^{13}}{5e^{12}}$

$$5e^1$$

c. $(2e^{-3x})^5$

$$32e^{-15x}$$

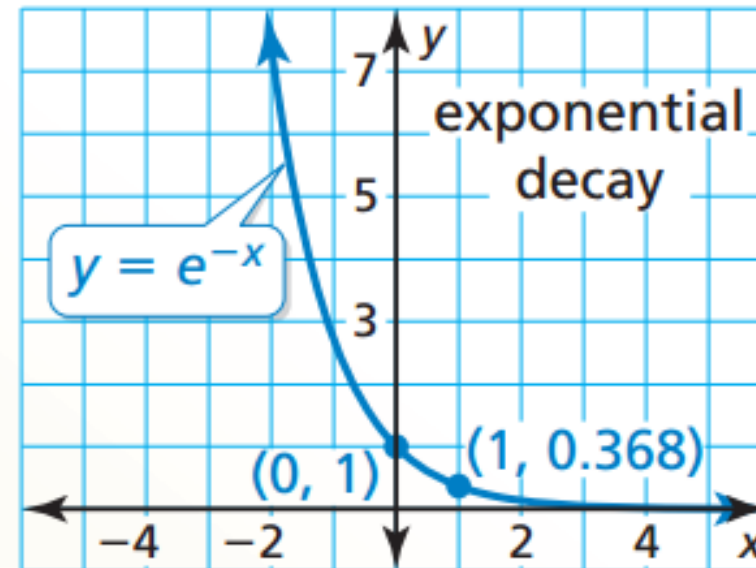
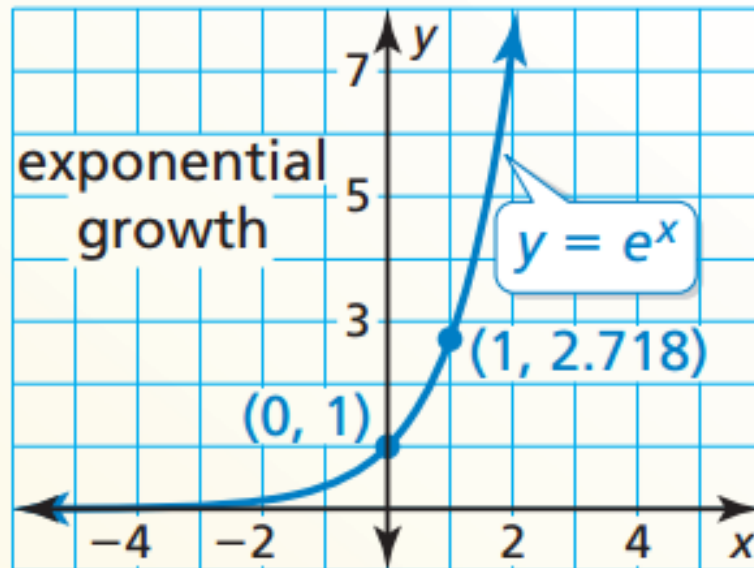
$$\frac{32}{e^{15x}}$$

Natural Base Functions

A function of the form $y = ae^{rx}$ is called a *natural base exponential function*.

- When $a > 0$ and $r > 0$, the function is an exponential growth function.
- When $a > 0$ and $r < 0$, the function is an exponential decay function.

The graphs of the basic functions $y = e^x$ and $y = e^{-x}$ are shown.



Tell whether each function represents exponential growth or exponential decay.

a. $f(x) = 2.5e^x$
↑
growth

b. $y = e^{-0.2x}$
decay

Continuously Compounded Interest

When interest is compounded continuously, the amount A in an account after t years is given by the formula

$$A = Pe^{rt}$$

where P is the principal and r is the annual interest rate expressed as a decimal.

P = principal - started with

Calculating the Amount Earned

$$A = P \left(1 + \frac{r}{n}\right)^{nt}$$

\$5000 is invested at 4% interest rate compounded quarterly. Find the amount after 20 years.

$$\begin{aligned} A &= 5000 \left(1 + \frac{.04}{4}\right)^{4(20)} \\ &= 5000(1 + .01)^{80} \\ &= 5000(1.01)^{80} \\ &= 5000(2.217) \\ &= \$11,083.58 \end{aligned}$$

$$A = Pe^{rt}$$

\$5000 is invested at 4% interest rate compounded continuously. Find the amount after 20 years.

$$\begin{aligned} A &= 5000e^{.04(20)} \\ &= 5000e^{.8} \\ &= \$11,127.70 \end{aligned}$$

Compound and Continuous Compounded Interest ws