

## Exponential Models

$$1) 11236 = 8530(1+r)^6$$

$$1.3172 = (1+r)^6$$

$$1.0470 = 1+r$$

$$.0470 = r$$

4.7% growth

$$2) 1000 = 470(1+.12)^t$$

$$2.1277 = (1.12)^t$$

$$\log_{1.12} 2.1277 = \log_{1.12} (1.12)^t$$

$$6.7 = t$$

$$3) 14330 = 25000(1-r)^4$$

$$.5732 = (1-r)^4$$

$$.8701 = 1-r$$

$$-.1299 = -r$$

$$.1299 = r$$

$$A = 25000(1-.1299)^7$$

$$A = 25000(.8701)^7$$

$$A = 9438.96$$

$$9438.96 \cdot 0.003$$

\$28.32 road use tax

$$4) 3 = 200(1-r)^{20}$$

$$.015 = (1-r)^{20}$$

$$.8106 = 1-r$$

$$-.1894 = -r$$

$$.1894 = r$$

18.9%

decrease

$$5) 7200 = 2400 \left(1 + \frac{.062}{4}\right)^{4t}$$

$$3 = (1.0155)^t$$

$$\log_{1.0155} 3 = \log_{1.0155} (1.0155)^t$$

$$71.4 = t$$

$$6) 6147 = P \left(1 + \frac{.04}{12}\right)^{12t}$$

$$6147 = P(1.0033)^{144}$$

$$3824.95 = P$$

## Exponential Models Cont.

$$7) 7200 = 2400e^{.057t}$$

$$3 = e^{.057t}$$

$$\ln 3 = \ln e^{.057t}$$

$$\ln 3 = .057t$$

$$\frac{\ln 3}{.057} = t$$

$$\boxed{19.3 = t}$$

$$8) 6000 = 5000e^{r(3)}$$

$$1.2 = e^{3r}$$

$$\ln 1.2 = \ln e^{3r}$$

$$\ln 1.2 = 3r$$

$$\frac{\ln 1.2}{3} = r$$

$$\boxed{.0608 = r}$$

$$9) (1.0375)^t = (1.0375^{\frac{1}{12}})^{12t}$$

$$(1.0375)^t = (1.0031)^{12t}$$

$$\boxed{\text{monthly rate} = .0031}$$

$$.31\%$$

$$10) (1.004^{12})^t = (1.004)^{12t}$$

$$(1.0491)^t = (1.004)^{12t}$$

$$\boxed{\text{yearly rate} = .0491}$$

$$4.91\%$$

## Inverse Functions

$$1) f(x) = 3^{x-2} - 5$$

$$x = 3^{y-2} - 5$$

$$x + 5 = 3^{y-2}$$

$$\log_3(x+5) = y-2$$

$$\log_3(x+5) + 2 = y$$

$$\boxed{f^{-1}(x) = \log_3(x+5) + 2}$$

$$2) f(x) = \log(2x-1)$$

$$x = \log(2y-1)$$

$$10^x = 2y-1$$

$$10^x + 1 = 2y$$

$$\frac{10^x + 1}{2} = y$$

$$\boxed{f^{-1}(x) = \frac{10^x + 1}{2}}$$

## Inverse Functions Cont

$$3) f(x) = \ln(2x+3) - 4$$

$$x = \ln(2y+3) - 4$$

$$x+4 = \ln(2y+3)$$

$$e^{x+4} = 2y+3$$

$$e^{x+4} - 3 = 2y$$

$$\frac{e^{x+4} - 3}{2} = y$$

$$f^{-1}(x) = \frac{e^{x+4} - 3}{2}$$

$$4) f(x) = (x+2)^3$$

$$x = (y+2)^3$$

$$\sqrt[3]{x} = y+2$$

$$-2 + \sqrt[3]{x} = y$$

$$f^{-1}(x) = -2 + \sqrt[3]{x}$$

$$5) f(x) = e^{2x-1}$$

$$x = e^{2y-1}$$

$$\ln x = 2y - 1$$

$$1 + \ln x = 2y$$

$$\frac{1 + \ln x}{2} = y$$

$$f^{-1}(x) = \frac{1 + \ln x}{2}$$

## Definition of Logarithms

$$1) 6^x = 36$$

$$\log_6 36 = x$$

$$2) x^3 = 125$$

$$\log_x 125 = 3$$

$$3) 2^4 = x$$

$$\log_2 x = 4$$

$$4) \log_2 a = 3$$

$$2^3 = a$$

$$5) \log_b 81 = 4$$

$$b^4 = 81$$

$$6) \log_4 16 = x$$

$$4^x = 16$$

# Exponential and Logarithmic Equations

1)  $3^x = 27^{x+2}$

$$3^x = (3^3)^{x+2}$$

$$3^x = 3^{3x+6}$$

$$x = 3x + 6$$

$$-2x = 6$$

$$x = -3$$

2)  $2(8^{n+1}) = 4$

$$8^{n+1} = 2$$

$$(2^3)^{n+1} = 2$$

$$2^{3n+3} = 2$$

$$3n+3 = 1$$

$$3n = -2$$

$$n = -\frac{2}{3}$$

3)  $10^{3y} = 5$

$$\log 10^{3y} = \log 5$$

$$3y = \log 5$$

$$y = \frac{\log 5}{3}$$

$$y \approx 0.2330$$

4)  $\log(2x+5) = 3$

$$10^3 = 2x+5$$

$$1000 = 2x+5$$

$$995 = 2x$$

$$497.5 = x$$

5)  $4^x - 5 = 12$

$$4^x = 17$$

$$\log_4 4^x = \log_4 17$$

$$x = \log_4 17$$

$$x \approx 2.0437$$

6)  $\log 4x = 2$

$$10^2 = 4x$$

$$100 = 4x$$

$$25 = x$$

7)  $2 \log(2x+5) = 4$

$$\log(2x+5) = 2$$

$$10^2 = 2x+5$$

$$100 = 2x+5$$

$$95 = 2x$$

$$47.5 = x$$

8)  $\ln(x+2) = 3$

$$e^3 = x+2$$

$$e^3 - 2 = x$$

$$18.0855 \approx x$$

9)  $5e^{x+3} = 15$

$$e^{x+3} = 3$$

$$\ln e^{x+3} = \ln 3$$

$$x+3 = \ln 3$$

$$x = -3 + \ln 3$$

$$x \approx -1.9014$$

# Graphing Exponential and Logarithmic Functions

1)  $D: (-\infty, \infty)$  or  $\mathbb{R}$

$R: (-1, \infty)$  or  $y > 1$

2)  $y = 2^x$

$\rightarrow 3$

$\uparrow 5$

3)  $y = \log x$

stretch bfo 2

$\rightarrow 2$

$\downarrow 1$

4)  $g(x) = f(x) - 8$