$$\log_5 12 = 1.544$$

$$\frac{\log 12}{\log 5} \approx \frac{\ln 12}{\ln 5}$$

Solve exponentials

$3^{1-x} = \frac{1}{27}$

$3^{1-x} = \frac{1}{3^3}$

$3^{1-x} = 3^{-3}$

$1 - x = -3$

$-x = -4$

$x = 4$

Solve

$$9^x = \frac{1}{\sqrt[3]{3}}$$

$$3^{2x} = \frac{1}{3^{1/3}}$$

$$3^{2x} = 3^{-\frac{1}{3}}$$

$$\frac{1}{2} \cdot 2x = -\frac{1}{3} \cdot \frac{1}{2}$$

$$x = -1/6$$

1

$$\log_2 2^{x} = \log_2 7$$

$$x = \log_2 7$$

$$\boxed{x = \frac{\ln 7}{\ln 2}}$$

$$\ln 2^{x} = \ln 7$$

$$x \cdot \ln 2 = \ln 7$$

$$x = \frac{\ln 7}{\ln 2}$$

$$\frac{3 \cdot 5^x}{3} = \frac{12}{3}$$

$$\ln 5^{x} = \ln 4$$

$$x \ln 5 = \ln 4$$

$$x = \frac{\ln 4}{\ln 5}$$

$$\frac{\sqrt{3}}{2}$$

$$\ln 7^{(2x-1)} = \ln 30$$

$$\frac{(2x-1)\ln 7}{\ln 7} = \frac{\ln 30}{\ln 7}$$

$$2x-1 = \frac{\ln 30}{\ln 7}$$

$$\frac{1}{2}2x = \frac{1}{2}\left(\frac{\ln 30}{\ln 7} + 1\right)$$

$$x = \frac{\ln 30}{2\ln 7} + \frac{1}{2}$$

Solve

$$\frac{3 \cdot 2^{4x-1}}{3} = \frac{27}{3}$$

$$\ln 2^{4x-1} = \ln 9$$

$$\frac{(4x-1)\ln 2}{\ln 2} = \frac{\ln 9}{\ln 2}$$

$$4x - 1 = \frac{\ln 9}{\ln 2}$$

$$\frac{1}{4} 4x = \frac{1}{4}\left(\frac{\ln 9}{\ln 2} + 1\right)$$

$$x = \frac{\ln 9}{4 \ln 2} + \frac{1}{4}$$

$$\ln 2^{(x+1)} = \ln 5^{x}$$

$$(x+1)\ln 2 = x \ln 5$$

$$x \ln 2 + 1 \ln 2 = x \ln 5$$

$$1 \ln 2 = x \ln 5 - x \ln 2$$

$$\frac{1 \ln 2}{\ln 5 - \ln 2} = \frac{x(\ln 5 - \ln 2)}{\ln 5 \cdot \ln 2}$$

$$\boxed{\frac{1 \ln 2}{1 \ln 5 - \ln 2} = x}$$

Solve for x

$$\frac{4e^{7x}}{4} = \frac{10273}{4}$$

$$\cancel{\ln e}^{7x} = \ln 2568.25$$

$$7x = \ln 2568.25$$

$$x = \frac{\ln 2568.25}{7}$$

91. The formula $A = 18.9e^{0.0055t}$ models the population of New York State, A, in millions, t years after 2000.

a. What was the population of New York in 2000?

b. When will the population of New York reach 19.54 million?

$A = Pe^{rt}$

Continuous compounding

$$\frac{19.54}{18.9} = \frac{\cancel{18.9}e^{0.0055t}}{\cancel{18.9}}$$

$$\ln\left(\frac{19.54}{18.9}\right) = \cancel{\ln e}^{0.0055t}$$

$$\frac{\ln(19.54/18.9)}{0.0055} = \frac{0.0055t}{0.0055}$$

$$6.1 = t$$

$\boxed{\text{in } 2006}$

	Amount Invested	Number of Compounding Periods	Annual Interest Rate	Accumulated Amount	Time t in Years
93.	$12,500	4	5.75%	$20,000	t ?
94.	$7250	12	6.5%	$15,000	
95.	$1000	360		$1400	2
96.	$5000	360		$9000	4

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

$$\frac{20000}{12500} = \frac{12500\left(1+\frac{.0575}{4}\right)^{4t}}{12500}$$

$$1.6 = \left(1+\frac{.0575}{4}\right)^{4t}$$

$$\ln 1.6 = \ln(1.014375)^{4t}$$

$$\frac{\ln 1.6}{4\ln(1.014375)} = \frac{4t \cdot \ln(1.014375)}{4\ln(1.014375)}$$

$$(\ln(1.6)) \div (4\ln(1.014375))$$

$$8.2 \approx t \approx 8.2 \text{ years}$$

94. \$7250 12 6.5% \$15,000

P n r A

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

$$\frac{1500\cancel{0}}{725\cancel{0}} = \frac{7\cancel{25}0\left(1+\frac{.065}{12}\right)^{12t}}{725\cancel{0}}$$

$$\ln\frac{1500}{725} = \ln\left(1+\frac{.065}{12}\right)^{12t}$$

$$\frac{\ln(1500/725)}{\left(12\ln(1+.065/12)\right)} = \frac{12t\ln\left(1+\frac{.065}{12}\right)}{12\ln(1+.065/12)}$$

$$\underset{\text{yrs}}{11.2 \approx t}$$