23. Suppose you deposit \$1000 in an account paying 2% annual interest, compounded continuously, how many years would It take for your account to be worth \$2000?

$$A = Pe^{rt}$$

$$2000 = 1000e^{.02t}$$

$$2 = e^{.02t}$$

$$\ln 2 = \ln e^{.02t}$$

$$\ln 2 = .02t$$

$$\frac{\ln 2}{.02} = t$$

$t \approx 34.66$ yrs

34.7

35

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13. $3e^{-2x} - 5 = 4$

$$3e^{-2x} = 9$$

$$e^{-2x} = 3$$

$$\ln e^{-2x} = \ln 3$$

$$-2x = \ln 3$$

$$x = \frac{\ln 3}{-2}$$

$x \approx -.5493$

19. $\ln(7x-4)=-0.3$

$e^{-.3}=7x-4$

$e^{-.3}+4=7x$

$\frac{(e^{-.3}+4)}{7}=x$

$x \approx .6773$

Exponential Growth: $y = a(1+r)^t$ $\quad y = a(b)^x \quad b > 1$

Exponential Decay: $y = a(1-r)^t$ $\quad y = a(b)^x \quad 0 < b < 1$

Where y is the amount of a quantity that exists/remains after t time periods given an initial amount a and r is the percent of increase/decrease expressed as a decimal.

2. In 1910, the population of a city was 120,000. Since then, the population has increased by 1.5% per year. If the population continues to grow at this rate, what will the population be in 2010?

$$y = a(1+r)^t$$

$$y = 120,000(1+.015)^{100}$$

$$y = 120,000(1.015)^{100}$$

$$y = 531,845 \text{ people}$$

1. A cup of coffee contains 130 milligrams of caffeine. If caffeine is eliminated from the body at a rate of 11% per hour, how long will it take for half of this caffeine to be eliminated?

$y = a(1-r)^t$

$\frac{65}{130} = \frac{130(1-.11)^t}{130}$

$.5 = .89^t$

$\ln .5 = \ln .89^t$

$\frac{\ln .5}{\ln .89} = \frac{t \ln .89}{\ln .89}$

$5.95\text{ hrs} = t$

6 hr

$\log .5 = \log .89^t$

$\frac{\log .5}{\log .89} = \frac{t \log .89}{\log .89}$

$5.95\text{ hrs} = t$

6 hrs