$g(x) = 7 \cdot 3^{5x+2} - 11$

$f(x) = 3^x$

$g(x) = 7 \cdot f\left(5\left(x + \frac{2}{5}\right)\right) - 11$

① $(x, y) \rightarrow (x, 7y)$

② $(x, y) \rightarrow \left(\frac{1}{5}x, y\right)$

③ $(x, y) \rightarrow \left(x - \frac{2}{5}, y\right)$

④ $(x, y) \rightarrow (x, y - 11)$

① $7 \cdot 3^x = 7f(x)$

② $\boxed{7 \cdot 3^{5x} = 7f(5x)}$ → Not on Quiz #9/wksht.

③ $7 \cdot 3^{5\left(x + \frac{2}{5}\right)} = 7f\left(5\left(x + \frac{2}{5}\right)\right)$

④ $7 \cdot 3^{5\left(x + \frac{2}{5}\right)} - 11 = 7f\left(5\left(x + \frac{2}{5}\right)\right) - 11 = g(x)$

Recall

Future Value

$A = P(1+\frac{r}{n})^{nt} \xrightarrow{n \to \infty} Pe^{rt}$ continuous compounding

Population Growth: $A = Pe^{kt}$

Population grows at 5% per year.
Today, there are 20,000 people.
How many people in 14 years.
Assume population follows the law of uninhibited growth.

Assume continuous model

$A(t) = Pe^{.05t}$

$A(t) = 20000e^{.05t}$

$A(14) = 20000e^{.05(14)}$

$\approx 40{,}275$ people.

Close to double.

```
2000e^(.05*14
     4027.505415
Ans*10
     40275.05415
```

Oct 26-10:17 AM

FACT $\log_b x$ and b^x are inverses.

Common $\log x$ " 10^x " "

Natural $\log_e x = \ln x$ " e^x " "

Doubling Time

P = initial

2P = double the initial

$$\boxed{Pe^{kt} = 2P}$$

From previous example:

$$\boxed{Pe^{.05t} = 2P}$$

Remember it this way

$$\cancel{20000}e^{.05t} = 2\cdot\cancel{20000}$$

$$e^{.05t} = 2$$

$$\ln(e^{.05t}) = \ln(2)$$

$$.05t = \ln(2)$$

$$t = \frac{\ln(2)}{.05}$$

$$\boxed{e^{kt} = 2}$$

$$\boxed{t = \frac{\ln(2)}{k}}$$

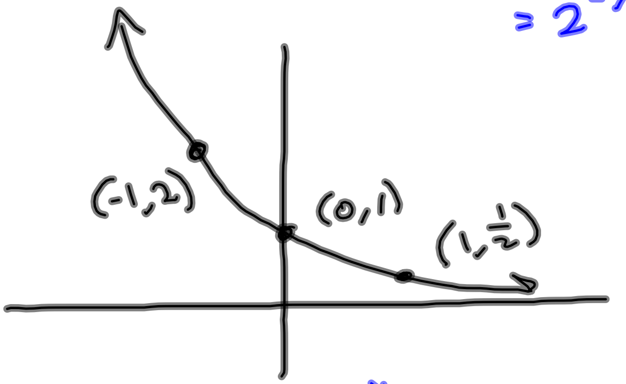
Tripling Time

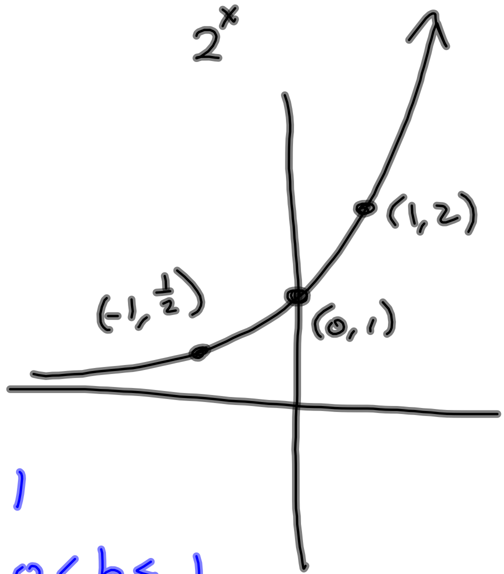
$$Pe^{kt} = 3P$$

Exponential Decay   Our basic graph.

$\left(\frac{1}{2}\right)^x = \left(2^{-1}\right)^x = 2^{-1\cdot x}$
$= 2^{-x}$

2^x





Decay b^{-x} when $b > 1$
or b^x when $0 < b < 1$

e^{-x} $\left(\frac{1}{e}\right)^x$ $e \approx 2.718$

The half-life of Millsium^{-130} is 50 years.

A sample is found to have 10%
of naturally occuring Millsium-130

$\frac{1}{2}$ life is 50 years

$$\boxed{Pe^{k\cdot 50} = \frac{1}{2}P}$$

Solve for k:

used $\frac{1}{2}$-life to find k.

$$e^{50k} = \frac{1}{2}$$

$$\ln(e^{50k}) = \ln(\tfrac{1}{2})$$

$$50k = \ln(\tfrac{1}{2})$$

$$k = \frac{\ln(\frac{1}{2})}{50} = -.01386$$

$$= -\frac{\ln(2)}{50}$$

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

How old is the sample, then?

Oct 26-10:39 AM

$A = Pe^{kt}$

we know k
we know we have
10% of the original
amount.

$Pe^{kt} = .10P$

$e^{-\frac{\ln(2)}{50}t} = .10$

$\ln\left(e^{-\frac{\ln(2)}{50}t}\right) = \ln(.10)$

$-\frac{\ln(2)}{50}t = \ln(.1)$

$t = -\frac{50\ln(.1)}{\ln(2)}$

≈ 166.0964047

≈ 166 yrs.

```
2000e^(.05*14
     4027.505415
Ans*10
     40275.05415
-50*ln(.1)/ln(2)

     166.0964047
```

Find $f^{-1}(x)$ for

$$f(x) = 5 \cdot 10^{3x-7} + 11 = y$$

Solve for y

PEMDAS

SADMEP

$$5 \cdot 10^{3y-7} + 11 = x$$

$$-11 = -11$$

$$5 \cdot 10^{3y-7} = x - 11$$

$$10^{3y-7} = \frac{x-11}{5}$$

$$\log(\quad) = \log\left(\frac{x-11}{5}\right)$$

$$3y-7 = \log\left(\frac{x-11}{5}\right)$$

$$3y = \log\left(\frac{x-11}{5}\right) + 7$$

$$y = \frac{\log\left(\frac{x-11}{5}\right) + 7}{3} = f^{-1}(x)$$