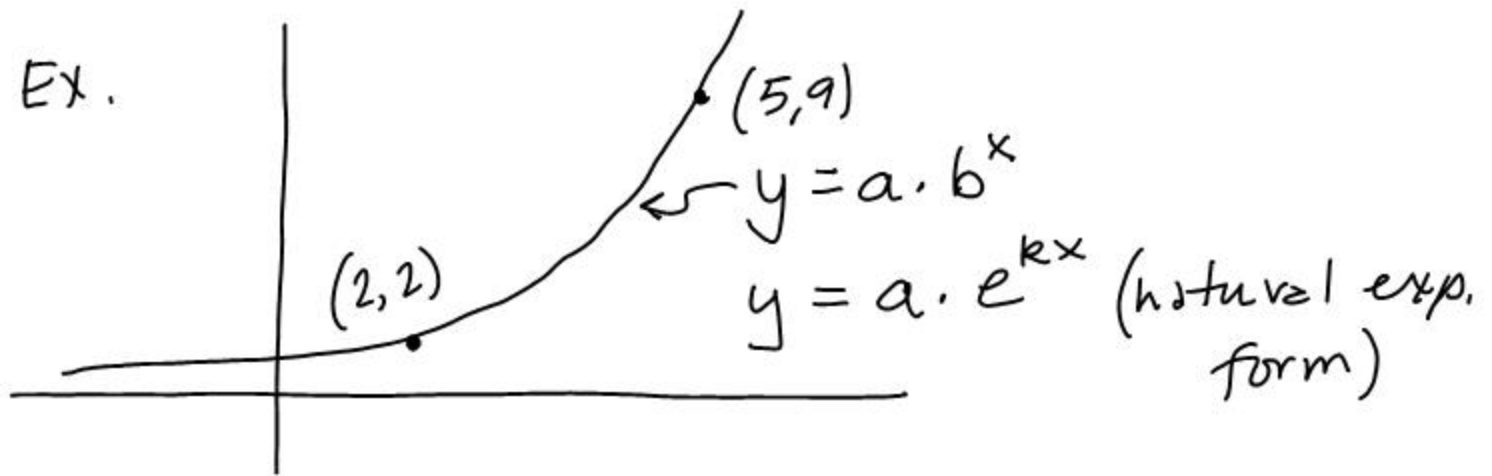


Natural Exponential functions

$$y = a \cdot e^{kt}$$

Ex.



$$(2, 2) \begin{cases} 2 = a \cdot b^2 \rightarrow a = 2b^{-2} \end{cases}$$

$$(5, 9) \begin{cases} 9 = a \cdot b^5 \end{cases}$$

$$\rightarrow 9 = (2b^{-2})b^5$$

$$9 = 2b^3$$

$$b^3 = \frac{9}{2}$$

$$b = \left(\frac{9}{2}\right)^{1/3} \approx 1.65096$$

$$a = 2 \left(\left(\frac{9}{2}\right)^{1/3}\right)^{-2}$$

$$a = 2 \left(\frac{9}{2}\right)^{-2/3}$$

$$a = 2 \left(\frac{2}{9}\right)^{2/3}$$

$$\approx 0.73376$$

$$y = 0.73376 (1.65096)^x$$

$$y = 0.73376 (1.65096)^x$$

$$y = a \cdot e^{kx}$$

$$e^k = 1.65096 \leftarrow \text{exp. eq.}$$

$$k \cdot \frac{1}{e} = \ln 1.65096 \\ = 0.50136$$

$$y = 0.73376 e^{0.50136x}$$

Ex. Population at $t=0$ is 150000

Population at $t=3$ is 190000

Write an eq. in the form $P = a \cdot b^t$

$$P = 150000 b^t$$

$$190000 = 150000 \cdot b^3$$

$$\frac{19}{15} = b^3$$

$$b = \left(\frac{19}{15}\right)^{\frac{1}{3}} = 1.08198$$

$$P = 150000 (1.08198)^t$$

$$P = 150000 (1.08198)^t$$

$$P = a \cdot e^{kt}$$

$$P = 150000 e^{0.078796t}$$

$$e^k = 1.08198$$

$$k = \ln 1.08198$$

$$= 0.078796$$

Ex Fermium-253 has a half life of 3 days. Start with 1g.

Write an eq. in the form $m = a \cdot b^t$

$$m = 1 \cdot b^t$$

$$m = 0.79370^t$$

$$0.5 = b^3$$

$b < 1 \rightarrow$ decay

$$b = (0.5)^{1/3} = 0.79370$$

Rewrite in natural exponential form

$$m = a \cdot e^{kt}$$

$$m = e^{-0.23105t}$$

$$e^k = 0.79370$$

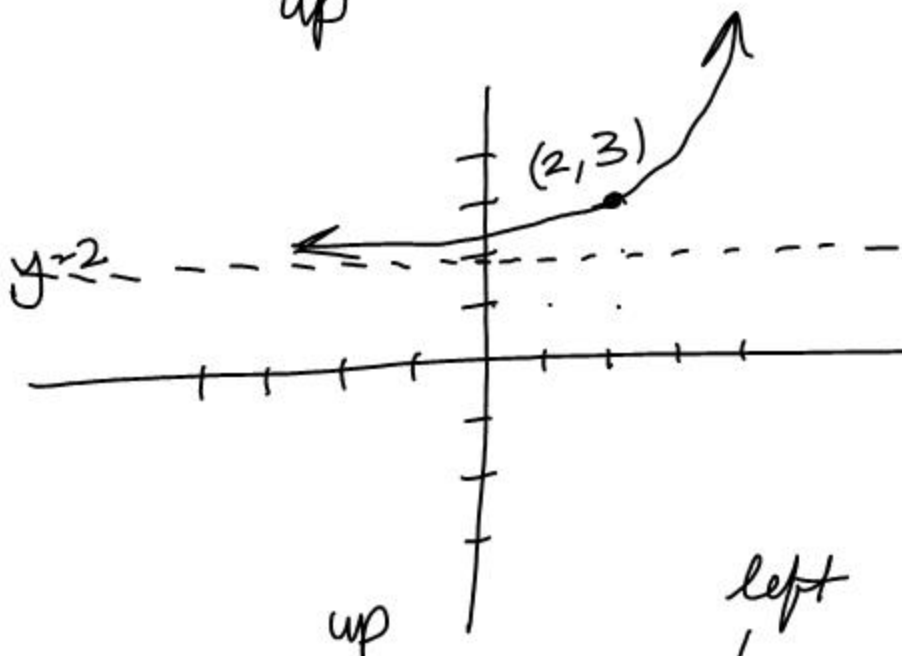
$$k = \ln 0.79370$$

neg. $k \rightarrow$
decay

$$\textcircled{a} y = 2 + 2^{x-2}$$

↑ up

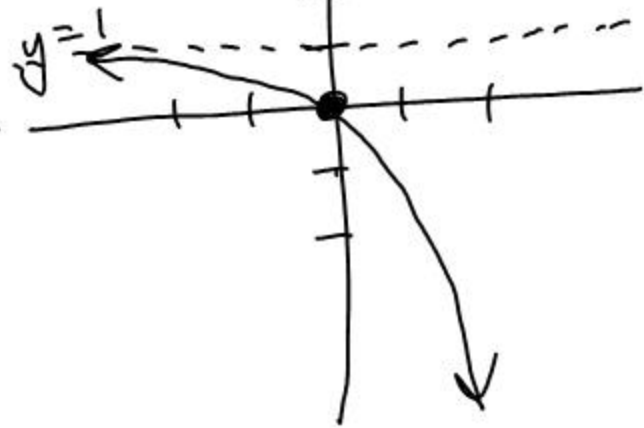
↖ right



$$\textcircled{b} y = 1 - e^x$$

↖ up

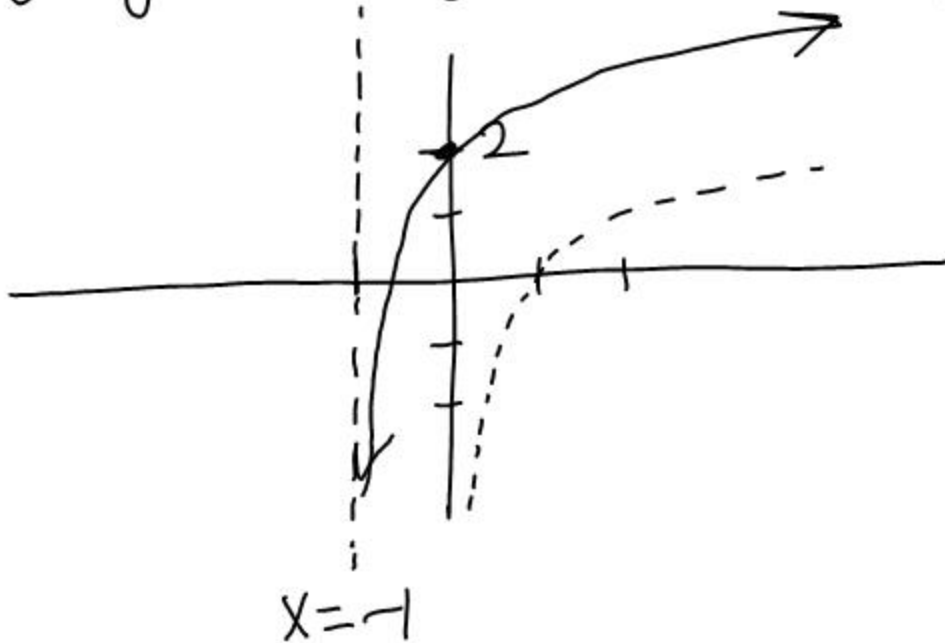
↑ flip over the x-axis



$$\textcircled{c} y = 2 + \log_2(x+1)$$

↖ up

↖ left



$$\textcircled{2} \textcircled{a} \log_4 64 = 3$$

$$\textcircled{b} \log_2 32 = 5$$

$$\textcircled{c} \ln \sqrt{e} = \frac{1}{2}$$

$$\textcircled{d} \ln 1 = 0$$

$$\textcircled{3} \textcircled{a} 3^3 = 27 \quad \textcircled{b} 10^{1/2} = \sqrt{10} \quad \textcircled{c} e^2 = e^2$$

$$\textcircled{d} e^{-1} = \frac{1}{e}$$

$$\textcircled{4} \textcircled{a} 2 \quad \textcircled{b} \frac{1}{2} \quad \textcircled{c} 0 \quad \textcircled{d} -1$$

$$\textcircled{e} \frac{1}{2} \quad \textcircled{f} -\frac{1}{2} \quad \textcircled{g} 1 \quad \textcircled{h} \frac{2}{3}$$

$$\textcircled{i} 4 \quad \textcircled{j} -1 \quad \textcircled{k} 1 \quad \textcircled{l} 0$$

$$\textcircled{m} \frac{1}{3} \quad \textcircled{n} -\frac{1}{2} \quad \textcircled{o} -2 \quad \textcircled{p} 5$$

$$\textcircled{q} 1 \quad \textcircled{r} -1 \quad \textcircled{s} 3 \quad \textcircled{t} \frac{1}{2}$$

$$\boxed{4h} \log_8 4 = x$$

$$8^x = 4$$

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

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

$$3x = 2$$

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

$$\boxed{4i} \log_3 \frac{1}{9} = x$$

$$3^x = \frac{1}{9}$$

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

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

$$x = -2$$

TEST on Wednesday 11/15

4 p

$$\log_3 3^5 = x$$

$$3^x = 3^5$$

$$x = 5$$