The Euler Number (e)

① $e = \lim_{n\to\infty}\left(1+\frac{1}{n}\right)^n$

② $4! = \underline{4}\cdot\underline{3}\cdot\underline{2}\cdot\underline{1} = 24$

factorial notation $6! = 6\cdot5\cdot4\cdot3\cdot2\cdot1$

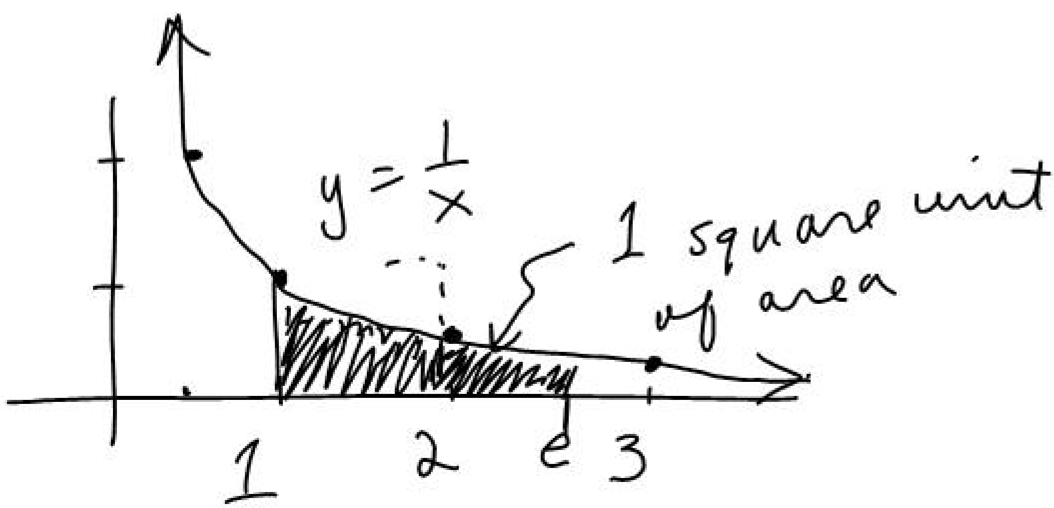
$= 30\cdot24$

$= 720$

$0! = 1$

$$e = \frac{1}{0!}+\frac{1}{1!}+\frac{1}{2!}+\frac{1}{3!}+\frac{1}{4!}+\cdots$$

(3)



$\ln 2$

Evaluating Logarithms

$$\boxed{\log_b a = L}$$

logarithm

base

argument

same statement

$$\boxed{b^L = a}$$

Ex. $\log_{10} \frac{1}{1000} = \boxed{-3}$

$$10^{\square} = \frac{1}{1000} = \frac{1}{10^3} = 10^{-3}$$

Ex. $\log_9 27 = \boxed{\frac{3}{2}}$

$$9^{\square} = 27$$

$$3^{2\square} = 3^3$$

Ex. $\log_2 \frac{1}{\sqrt[3]{2}} = \boxed{-\frac{1}{3}}$

$$2^{\square} = \frac{1}{\sqrt[3]{2}} = \frac{1}{2^{1/3}} = 2^{-1/3}$$

Ex. $\ln \sqrt{e} = \boxed{\frac{1}{2}}$

$\log_e \sqrt{e}$ <u>The natural logarithm</u>

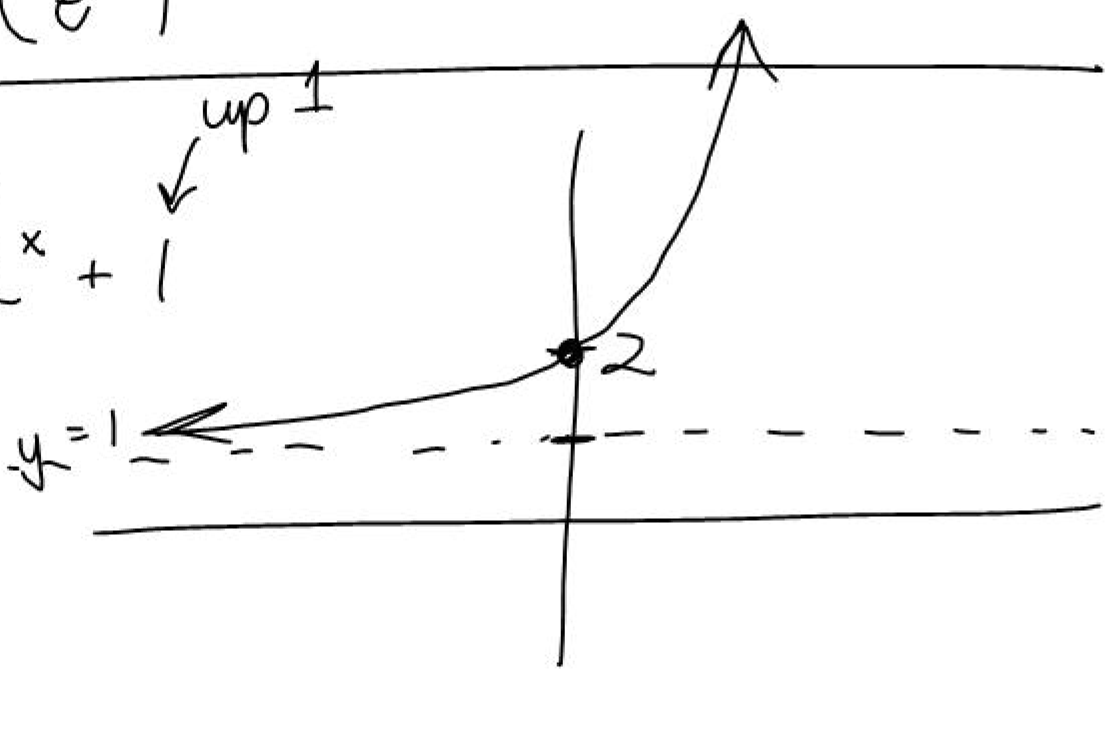
$$e^{\square} = \sqrt{e}$$

Ex. $\ln\left(\frac{1}{e^3}\right) = \boxed{-3}$

<u>Graphing</u>

up 1

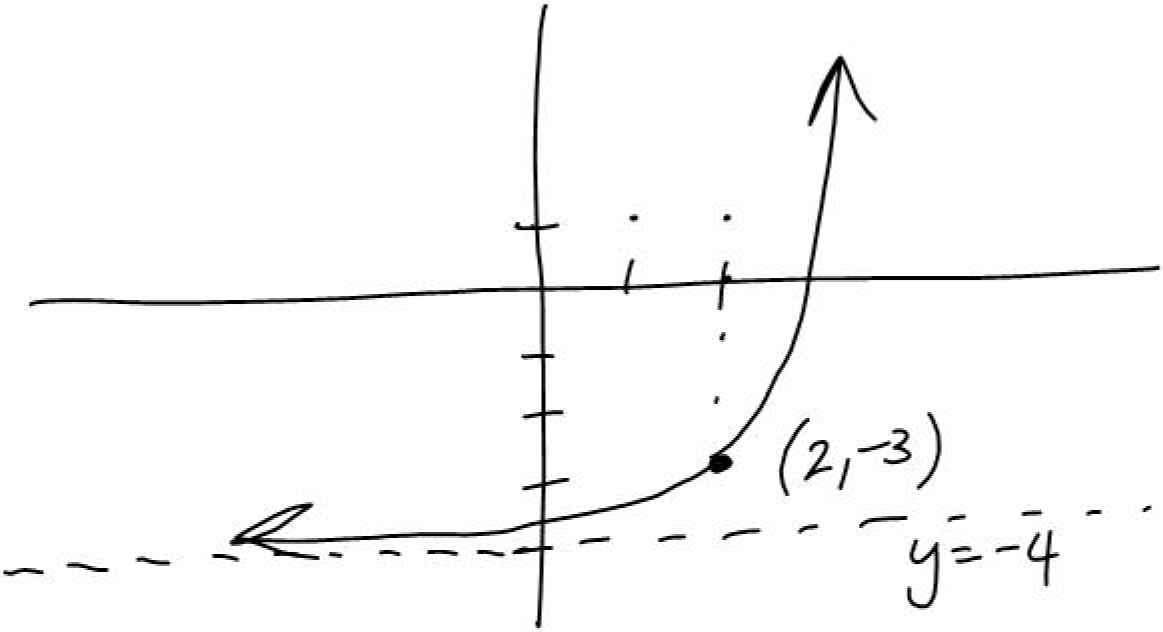
$y = 2^x + 1$



2 right

Ex. $y = 3^{x-2} - 4$

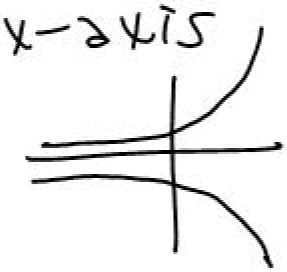
down 4

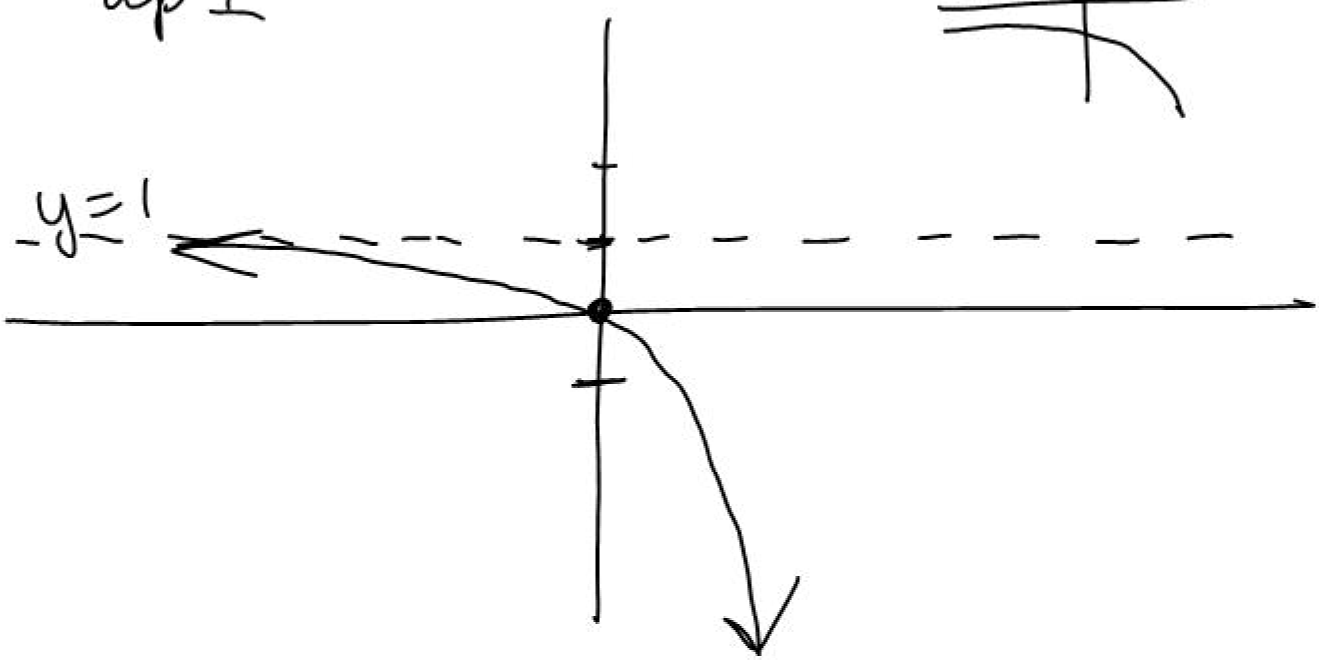


Ex. $y = 1 - 4^x$

flip around the x-axis

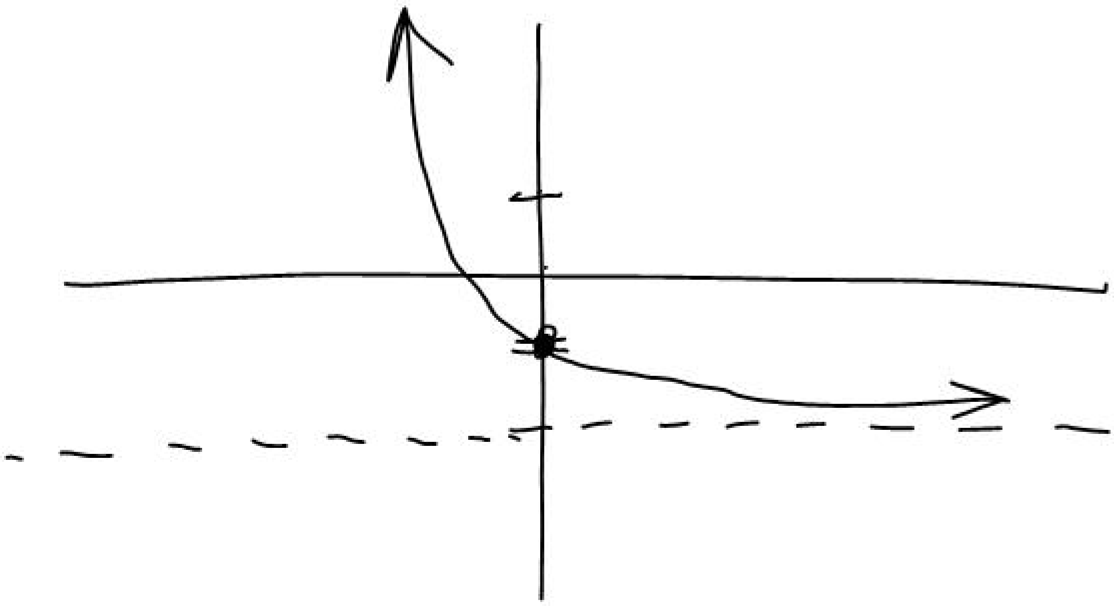
up 1





ex. $y=\left(\frac{1}{2}\right)^{x}-2$

$0 < \text{base} < 1 \rightarrow$ exponential decay

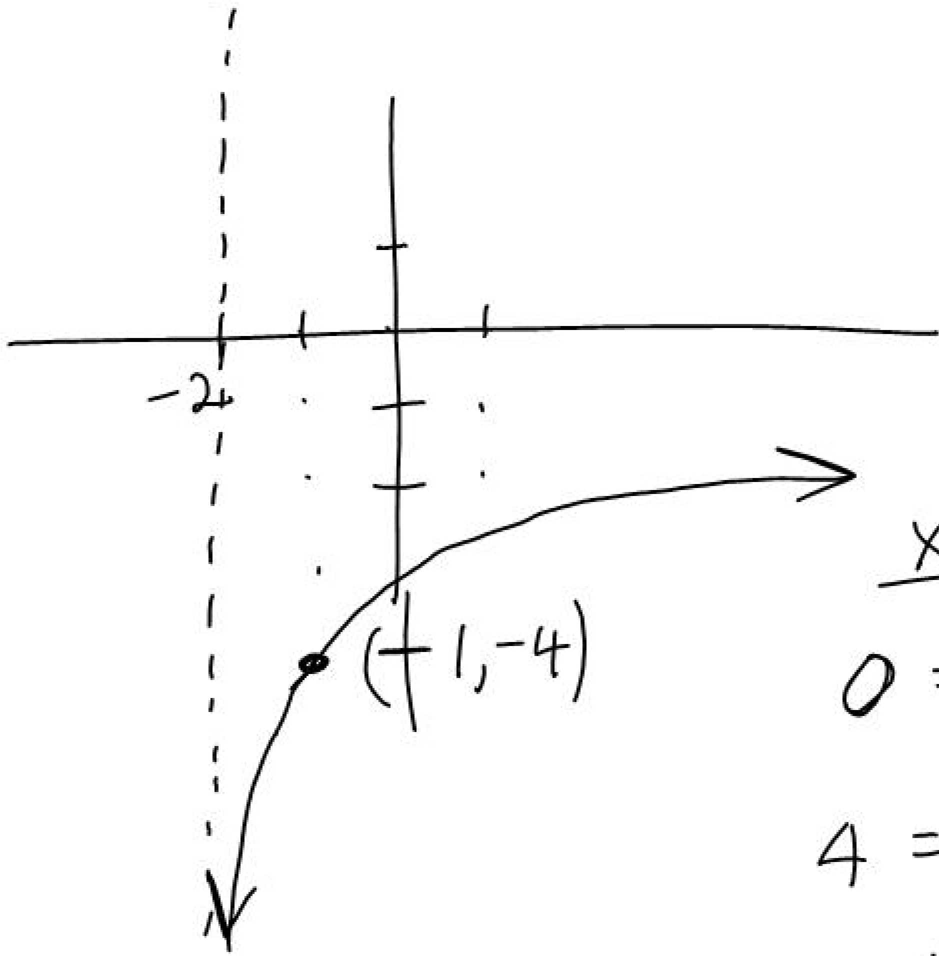


$\cancel{y=(-2)^{x}}$ $\cancel{y=1^{x}}$ $\boxed{0<b<1 \text{ or } b>1}$

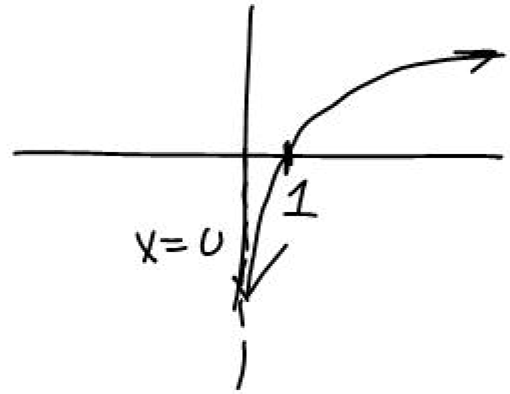
$\underbrace{0<b<1}_{\text{decay}} \text{ or } \underbrace{b>1}_{\text{growth}}$

left down 4

Ex. $y = \log_5(x+2) - 4$



$y = \log_3 x$



x-intercept

$0 = \log_5(x+2) - 4$

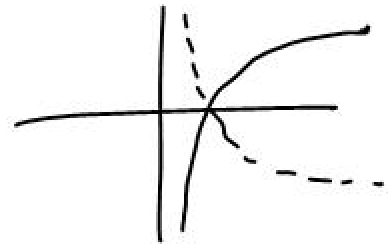
$4 = \log_5(x+2)$

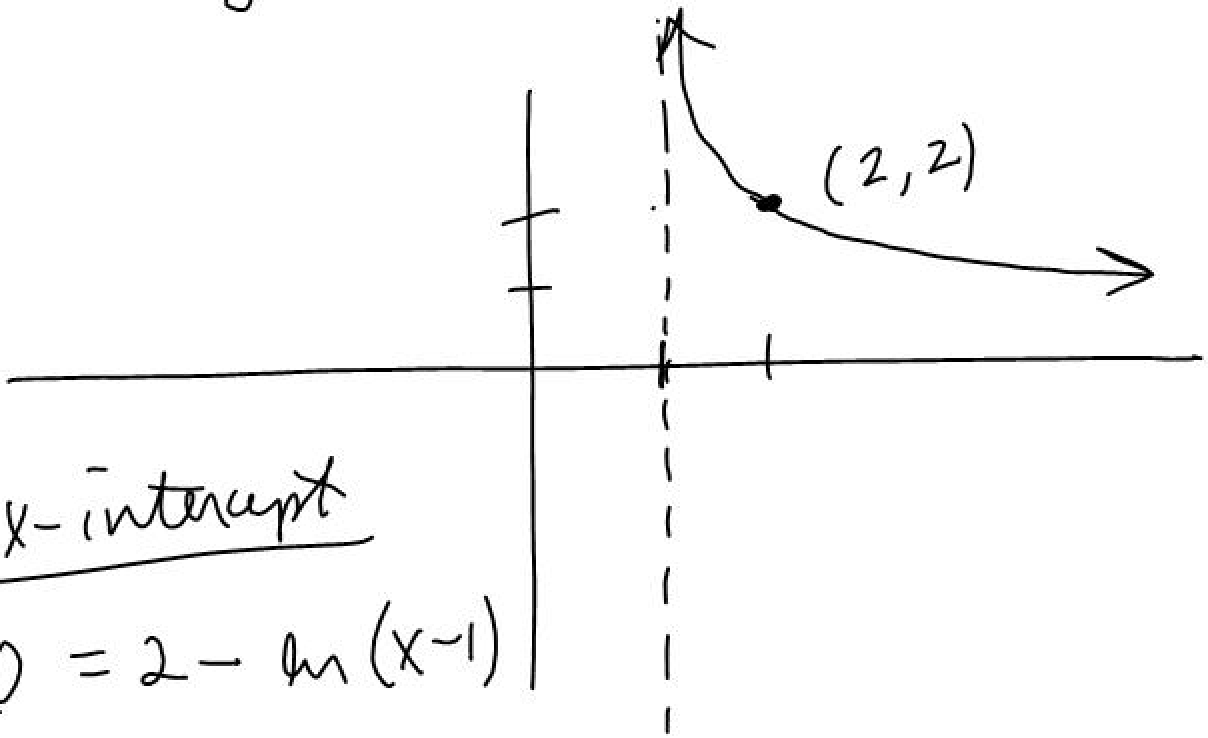
$5^4 = x + 2$

$625 = x + 2$

$623 = x$

Ex. $y = 2 - \ln(x-1)$





x-intercept

$0 = 2 - \ln(x-1)$

$\ln(x-1) = 2$

$e^2 = x - 1$

$e^2 + 1 = x$

$x \approx 8.4$

p. 322

#5. $8^1 = 8$

$8^2 = 64$

$\log_8 4 = \frac{2}{3}$

$\log_8 512 = 3$

HW p.322 #6, 8, 10, 12, 14, 15, 17

#19-28

Log graphs #1, 3, 5, 7, 9

Exp graphs #1, 3, 5, 7, 9