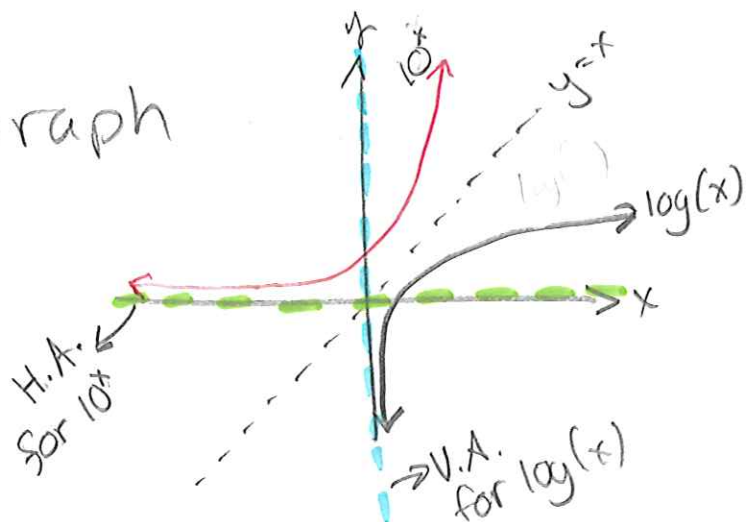


## 4.4. Log Part II

Assign 4.4: 59, 62, 63-70,  
71, 73, 87, 89,  
93, 97, 99, 101,  
103, 121, 122

Graph



- the inverse of  $\log(x)$  is exp. fnn ( $10^x$ )
  - the graphs are reflections of each other over  $y=x$
- V.A. = vertical asymptote  
H.A. = horizontal asymptote

### Properties of graph of $\log_a(x)$ [a = base]

- ① D:  $(0, \infty)$  R:  $(-\infty, \infty)$
- ② x intercept is 1. No y-intercept
- ③  $x=0$  or the y-axis is a vertical asymptote
- ④ the graph contains the points  $(1, 0)$ ,  $(a, 1)$ ,  $(\frac{1}{a}, -1)$
- ⑤ the graph is smooth + continuous

natural log is  $\ln$

$\ln$  is log w/ base e

$$\log_e(x) = \ln(x)$$

$$y = \ln(x) \text{ if and only if } x = e^y$$

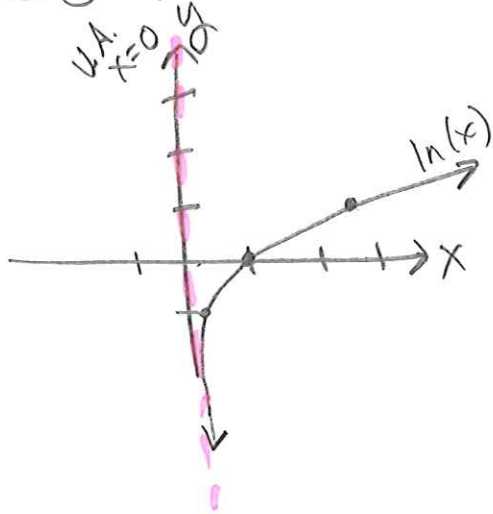
so  $y = e^x$  is the inverse of  $y = \ln x$

Graph  $f(x) = -\ln(x-2)$

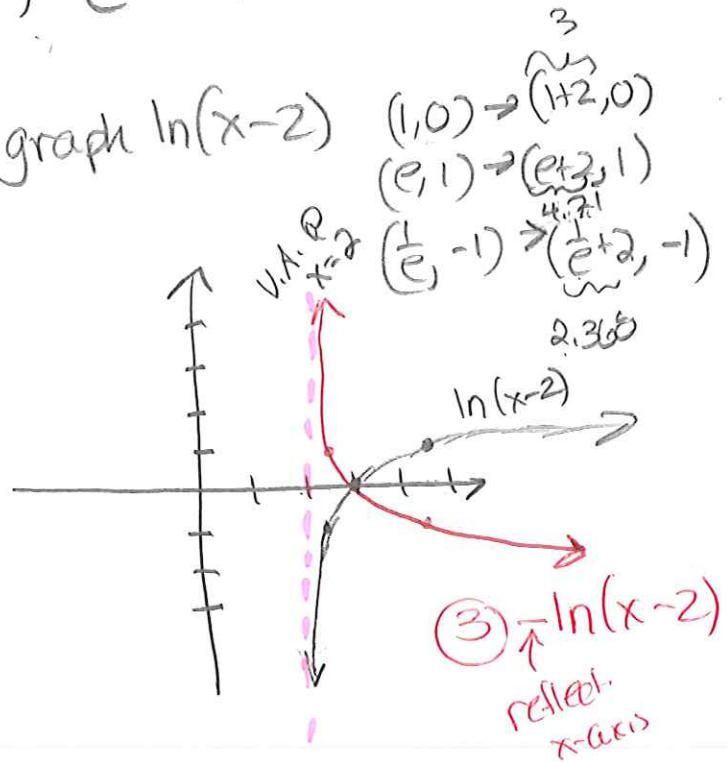
base is  $e \therefore (1,0), (e,1), (\frac{1}{e}, -1)$  are contained in graph of  $\ln(x)$

$e \approx 2.71, \frac{1}{e} \approx .368$

① graph  $\ln(x)$



② graph  $\ln(x-2)$



find  $f^{-1}(x)$

$f(x) = -\ln(x-2)$

$y = -\ln(x-2)$  [switch  $x \leftrightarrow y$ ]

$x = -\ln(y-2)$  [divided by -1]

$-x = \ln(y-2)$

$e^{-x} = e^{\ln(y-2)}$  [raised each side to the exponent of "e"]

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

$y = e^{-x} + 2$

$\therefore f^{-1}(x) = e^{-x} + 2$

to graph  $e^{-x} + 2$

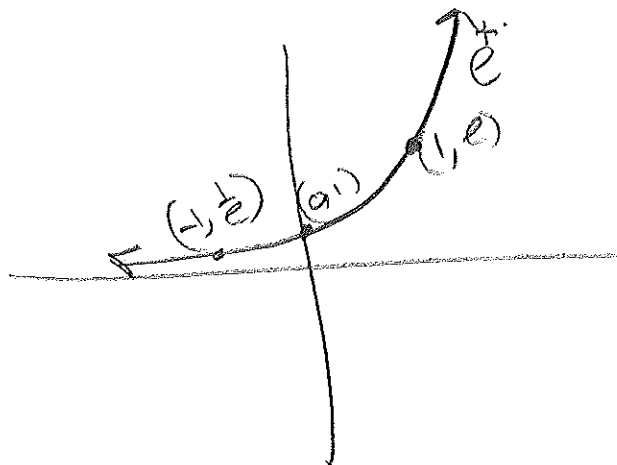
① graph  $e^x$

② reflect y-axis

③ shift up 2 units

To graph  $y = e^x$

x	$e^x$	y
-1	$e^{-1}$	$\frac{1}{e}$
0	$e^0$	1
1	$e^1$	e



## Solving

use properties:  $\ln(e^x) = x$   
 $e^{\ln x} = x$

$$\log(10^x) = x$$
$$10^{\log(x)} = x$$

ex)  $\ln(e^4) = 4$

$$\log_2(2^5) = 5$$

$$\log_7(7^{13}) = 13$$
$$3^{\log_3(11)} = 11$$

A. Solve  $\log_3(4x-7) = 2$

$$3^2 = 4x - 7$$

$$9 = 4x - 7$$

$$16 = 4x$$

$$\boxed{x = 4}$$

changed to  
exp. form

add "7"  
divide "4"

B.  $e^{2x} = 5$  (variable is stuck in exponent)

$$\ln(e^{2x}) = \ln(5) \quad [\text{take } \ln \text{ of both sides}]$$

$$2x = \ln(5) \quad [\ln(e) \text{ cancels}]$$

$$x = \frac{\ln(5)}{2} \quad [\text{divide by } 2]$$

$$\boxed{x \approx .805}$$

