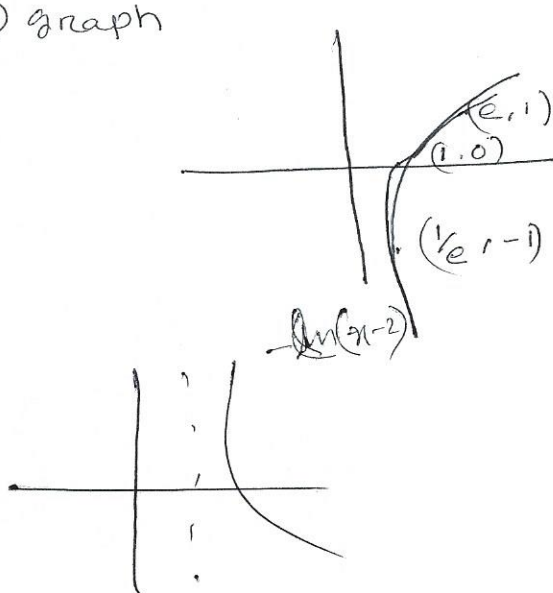


$$f(x) = -\ln(x-2)$$

(a) domain:  $x-2 > 0$   
 $x > 2$   
 $\{x > 2\}$   
 $(2, \infty)$

(b) graph



$$y = \ln x$$

vertical  
reflection

$$y = -\ln x$$

(c) Range:  $\mathbb{R} (-\infty, \infty)$   
 v-asymptote  $x = 2$

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

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

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

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

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

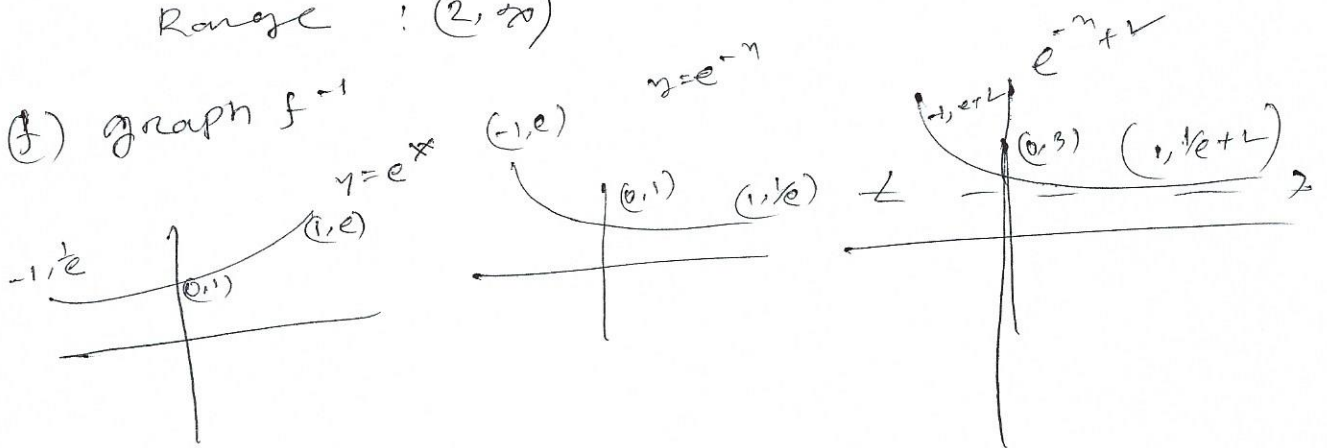
$$f^{-1}(x) = e^{-x} + 2$$

(e) find domain, range  $f^{-1}$

domain:  $\mathbb{R}$

Range:  $(2, \infty)$

(f) graph  $f^{-1}$



$$f(x) = 3 \log(x-1)$$

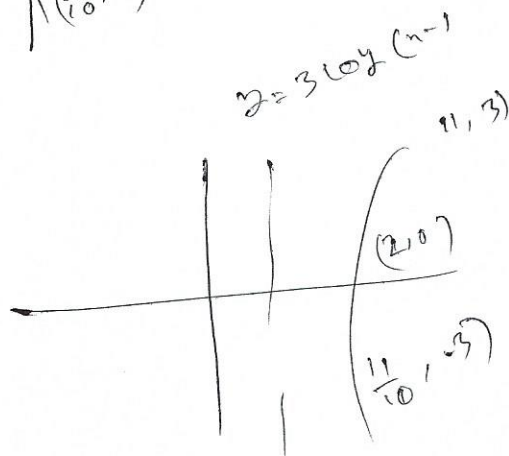
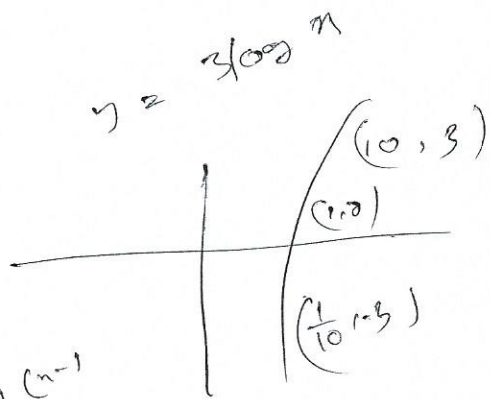
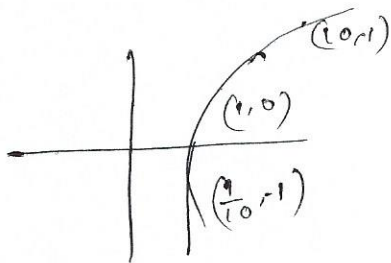
(a) domain  $x-1 > 0$

$$x > 1$$

$(1, \infty)$

(b) graph

$$y = \log x$$



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

$$y = 3 \log(x-1)$$

$$x = 3 \log(y-1)$$

$$x/3 = \log(y-1)$$

(e) find domain, range  $f^{-1}$ :

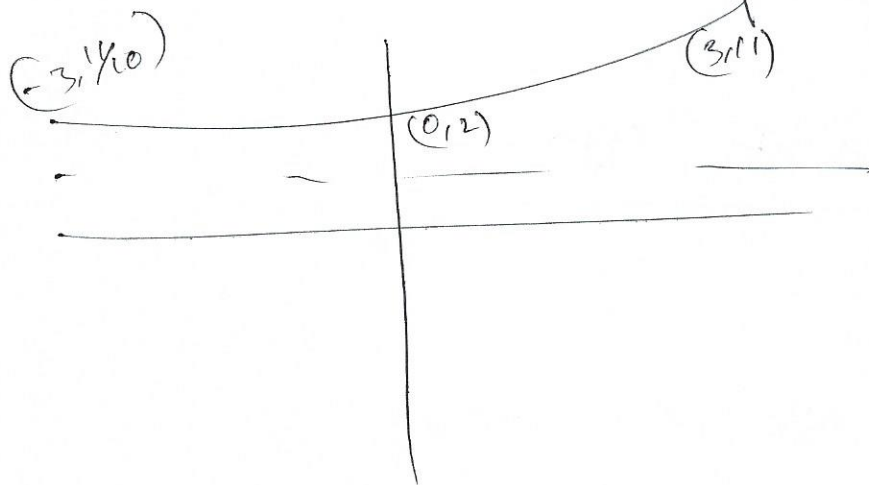
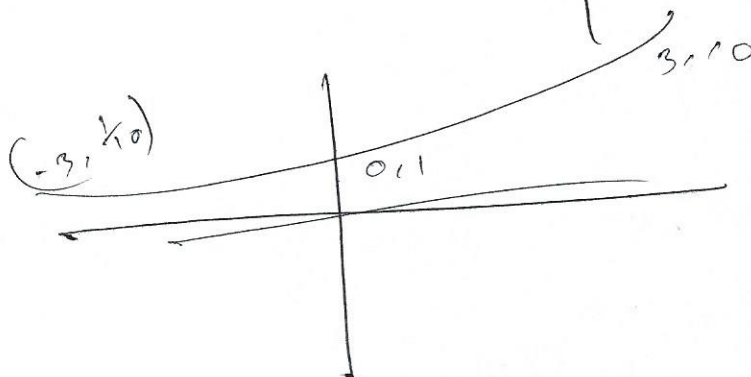
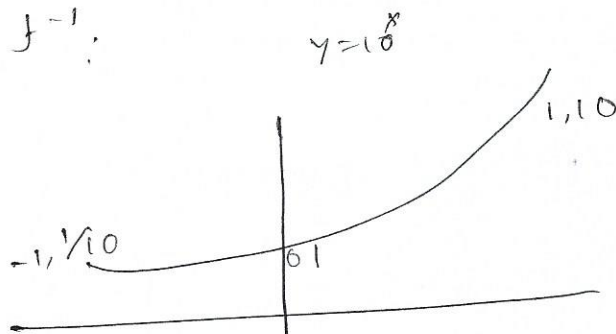
$$D: \mathbb{R}$$

$$R: (1, \infty)$$

$$10^{x/3} = y-1$$

$$f^{-1}(y) = x = 10^{y/3} - 1$$

| x  | y    |
|----|------|
| 0  | 1    |
| 3  | 10   |
| -3 | 1/10 |



## Logarithm equation.

check for extraneous roots,  $a > 0, a \neq 1$

$$\textcircled{a} \log_3(4n-7) = 2$$

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

$$4n = 16$$

$$n = 4$$

$$\textcircled{b} \log_x 64 = 2$$

$$x^2 = 64$$

$$x = \pm 8$$

exclude  $-8$ ,  $x > 0$

$\{8\}$ .

$$e^{2n} = 5$$

$$\ln 5 = 2n$$

$$n = \frac{\ln 5}{2}$$

## 9.5 Properties of Logs

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$$\log_a 1 = 0$$

$$\log_a a = 1$$

In following:  $M, a > 0, a \neq 1, n \in \mathbb{R}$

$${}_a(\log_a M) = M$$

$$\log_a(MN) = \log_a M + \log_a N$$

$$\log_a(M/N) = \log_a M - \log_a N$$

$$\log_a M^r = r \log_a M$$

$$a^x = e^{x \ln a} = (e^{\ln a})^x$$

ex: write the expression as sum of logs. Express all powers as factors.

$$\log_a(x \sqrt{x^r+1}), \quad x > 0$$

$$\log_a x + \log_a (\sqrt{x^r+1})^{1/2}$$

$$\log_a x + \frac{1}{2} \log_a (x^r+1)$$

ex:  $\ln \frac{x^r}{(x-1)^3}, \quad x > 1$

$$r \ln x - 3 \ln (x-1)$$

ex: write the expression as single log.

$$\log_a 7 + 4 \log_a 3$$

$$\log_a 7 + \log_a 3^4$$

$$\log_a (7 \cdot 3^4)$$

$$\log_a 567$$

ex  $\frac{2}{3} \ln 8 - \ln(5^2 - 1)$

$$\ln(8)^{2/3} - \ln 24$$

$$\ln(8^{1/3})^2 - \ln 24$$

$$\ln 2^2 - \ln 24$$

$$\ln(4 - 24)$$

$$\ln \frac{4}{24} = \ln \frac{1}{6} = \ln 6^{-1} = -\ln 6.$$

Due to one-to-one characteristic of logarithms

$$\text{If } M=N, \text{ then } \log_a M = \log_a N$$

$$\text{If } \log_a M = \log_a N, \text{ then } M=N.$$

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Presentation

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