

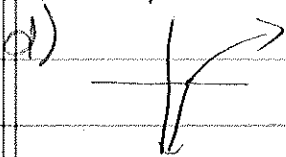
Sec 1.6 day 2 page 70 (33-42, 49-51, 53, 55, 59)

33) a) as the inverse of the exponential function,

$$\log_a x = y \Leftrightarrow a^y = x$$

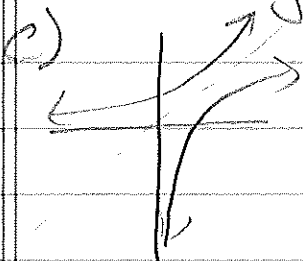
b) $(0, \infty)$

c) $(-\infty, \infty)$



34) a) is the log with base e denoted $\ln a$

b) is the log with base 10 denoted $\log a$



35) a) $\log_5 125 = \log_5 5^3 = \boxed{3}$

b) $\log_3 \frac{1}{27} = \log_3 3^{-3} = \boxed{-3}$

36) a) $\ln \frac{1}{e} = \ln e^{-1} = \boxed{-1}$

b) $\log_{10} \sqrt{10} = \log_{10} 10^{1/2} = \boxed{1/2}$

37) a) $\log_2 6 - \log_2 15 + \log_2 20 = \log_2 \left(\frac{6 \cdot 20}{15} \right) = \log_2 8 = \boxed{3}$

b) $\log_3 100 - \log_3 18 - \log_3 50 = \log_3 \frac{100}{90} - \log_3 50$
 $= \log_3 \frac{10}{9} - \log_3 50 = \log_3 \left(\frac{10}{9 \cdot 50} \right) = \log_3 \frac{1}{45} = \log_3 3^{-2} = \boxed{-2}$

38) a) $e^{-2 \ln 5} = e^{\frac{1}{2} \ln 25} = \boxed{\frac{1}{25}}$

b) $\ln(\ln e^{e^{10}}) = \boxed{10}$

$$(39) \ln 5 + 5 \ln 3 = \ln 5(3)^5 = \boxed{\ln 1215}$$

$$(40) \ln(a+b) + \ln(a-b) - 2 \ln c \\ = \ln\left(\frac{(a+b)(a-b)}{c^2}\right) = \boxed{\ln\left(\frac{a^2-b^2}{c^2}\right)}$$

$$(41) \ln(1+x^2) + \frac{1}{2} \ln x - \ln \sin x \\ \ln\left(\frac{(1+x^2)\sqrt{x}}{\sin x}\right) = \ln\left(\frac{\sqrt{x} + x^{5/2}}{\sin x}\right) \text{ or } \ln\left(\frac{(1+x^2)\sqrt{x}}{\sin x}\right)$$

$$(42) a) \log_2 10 = \frac{\ln 10}{\ln 2} = 0.926628$$

$$b) \log_2 8.4 = \frac{\ln 8.4}{\ln 2} \approx 3.070389$$

$$(49) a) e^{7-4x} = 6 \\ 7-4x = \ln 6 \\ \boxed{x = \frac{-(\ln 6 - 7)}{4}}$$

$$b) \ln(3x-10) = 2 \\ 3x-10 = e^2 \\ \boxed{x = \frac{e^2 + 10}{3}}$$

$$(50) a) \ln(x^2-1) = 3 \\ x^2-1 = e^3 \\ \boxed{x = \pm \sqrt{e^3 + 1}}$$

$$b) e^{2x} - 3e^x + 2 = 0 \\ (e^x - 1)(e^x - 2) = 0 \\ e^x - 1 = 0 \quad e^x - 2 = 0 \\ e^x = 1 \quad e^x = 2 \\ x = \ln 1 \quad \boxed{x = \ln 2} \\ \boxed{x = 0}$$

$$51) a) 2^{x-5} = 3$$

$$x-5 = \log_2 3$$

$$\boxed{x = \log_2 3 + 5}$$

$$b) \ln x + \ln(x-1) = 1$$

$$x^2 - x = e^1$$

$$x^2 - x - e^1 = 0$$

$$x = \frac{1 \pm \sqrt{1+4e}}{2}$$

$$53) a) e^x < 10$$

$$\boxed{x < \ln 10}$$

$$b) \ln x > -1$$

$$\boxed{x > e^{-1}}$$

$$55) y = \sqrt{3 - e^{2x}}$$

$$x = \sqrt{3 - e^{2y}}$$

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

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

$$\boxed{\frac{1}{2} \ln(3 - x^2) = y}$$

$$D = 3 - x^2 > 0$$

$$x^2 < 3$$

$$|x| < \sqrt{3}$$

$$(0, \sqrt{3}) \quad \text{b/c } x \geq 0$$

$$a) 3 - e^{2x} \geq 0$$

$$3 \geq e^{2x}$$

$$\ln 3 \geq 2x$$

$$\frac{1}{2} \ln 3 \geq x$$

$$D = (-\infty, \frac{1}{2} \ln 3]$$

$$57) a) t = 100 \cdot 2^{n/3}$$

$$\frac{t}{100} = 2^{n/3}$$

$$\log_2 \frac{t}{100} = \frac{n}{3} \Rightarrow f^{-1}(t) = f(n) = 3 \log_2 \left(\frac{n}{100} \right)$$

$$b) n = 50,000 \quad f(50,000) = 3 \log_2 \frac{50,000}{100} = 3 \log_2 500 \\ \approx \underline{\underline{26.9 \text{ hrs}}}$$