4.4

→ 4) a) $\log_2(8\sqrt{2}) = \log_2(2^3 2^{\frac{1}{2}}) = \log_2(2^{\frac{7}{2}}) = \boxed{\frac{7}{2}}$

b) $\log_{\frac{2}{3}}\left(\frac{4}{25}\right) = \log_{\frac{2}{5}}\left(\left(\frac{2}{5}\right)^2\right) = \boxed{2}$

c) $\ln(e) = \log_e(e) = \log_e(e^1) = \boxed{1}$

d) $\log_4(-2)$, **undefined**

6) a) $10^k = 7.5 \longleftrightarrow \boxed{\log_{10}(7.5) = k}$

b) $e^{-2t} = m \longrightarrow \boxed{\ln(m) = -2t}$

→ 7) a) $\log_5(2t) = M \longrightarrow \boxed{5^M = 2t}$

b) $\log_{\frac{x}{2}}(4t) = 5 \longrightarrow \boxed{\left(\frac{x}{2}\right)^5 = 4t}$

9) a) $\log 13.4 \approx \boxed{1.1271}$

b) $\log 0.0135 \approx \boxed{-1.8697}$

c) $\ln 8.4 \approx \boxed{2.1282}$

d) $\ln 0.075 \approx \boxed{-2.5903}$

→ 14) a) $\ln(2x^3) = \ln(2) + \ln(x^3) = \boxed{\ln(2) + 3\ln(x)}$

b) $\log\left(\frac{3v}{w^2}\right) = \log(3v) - \log(w^2) =$

$= \log(3) + \log(v) - \log(w^2)$

$= \boxed{\log(3) + \log(v) - 2\log(w)}$

15) a) $\ln\left(\sqrt{1-x}\right) = \ln\left((1-x)^{\frac{1}{2}}\right) = \boxed{\frac{1}{2}\ln(1-x)}$

b) $\log_2\left(\frac{1}{\sqrt{x^2-9}}\right) = \log_2\left((x^2-9)^{-\frac{1}{2}}\right) = -\frac{1}{2}\log_2(x^2-9)$

$= -\frac{1}{2}\log_2((x-3)(x+3))$

$= \boxed{-\frac{1}{2}\log(x-3) - \frac{1}{2}\log(x+3)}$

16) c) $\log_{11}\left(\sqrt[3]{\frac{x}{5}}\right) = \log_{11}\left(\left(\frac{x}{5}\right)^{\frac{1}{3}}\right) = \frac{1}{3}\log_{11}\left(\frac{x}{5}\right)$

$= \boxed{\frac{1}{3}\log_{11}(x) - \frac{1}{3}\log(5)}$

b) $\ln\left(\frac{y}{\sqrt{x^2-25}}\right) = \ln(x) - \ln\left((x-5)(x+5)\right)^{\frac{1}{2}}$

$= \boxed{\ln(x) - \frac{1}{2}\ln(x-5) - \frac{1}{2}\ln(x+5)}$

19) a) $2\log(a-3) - \log(a+4) = \log(a-3)^2 - \log(a+4)$

$= \boxed{\log\left(\frac{(a-3)^2}{(a+4)}\right)}$

b) $\log_2(x^2-3) - \log_2(y) - \log_2(z)$

$= \log_2\left(\frac{x^2-3}{y}\right) - \log_2(z) = \boxed{\log_2\left(\frac{x^2-3}{yz}\right)}$

22) a) $\frac{1}{2}\ln(2y) + \ln(x^4+4x) = \ln\left(\sqrt{2y}\right) + \ln(x^4+4x)$

$= \boxed{\ln\left(\sqrt{2y}\,(x^4+4x)\right)}$

b) $\log(12z) + \frac{1}{3}\log(z) - \log(4z)$

$= \log(12z) + \log\left(\sqrt[3]{z}\right) - \log(4z)$

$= \log\left(12z\sqrt[3]{z}\right) - \log(4z)$

$= \log\left(\frac{12z\sqrt[3]{z}}{4z}\right) = \boxed{\log\left(3\sqrt[3]{z}\right)}$

23) a) $e^{\ln(5y)} = \boxed{5y}$

b) $10^{1+\log x} = 10 \cdot 10^{\log x} = \boxed{10x}$

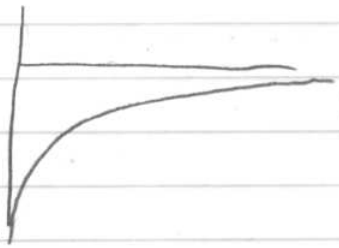
c) $\left(\frac{1}{2}\right)^{\log_2(4x)} = 2^{-\log_2(4x)} = 2^{\log_2\left(\frac{1}{4x}\right)} = \boxed{\frac{1}{4x}}$

27) $f(x) = \ln(x^2 - 16)$. The input of ln needs to be positive, so:

$x^2 - 16 > 0 \rightarrow x^2 > 16$

$\rightarrow \boxed{x > 4, \quad x < -4}$

34)



x-intercept is $x = 10,000$.
vertical asymptote is
$x = 0$.

36)

x-intercept is $x \approx 10.389$.
vertical asymptote is
$x = 3$

39) a) $\log_b(2x+y) \stackrel{?}{=} \log_b(2x) + \log_b(y)$ False

b) $\ln(a - b^2) \stackrel{?}{=} \ln(a) - \ln(b^2)$ False

c) $\log\left(\frac{1}{5d}\right) \stackrel{?}{=} -\ln(5d)$ True

d) $\log_k(10) \stackrel{?}{=} 1$ True

42) a) $\frac{\log_b(y)}{\log_b(x)} \stackrel{?}{=} \log_b(y-x)$ False

b) $(\ln(x))(\ln y) \stackrel{?}{=} \ln(xy)$ False

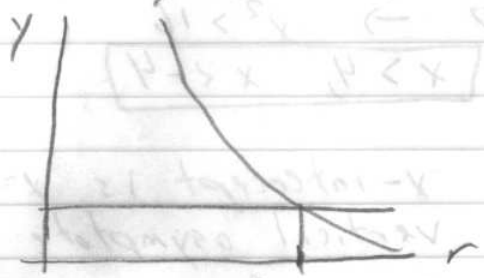
c) $\log_{\frac{1}{b}}(b) \stackrel{?}{=} -1$ True

d) $\ln(3c) \stackrel{?}{=} (\ln c)^3$ False

49) $N(r) = -5000 \ln r$

a) $N(.32) = -5000 \ln .32 \approx 5697$ years

b) Plot $y = 1300$ and $y = -5000 \ln r$



$r \approx 0.77$

53) $dB = 10 \log I + 120$

a) $I = 10^{-10} \rightarrow dB = 10 \log 10^{-10} + 120$

$= 10(-10) + 120$

$= -100 + 120$

$= \boxed{20}$

b) $I = 10^{3} \rightarrow dB = 10 \log 10^{3} + 120$

$= 10(3) + 120$

$= 30 + 120$

$= \boxed{150}$