#28. $\log_3 \frac{1}{9} = \log_3 \frac{1}{3^2} = \log_3 3^{-2}$

$\log_3 \underline{\underline{3^{-2}}} = \boxed{-2}$

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

#32. $\log_3 \frac{1}{\sqrt{3}} = \log_3\left(\frac{1}{3^{1/2}}\right)$

$= \log_3 3^{-1/2} = \boxed{-\frac{1}{2}}$

$3^{\square} = 3^{-1/2}$

#36. $\log_{11} \underline{11} = \boxed{1}$

$11^{\square} = 11$

#92. $\ln \frac{1}{e^7}$

$= \log_e e^{-7} = \boxed{-7}$

$e^{\square} = e^{-7}$

Explain what $\log_5 2$ means.

It is the number to which we can raise 5 to get 2.

$$5^{\log_5 2} = 2$$

$$3^2 \cdot 3^4 = 3^{2+4}$$

$$(3\cdot 3)(3\cdot 3\cdot 3\cdot 3) =$$

Ex. $$2^{\log_2 3 + \log_2 4}$$

$$\boxed{a^m \cdot a^n = a^{m+n}}$$

$$= 2^{\log_2 3} \cdot 2^{\log_2 4}$$

$$\boxed{\log a + \log b = \log(ab)}$$

1

$$= 3 \cdot 4 = 12$$

$$2^{\log_2 (3\cdot 4)} = 2^{\log_2 12} = 12$$

$$\log_2 3 + \log_2 4 = \log_2 (3\cdot 4)$$

Consider: $\underbrace{\log 5 + \log 5} + \underbrace{\log 5 + \log 5}$

$$\underbrace{\log 5^2 + \log 5^2}$$

$$4 \cdot \log 5 = \underline{\log 5^4}$$

2 $\boxed{a \cdot \log b = \log b^a}$

Consider: $\log a - \log b$

$= \log a + \log b^{-1}$ (see previous rule)

$= \log(a\, b^{-1})$

$\boxed{\log a - \log b = \log\left(\frac{a}{b}\right)}$ 3

Change of Base Rule

$$\boxed{\log_b x = \frac{\log_{10} x}{\log_{10} b}}$$ old base

$$\boxed{\log_b x = \frac{\ln x}{\ln b}}$$

$\boxed{\log}$ $\log_{10}$

$\boxed{\ln}$ $\log_e$

Ex $\log_5 10 = \dfrac{\log 10}{\log 5} \approx 1.43$

---

p 421

#13 $\ln\left(\dfrac{e^2}{5}\right) = \ln e^2 - \ln 5$

$= \underline{2 - \ln 5}$

#29 $\log_{10}\sqrt{100x} = \log_{10}(100x)^{1/2}$

$= \frac{1}{2}\cdot\log_{10}(100x) = \frac{1}{2}\left[\cancel{\log_{10} 100}^{2} + \log_{10} x\right]$

$= \underline{1 + \frac{1}{2}\log_{10} x}$

#33. $\log_b\left(\dfrac{\sqrt{x}\,y^3}{z^3}\right)$

$= \underbrace{\log_b(\sqrt{x}\,y^3)} - \log_b z^3$

$= \log_b\sqrt{x} + \log_b y^3 - \log_b z^3$

$= \frac{1}{2}\log_b x + 3\log_b y - 3\log_{10} z$

#57. $\ln x - \frac{1}{3}\ln y$

$= \ln x^3 - \ln\sqrt[3]{y}$

$= \ln\left(\dfrac{x^3}{\sqrt[3]{y}}\right)$

#65. $\frac{1}{2}\left(\underbrace{\log_5 x + \log_5 y}\right) - 2\log_5(x+1)$

$= \frac{1}{2}\log_5(xy) - 2\log_5(x+1)$

$= \log_5\sqrt{xy} - \log_5(x+1)^2$

$= \log_5\left(\dfrac{\sqrt{xy}}{(x+1)^2}\right)$

Log Equations (using the condensing process)

Ex. $\underbrace{\log_4(x+2) - \log_4(x-1)}$ $= 1$

$$\log_4\left(\frac{x+2}{x-1}\right) = 1$$

$\log_4 16 = \boxed{2}$

$4^{\square} = 16$

$$4^1 = \frac{x+2}{x-1}$$

$$4(x-1) = x+2$$

$$4x-4 = x+2$$

$$3x = 6$$

$$\boxed{x = 2}$$

you must check all answers from a log equation.

Ex. $\log_2(x-6)+\log_2(x-4)-\log_2 x=2$

$$\log_2(x-6)(x-4)-\log_2 x=2$$

log form: $\boxed{\log_2 \frac{x^2-10x+24}{x}}=2$

exponential form: $2^2=\frac{x^2-10x+24}{x}$

$$4x=x^2-10x+24$$

$$0=x^2-14x+24$$

$$0=(x-2)(x-12)$$

$\cancel{x=2}$ or $\boxed{x=12}$

$$\log_2(12-6)+\log_2(12-4)-\log_2 12$$

$$=\log_2 6+\log_2 8-\log_2 12$$

$$=\log_2\frac{48}{12}=\log_2 4=2\ \checkmark$$

$\boxed{\text{HW}}$ <u>p. 421</u>

expand # 14, 21, 24, 27, 32

condense # 49, 51, 58, 66

solve <u>p. 433</u> # 65, 67, 74

$$\log(x+y) \neq \log x + \log y$$

$$\log x + \log y = \log(xy)$$

$$\sqrt{x+y} \neq \sqrt{x} + \sqrt{y}$$

$$\sin(x+y) \neq \sin x + \sin y$$