#68 $\log_2(x-1) + \log_2(x+1) = 3$

logform: $\log_2[(x-1)(x+1)] = 3$

expform: $2^3 = x^2 - 1$

$9 = x^2$

$\boxed{x = 3}$ ✓ ~~-3~~

$\log_2(3-1) + \log_2(3+1)$

$1 + 2 = 3$ ✓

~~$\log_2(-3-1)$~~

$\log_2 8 - \log_2 4$

#69 $\log_2(x+2) - \log_2(x-5) = 3$

$\log_2 \frac{x+2}{x-5} = 3$

$8 \quad 2^3 = \frac{x+2}{x-5}$

$8x - 40 = x + 2$

$7x = 42$

$\boxed{x = 6}$

#36. $\log_2 \sqrt[5]{\frac{x y^4}{16}} = \log_2 \frac{x^{\frac{1}{5}} y^{\frac{4}{5}}}{16^{1/5}}$

$= \log_2 (x^{1/5} \cdot y^{4/5}) - \log_2 16^{1/5}$

$= \log_2 x^{1/5} + \log_2 y^{4/5} - \frac{1}{5} \log_2 16^4$

$= \frac{1}{5} \log_2 x + \frac{4}{5} \log_2 y - \frac{4}{5}$

#61 $3 \ln x + 5 \ln y - 6 \ln z$

$= \ln x^3 + \ln y^5 - \ln z^6$

$= \ln (x^3 \cdot y^5) - \ln z^6$

$= \ln \left(\frac{x^3 y^5}{z^6} \right)$

#52 $\frac{1}{3}\ln x + \ln y$

$= \ln x^{1/3} + \ln y$

$= \ln\left(x^{1/3} \cdot y\right) = \ln\left(\sqrt[3]{x} \cdot y\right)$

Exponential Equations

↑ variable in the exponent

Ex. $5^x = 125$

$x = 3$

Ex. $5^x = 10$ ✱ $\log a^b = b \cdot \log a$

$\ln 5^x = \ln 10$

$\frac{x \cdot \cancel{\ln 5}}{\cancel{\ln 5}} = \frac{\ln 10}{\ln 5}$

$$x = \frac{\ln 10}{\ln 5}$$

Ex. $2^x = 3^{x+1}$ ⟩ take the log of both sides

$\ln 2^x = \ln 3^{x+1}$

$x \cdot \ln 2 = (x+1)\ln 3$

$x \cdot \ln 2 = x \cdot \ln 3 + \ln 3$

$-x \ln 3 \qquad -x \cdot \ln 3$

$x \ln 2 - x \ln 3 = \ln 3$

$\dfrac{x(\ln 2 - \ln 3)}{\ln 2 - \ln 3} = \dfrac{\ln 3}{\ln 2 - \ln 3}$

$$\boxed{x = \frac{\ln 3}{\ln 2 - \ln 3}}$$

$\dfrac{5}{10-5} = 1$

$\dfrac{1\cancel{5}}{10-\cancel{5}}$

Ex. #41. $5^{2x+3} = 3^{x-1}$

$\ln 5^{2x+3} = \ln 3^{x-1}$

$(2x+3)\ln 5 = (x-1)\ln 3$

$2x\ln 5 + 3\ln 5 = x\ln 3 - \ln 3$

$2x\ln 5 - x\ln 3 = -\ln 3 - 3\ln 5$

$x(2\ln 5 - \ln 3) = -\ln 3 - 3\ln 5$

$$x = \frac{-\ln 3 - 3\ln 5}{2\ln 5 - \ln 3}$$

mult. by $\frac{-1}{-1}$

(or)

$$x = \frac{\ln 3 + 3\ln 5}{\ln 3 - 2\ln 5}$$

$x \approx -2.80$

43. $e^{2x} - 3e^x + 2 = 0$

$$\downarrow$$

$$(e^x)^2 - 3(e^x) + 2 = 0$$

quadratic equation

$$y = e^x$$

$$y^2 - 3y + 2 = 0$$

$$(y - 1)(y - 2) = 0$$

$$y - 1 = 0 \quad \text{or} \quad y - 2 = 0$$

$$y = 1 \quad \text{or} \quad y = 2$$

un-substitute

$$e^x = 1 \quad \text{or} \quad e^x = 2$$

$$x = 0$$

$$\ln e^x = \ln 2$$

$$x \cdot \cancel{\ln e}^{1} = \ln 2$$

$$x = \ln 2$$

#46. $e^{4x} - 3e^{2x} - 18 = 0$

$(e^x)^4 - 3(e^x)^2 - 18 = 0$

substitute: $y = e^x$

$y^4 - 3y^2 - 18 = 0$

$(y^2 + 3)(y^2 - 6) = 0$

no real solution

$y^2 - 6 = 0$

$y^2 = 6$

$y = \pm\sqrt{6}$

unsubstitute

$e^x = \sqrt{6}$ or $e^x = -\sqrt{6}$

no real solution

$x \cdot \ln e = \frac{1}{2}\ln 6$

$\boxed{x = \frac{1}{2}\ln 6} \approx 0.896$

HW

p. 433 # 23, 24, 29, 30
37, 42, 45, 47

Quiz

p. 421 # 1-68
p. 433 # 23-83

} DO NOT work all these!