

2.4

July 9<sup>th</sup>

(5)  $y = \left(\frac{1}{3}\right)^{1-x} = \frac{1}{3} 3^x = 3^{x-1}$  C  
 (shift  $3^x$  right by 1)

(7)  $y = 3 \cdot 3^x = 3^{x+1}$  F (shift  $3^x$  left by 1)

(9)  $y = 2 - 3^{-x}$  A

(19)  $16^{x+3} = 64^{2x-5}$

$4^{2x+6} = 4^{6x-15}$

$2x+6 = 6x-15$

$21 = 4x$

$x = 21/4$

$(4^2)^{x+3} = (4^3)^{2x-5}$

(25)  $5^{x^2+x} = 1$   $x(x+1) = 0$

$x^2+x=0$   $x=0, -1$

(27)  $27^x = 9^{x^2+x}$   $3x = 2x^2+2x$

$(3^3)^x = (3^2)^{x^2+x}$   $2x^2-x=0$

$3^{3x} = 3^{2x^2+2x}$   $x(2x-1)=0$

$x=0, \frac{1}{2}$

(48)  $f(x) = 500 \cdot 2^{3x}$

(a)  $f(1) = 500 \cdot 2^3 = 4000$  (b)  $f(0) = 500 \cdot 2^0 = 500$

(c)  $f(x) = 2f(0)$ ,  $500 \cdot 2^{3x} = 1000$ ,  $2^{3x} = 2$ ,  $3x = 1$ ,  $x = \frac{1}{3}$

(d)  $32000 = 500 \cdot 2^{3x}$

$2^6 = 64 = 2^{3x}$   $x = 2$

$6 = 3x$

2.5 ①  $5^3 = 125, \log_5 125 = 3$

⑨  $\ln\left(\frac{1}{e}\right) = -1, e^{-1} = \frac{1}{e}$

③  $3^4 = 81, \log_3 81 = 4$

⑩  $\log(100,000) = 5, 10^5 = 100,000$

⑤  $3^{-2} = \frac{1}{9}, \log_3\left(\frac{1}{9}\right) = -2$

⑦  $\log_2(32) = 5, 2^5 = 32$

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⑰  $\log_2\left(\frac{1}{16}\right) = \log_2(2^{-4}) = -4$

⑲  $\log_2\left(\sqrt[3]{\frac{1}{4}}\right) = \log_2(2^{-2/3}) = -\frac{2}{3}$

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⑳  $\ln\left(\frac{3\sqrt{5}}{\sqrt[3]{6}}\right) = \ln 3 + \frac{1}{2}\ln 5 - \frac{1}{3}\ln 6$   
 $= \frac{2}{3}\ln 3 + \frac{1}{2}\ln 5 - \frac{1}{3}\ln 2$

㉓  $\log_b 2 = a, \log_b 3 = c$

$\log_b(72b) = \log_b(3^2 2^3) + \log_b b = 2\log_b 3 + 3\log_b 2 + 1$   
 $= 2c + 3a + 1$

㉔  $\log_5(ax-4) = 1, 5^1 = ax-4, ax = 9, \underline{x=1}$

㉕  $\log_3(x-2) + \log_3(x+6) = 2, \log_3((x-2)(x+6)) = 2$

$3^2 = x^2 + 4x - 12, x^2 + 4x - 24 = 0, (x+7)(x-3) = 0$

$x=3$  ( $x=-7$  not a solution since  $\log_3(-7-2), \log_3(-7+6)$  are undefined)

$$\textcircled{87} \quad h(t) = 37.79(1.021)^t$$

$$(a) \quad h(t) = 2h(5), \quad 37.79(1.021)^t = 2h(5)$$

$$t = \ln\left(\frac{2 \cdot h(5)}{37.79}\right) / \ln(1.021) = \ln\left(2 \cdot (1.021)^5\right) / \ln(1.021)$$

$$= \frac{\ln 2}{\ln(1.021)} + 5 \approx 38.35, \quad \underline{2038}$$

$$(b) \quad h(t) = 11.14(1.023)^t$$

$$h(t) = 2h(5), \quad \cancel{11.14}(1.023)^t = 2 \cdot \cancel{11.14}(1.023)^5$$

$$t \ln(1.023) = \ln 2 + 5 \ln(1.023)$$

$$t = \frac{\ln 2}{\ln(1.023)} + 5 \approx 35.48, \quad \underline{2035}$$