Nate was hit by a semi-truck and sued them for $75,000

Nate wants to use his money to buy $1,000,000 worth of rubber ducks. If he is able to get an 8% interest rate compounded continuously, how many years will it take?

$A = Pe^{rt}$ P = initial amount, r = rate

$\$1,000,000 = \$75,000\, e^{0.08t}$

$\frac{\$1,000,000}{\$75,000} = \frac{\$75,000\, e^{0.08t}}{\$75,000}$

$\ln\left(\frac{1,000,000}{75,000}\right) = \ln\left(e^{0.08t}\right)$

$\frac{\ln\left(\frac{1,000,000}{75,000}\right)}{0.08} = \frac{0.08t}{0.08}$

$t = \frac{\ln\left(\frac{1,000,000}{75,000}\right)}{0.08} = \frac{\ln(13.\overline{3})}{0.08}$

$= 32.4$ years

$\log\left(2^{3x}\right) = \log(28)$

Logs are exponents

$\log\left(2^{\boxed{3x}}\right) = \log 28$

$$\frac{3x \log(2)}{3\log(2)} = \frac{\log 28}{3\log(2)}$$

$$\boxed{x = \frac{\log(28)}{3\log(2)}}$$

$\log\left(8^{2x-3}\right) = \log(82)$

$\log\left(8^{\boxed{2x-3}}\right) = \log 82$

$$\frac{(2x-3)(\log(8))}{\log(8)} = \frac{\log(82)}{\log(8)}$$

$$2x - 3 = \frac{\log(82)}{\log(8)}$$

$$x = \frac{\frac{\log(82)}{\log(8)} + 3}{2} \qquad +3 \qquad +3$$

$$\frac{2x}{2} = \frac{\frac{\log(82)}{\log(8)} + 3}{2}$$

$\boxed{= 2.54}$

$\log_x b = t$ ← exponent

$\log_{\uparrow \text{base}}$

$\longrightarrow x^t = b$

Logarithmic form exponential form

$\log_2 x = 5$ $2^5 = x$

$\boxed{32 = x}$

$\log_9 \boxed{512} = x$

$\log(9^x) = \log(512)$

$x \log(9) = \log(512)$

$\frac{x \log(9)}{\log(9)} = \frac{\log(512)}{\log(9)}$

$x = \frac{\log 512}{\log 9} = \boxed{2.84}$

$$\log_{16} 1082 = X$$

$$\log\left(16^{X}\right) = \log(1082)$$

$$X \log(16) = \log(1082)$$

$$\frac{X \log(16)}{\log(16)} = \frac{\log(1082)}{\log(16)}$$

$$X = \frac{\log(1082)}{\log(16)} \approx \boxed{2.51}$$

Expanding Logarithms

$$\log\left(\frac{(10{,}000)(1{,}000)}{100}\right) = \log\frac{10{,}000{,}000}{100}$$

$$\log\left(\frac{10{,}000 * 1{,}000}{100}\right) = 5 \qquad \log_{10}(100{,}000) = X$$

$$10^{X} = 100{,}000$$

$$\left[\log\frac{(10^{4}) * (10^{3})}{10^{2}}\right] \qquad 10^{4} * 10^{3} = 10^{4+3}$$

$$X = 5$$

$$\frac{10^{7}}{10^{2}} = 10^{7-2} = 10^{5}$$

$$\log\left(10^{7}/10^{2}\right) \quad \log 10^{5} = 5$$

Expand Logs

$$\log \frac{10^4 * 10^3}{10^2} = \log 10^4 + \log 10^3 - \log 10^2$$

$$4 + 3 - 2$$

$$7 - 2 = 5$$

$\log_{10} 10^4 = X$

$10^X = 10^4$

$$\log \frac{ac}{de} = \log a + \log c - \log d - \log e$$

(⊕ on ac, ⊖ on de)

$$\log \frac{a^7 b^8}{c^4}$$

$$\log a^7 + \log b^8 - \log c^4$$

$$7 \log a + 8 \log b - 4 \log c$$

$$\log_2 \frac{x^9}{y^7 z^3} = \log_2 x^9 - \log_2 y^7 - \log_2 z^3$$

$$9 \log_2 x - 7 \log_2 y - 3 \log_2 z$$

Contract — write as a single log.

$$3\log_4 x + 2\log_4 y - 8\log_4 z$$

$$\log_4 \frac{x^3 y^2}{z^8}$$

$$\log_b \frac{x^{\frac{1}{2}}}{y^{\frac{2}{3}}} = \log_b x^{\frac{1}{2}} - \log_b y^{\frac{2}{3}}$$

$$\frac{1}{2}\log_b x - \frac{2}{3}\log_b y$$

$$\log_8 \left(\sqrt{r}\sqrt[3]{t}\right) = \log_8 \sqrt{r} + \log_8 \sqrt[3]{t}$$

$$\log_8 r^{\frac{1}{2}} + \log_8 t^{\frac{1}{3}}$$

$$\frac{1}{2}\log_8 r + \frac{1}{3}\log_8 t$$

$\log (x^2)\left(\sqrt{x+5}\right)$ *

$\log x^2 + \log \sqrt{x+5}$

$$\boxed{2\log x + \frac{1}{2}\log(x+5)}$$

$$\log_8 \frac{x^2+3x-18}{x^2-4x+3} = \log_8 \frac{(x+6)(x-3)}{(x-3)(x-1)}$$

$$\log_8(x+6) + \log_8(x-3) - \log_8(x-3) - \log_8(x-1)$$

$$\log_8(x+6) - \log_8(x-1)$$

$$\log_8 \frac{x+6}{x-1} = 2$$

$$8^2 = \frac{x+6}{x-1} \qquad (x-1)(64) = \left(\frac{x+6}{x-1}\right)(x-1)$$

$64(x-1) = x+6$

$64x - 64 = x + 6$

$-x \qquad -x$

$63x - 64 = 6$

$+64 \quad +64$

$\frac{63x}{63} = \frac{70}{63}$

$x = \frac{70 \div 7}{63 \div 7} = \frac{10}{9}$

$x \neq 1$