Solving Exponential Equations (8.4)

p412 day 5

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10. Write each expression as a single logarithm in simplest form. State any restrictions on the variable.

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12c, 16

a) $\log_5 x + \log_5 \sqrt{x^3} - 2\log_5 x$

b) $\log_{11} \frac{x}{\sqrt{x}} + \log_{11} \sqrt{x^5} - \frac{7}{3}\log_{11} x$

$\log_{11} \frac{x}{x^{\frac{1}{2}}} + \log_{11} x^{\frac{5}{2}} - \log_{11} x^{\frac{7}{3}}$

$= \log_{11}\left(\frac{x \cdot x^{\frac{5}{2}}}{x^{\frac{7}{3}}}\right)$

$\vdots$

$= \log_{11} x^{\frac{2}{3}}$

12. Show that and $c \neq 1$.

a) $\log_c 48$

b) $7\log_c 4$

c) $\frac{1}{2}(\log_c$

11. Write each in simplest the variabl

a) $\log_2 (x^2$

b) $\log_7 (x^2$

c) $2\log_8 (x$

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16. The logarithmic scale used to express the pH of a solution is pH = −log [H⁺], where [H⁺] is the hydrogen ion concentration, in moles per litre (mol/L).

a) Lactic acidosis is medical condition characterized by elevated lactates and a blood pH of less than 7.35. A patient is severely ill when his or her blood pH is 7.0. Find the hydrogen ion concentration in a patient with a blood pH of 7.0.

b) Acid rain is caused when compounds from combustion react with water in the atmosphere to produce acids. It is generally accepted that rain is acidic if its pH is less than 5.3. The average pH of rain in some regions of Ontario is about 4.5. How many times as acidic as normal rain with a pH of 5.6 is acid rain with a pH of 4.5?

c) The hair conditioner that Alana uses is 500 times as acidic as the shampoo she uses. If the shampoo has a pH of 6.1, find the pH of the conditioner.

$7.0 = -\log H$

$-7 = \log H$

$H = 10^{-7}$ mol/L

$\frac{10^{6.1}}{500}$

$= 2517$

$\log 2517 = 3.4$

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ex1: Lead-210 is radioactive. If 8g decays to 6.75g in 5 years, then what is the half life?

$6.75 = 8\left(\frac{1}{2}\right)^{\frac{5}{h}}$

$0.84375 = \frac{1}{2}^{\frac{5}{h}}$

$\log 0.84375 = \log\left(\frac{1}{2}\right)^{\frac{5}{h}}$

$\log 0.84375 = \frac{5}{h}\log\left(\frac{1}{2}\right)$

$h = \frac{5\log\left(\frac{1}{2}\right)}{\log 0.84375}$

$h = 20.4$ years

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ex2: solve

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

$\log 2^x = \log 5$

$x \log 2 = \log 5$

$x = \frac{\log 5}{\log 2}$

$x = 2.3$

2ac

$2^{3x-1} = 100$

$(3x-1)\log 2 = \log 100$

$3x - 1 = \frac{\log 100}{\log 2}$

$3x = \frac{\log 100}{\log 2} + 1$

$x = \frac{\frac{\log 100}{\log 2} + 1}{3}$

$x = 2.5$

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ex3: Solve $4^{x+3} = 7^x$

$(x+3)\log 4 = x \log 7$

$x\log 4 + 3\log 4 = x \log 7$

$3\log 4 = x\log 7 - x\log 4$

$3\log 4 = x(\log 7 - \log 4)$

$\log 4^3 = x(\log \frac{7}{4})$

$\frac{\log 64}{\log 1.75} = x$

$7.4 = x$

7a

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ex5: How long will it take to grow $5000 to $15,000 if you invest at 6% compounded quarterly?

$15000 = 5000\left(1+\frac{0.06}{4}\right)^{4n}$

$3 = 1.015^{4n}$

$\log 3 = 4n \log 1.015$

$\frac{\log 3}{4 \log 1.015} = n$

$18.4 = n$

11

Solving Exponential Equations (8.4) p412 day 5

hw: p412 #5d, 7b, 8ab, 11

$\log_6 x = 1.6$

$6^{\log_6 x} = 6^{1.6}$

$x =$