7 MUST KNOW QUESTIONS TO CONQUER

EXPONENTIAL

1	Given that $\frac{8^x}{5^x} = \frac{5^{3-x}}{27^x}$, find the value of 6^x. Ans: $6^x = 5$
2	Solve the following equations. **(i)** $2(3^x) - 3^{2-x} = 3$, **(ii)** $7^x = e^{3x+5}$. Ans: (i) $x = 1$, (ii) $x = -4.74$
3	It is given that $2^{3-x} \times 7^{2x-1} = 7^{3x+2}$. **(i)** Show that $14^x = \frac{8}{343}$. **(ii)** Hence find the value of *x*, correct to 2 decimal places. Ans: (i) Shown, (ii) $x = -1.42$
4	Prove that $2^x + \frac{1}{2}(2^{x+4}) - 2^{x+2}$, where *x* is a positive integer, is exactly divisible by 5. Ans: $(2^x)(5)$ is a multiple of 5, is divisible by 5. (Proven)
5	Solve $8^{x+1} = 64^x + 16$. Ans: $x = \frac{2}{3}$
6	The population of a town in New Zealand is given by $P = 250342e^{0.012t}$, where $t = 0$ represents the population in the year 2000. **(i)** Find the population of the new town in the year 2010. Round off the answer to the nearest whole number. **(ii)** Find the year in which the population will be 320,000. **(iii)** Find the minimum number of years required for the population of the new town to be at least doubled from the year 2010. Answers: (i) $P = 282260$ (ii) Year 2020 (iii) 68
7	The quantity, N, of a particle decaying is given by $N = 3500 + 2000e^{-0.04t}$, where t is the time in years after the particle starts decaying. (i) Find the quantity of the particle at which the particle has not started decaying. (ii) Find the quantity of the particle when $t = 14$. (iii)Express t in terms of N. (iv)Explain why the quantity of the particle can never reach 3500. Ans: (i) $N = 5500$, (ii) $N = 4640$, (iii) $t = -25\ln\left(\frac{N-3500}{2000}\right)$ (iv) As t approaches infinity, $2000e^{-0.04t}$ approaches 0. As t approaches infinity, $3500 + 2000e^{-0.04t}$ approaches 3500.