1. Prove the following using proof by contrapositive:
Show If $x + 2$ is an even Z, then x is even.

$p \to q \equiv \bar{q} \to \bar{p}$

Show if x is odd, then $x+2$ is an odd Z

Proof: If x is odd is true

$x = 2k + 1, \exists k \in Z$

$x + 2 = 2k + 1 + 2$

$x + 2 = 2k + 2 + 1$

$x + 2 = 2(k+1) + 1,$ k+1 E Z, so let $p = k+1,$ for some $p \in Z$

$x + 2 = 2p + 1$

$\rightarrow$ $x + 2$ is an odd integer

$\therefore$ If x is odd, then $x+2$ is an odd Z is true.

$\therefore$ By T.T. If $x+2$ is an even Z, then x is even

2. Prove the following using proof by contrapositive:
(Hint: you will need to log both sides of the equation.)
Show If $x \neq 0$, then $2^x \neq 1$

$P \to Q = \overline{Q} \to \overline{P}$

Show If $2^x = 1$, then $x = 0$

Proof: If $2^x = 1$ is true

$$2^x = 1$$

$$\log 2^x = \log 1$$

$$x \log 2 = \log 1$$

$$\frac{x \log 2}{\log 2} = \frac{0}{\log 2}$$

$$\longrightarrow x = 0$$

$\therefore$ If $2^x = 1$, then $x = 0$

$\therefore$ If $x \neq 0$, then $2^x \neq 1$

This proof is perfect.!