Q4) Assume that x is $m^2 + 2$ where m and x are integers,
we will split m into even and odd integers:

Case 1: m is odd ($2k+1 = m$ for some integer k)

$x = m^2 + 2$

$\Rightarrow x = (2k+1)^2 + 2$ ← from our definition of odd

$\Rightarrow x = 4k^2 + 2k + 1 + 2$

$\Rightarrow x = 2(2k^2 + k) + 3$ ← let $a = 2k+1$ (an integer)

$\Rightarrow x = 2(2x + y) + 3$ ← let $x = k^2$ (an integer) and $y = k$ an integer

$\Rightarrow x = 2(2n) + 3$ ← let $2n = 2x + y$ (an integer)

$\Rightarrow x = 4n + 3$

$\therefore$ if m is odd then $x = 4n + 3$ for some integer n

Case 2: m is even ($2k = m$ for some integer k)

$x = m^2 + 2$

$\Rightarrow x = (2k)^2 + 2$

$\Rightarrow x = 4k^2 + 2$

$\Rightarrow x = 4a + 2$ ← since k is an integer if $a = k^2$ then a will also be an integer

$\therefore$ if m is even then $x = 4a + 2$ for some integer n

$\therefore$ for any integer x that can be expressed as $m + 2$ for some integer m, it can also be expressed as $4k+3$ or $4k+2$ for some integer k