1a. Symmetric, ~~transitive~~, reflexive, transitive

Not antisymmetric because it's symmetric.

~~not transitive not transitive~~

b. Symmetric, transitive

not reflexive as one value must be 0 to be true.

not antisymmetric as it's multiplication (is symmetric)

2. $x + y = 3q$

is symmetric is reflexive, is transitive so it is

~~not transitive~~

3. ~~{0,0},{0,1},{0,2}...~~ a. {{0,0}, {0,2}, {0,4}, {1,1}, {1,3}, {2,0}, {2,2}, {2,4} {3,1}, {3,3}, {4,0}, {4,2}, {4,4}}

~~{{2,2}, {0,3}, {1,0}...}~~

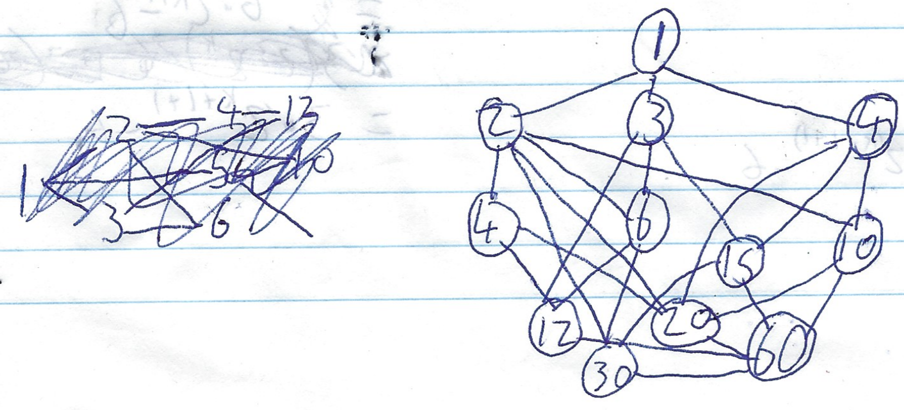
b. {{0,2},{0,4}, {2,0}, {2,4}, {4,0}, {4,2}, {3,1}, {1,3}}

4a. The set of students that can do neither is a partition as there are people who can do both and people who can't do both ($a \cap b = \emptyset$). The other 2 are not as there can be overlap with people that speak a certain language and people that play an instrument.

b. both are partitions as there is no overlap. ($NZ \cap !NZ = \emptyset$)

c. none are partitions as there may be overlap in what each students study.

5.



6. a. is not a function as not all inputs have outputs ("0" is not present in first slot on relation)

b is not 1→1 as 2 inputs are able to produce the same output. (-2 and -1 both output 1) is not onto because the 0 in B has no relation in A ({A, B} to-context)

c. function is not invertable as it's not 1→1 ((-2, 1), (-1, 1)) when inverted gives (1, -1), (1, -2) which is not a function

7. $3(2^{n+1}) - 6 = 3(2^1) + 3(2^2) + \ldots + 3(2^n) \quad n \geq 1$

base case: $(n = 1)$ $3(2^{1+1}) - 6 = 6$ ✓

$3(2^1) = 6$

IH: $K = n$ $3(2^1) + 3(2^2) + \ldots + 3(2^K) = 3(2^{K+1}) - 6$

~~IS: $(K+1)$ $3(2^{K+1+1}) - 6 = 3(2^{K+2}) - 6$~~

~~LHS = RHS~~ $= 3(2(2^K)) - 6$

$= 12(2^K) - 6$

IS$(n = k+1)$ ~~RHS~~ RHS

$3(2^1) + (3(2^2)) + \ldots + 3(2^{K+1}) = \ldots + 3(2^K) + 3(2^{k+1})$

$= (3(2^{K+1}) - 6) + 3(2^{k+1})$

$= 6 \cdot 2^{K+1} - 6$

~~$3 \cdot 2^{K+1} \cdot 2^{K+1} - 6$~~

$= 3 \cdot 2^{K+1+1} - 6$

LHS $= 3 \cdot 2^{(K+1+1)} - 6$