**Question 1a):** By definition of the Poisson Distribution:

Hence:

Recognising that :

Separating a factor of and reindexing such that :

By the definition of :

Similarly, for :

Simplifying :

Letting :

For :

Simplifying :

Letting :

Therefore  **as required.**

**Question 1b):** To calculate the probability that X takes even integers, we can define an indicator function of the form:

Then and we can relate the indicator to . We can observe that:

Taking the expectation:

Hence:

Taking from the Definition of the Poisson distribution:

Factoring out and recognising that :

Therefore, when substituting back into the probability:

**As required.**

Question 2a):