TUTORIAL5: INDUCTION

Prove the following by using induction:

A) $1(1!) + 2(2!) + 3(3!) + \ldots\ldots + n(n!) = (n + 1)! - 1$, for $n \geq 1$

B) $3 + 3(5) + 3(5^2) + 3(5^3) + \ldots + 3(5^n) = \frac{3(5^{n+1} - 1)}{4}$, for $n \geq 0$

C) $1(2) + 2(3) + 3(4) + \ldots\ldots + n(n + 1) = \frac{n\,(n + 1)\,(n + 2)}{3}$, for $n \geq 1$

D) $6^0 + 6^1 + 6^2 + 6^3 \ldots\ldots + 6^n = \frac{6^{n+1} - 1}{5}$, for $n \geq 0$

E) $7^n - 1$, is divisible by 6, for all integer $n \geq 1$

F) $n^3 - n$ is divisible by 3, for all positive integer $n \geq 2$.

G) $3^{2n} + 4^{n+1}$ is divisible by 5 , for $n \geq 0$

H) $n^3 + 2n$ is divisible by 3 given $n \geq 3$

I) $2^n > (n + 2)$, for all integer $n \geq 3$

J) $2^n < n!$ for all positive integer $n \geq 4$

K) $2^n \geq 3n^2 + 5$, for $n \geq 8$

L) $3^n < n!$ for all $n \geq 7$.