$$Pr\{X=k\} = \binom{n}{k} p^k (1-p)^{(n-k)} \tag{1}$$

$$E[X] = \sum_{k=0}^{n} k Pr\{X=k\} \tag{2}$$

$$E[X] = \sum_{k=0}^{n} k \binom{n}{k} p^k (1-p)^{(n-k)} \tag{3}$$

$$E[X] = \sum_{k=0}^{n} k \frac{n!}{k!(n-k)!} p^k (1-p)^{(n-k)} \tag{4}$$

$$E[X] = \sum_{k=0}^{n} \frac{n!}{(k-1)!(n-k)!} p^k (1-p)^{(n-k)} \tag{5}$$

$$E[X] = np \sum_{k=0}^{n} \frac{(n-1)!}{(k-1)!(n-k)!} p^{(k-1)} (1-p)^{(n-k)} \tag{6}$$

$$E[X] = np \sum_{k=0}^{n} \frac{(n-1)!}{(k-1)!((n-1)-(k-1))!} p^{(k-1)} (1-p)^{((n-1)-(k-1))} \tag{7}$$

$$E[X] = np \sum_{k=0}^{n} \binom{(n-1)}{(k-1)} p^{(k-1)} (1-p)^{((n-1)-(k-1))} \tag{8}$$

$$E[X] = np \sum_{k=1}^{n-1} \binom{(n-1)}{(k-1)} p^{(k-1)} (1-p)^{((n-1)-(k-1))} \tag{9}$$

$$E[X] = np \sum_{a=0}^{b} \binom{b}{a} p^a (1-p)^{(b-a)} \tag{10}$$

$$E[X] = np \times 1 \tag{11}$$

$$E[X] = np \tag{12}$$