

The random variable  $X$  has the binomial distribution  $B(n, p)$ .

- (a) Write down an expression for  $P(X = r)$  and hence show that the probability generating function of  $X$  is  $(q + pt)^n$ , where  $q = 1 - p$ . [3]
- (b) Use the probability generating function of  $X$  to prove that  $E(X) = np$  and  $\text{Var}(X) = np(1 - p)$ . [5]