

Probability Assignment

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Question: If X follows a binomial distribution with parameters $n = 5$, p and $p_X(2) = 9p_X(3)$ then p is?

Solution:

$$p_X(2) = {}^5C_2 p^2 (1-p)^{5-2} \quad (1)$$

$$= \frac{5!}{2!3!} p^2 (1-p)^3 \quad (2)$$

$$= 10p^2 (1-p)^3 \quad (3)$$

$$(4)$$

$$p_X(3) = {}^5C_3 p^3 (1-p)^{5-3} \quad (5)$$

$$= \frac{5!}{3!2!} p^3 (1-p)^2 \quad (6)$$

$$= 10p^3 (1-p)^2 \quad (7)$$

$$(8)$$

$$9p_X(3) = 9 \times 10p^3 (1-p)^2 \quad (9)$$

$$= 90p^3 (1-p)^2 \quad (10)$$

$$(11)$$

$$\text{Given that } p_X(2) = 9p_X(3) \quad (12)$$

$$\implies 10p^2 (1-p)^3 = 90p^3 (1-p)^2 \quad (13)$$

$$\implies (1-p) = 9p \quad (14)$$

$$\implies 10p = 1 \quad (15)$$

$$\implies p = \frac{1}{10} \quad (16)$$