Question 12.13.3.10

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10. A discrete random variable X has the probability distribution given as below:

X	0.5	1	1.5	2
P(X)	k	k^2	$2k^2$	k

1. Find the value of k
2. Determine the mean of the distribution

Solution:

1. We know,

$$\sum_k p_X(k) = 1 \tag{1}$$
$$k + k^2 + 2k^2 + k = 1 \tag{2}$$
$$\implies 3k^2 + 2k - 1 = 0 \tag{3}$$
$$\implies (3k-1)(k+1) = 0 \tag{4}$$
$$\implies k = \frac{1}{3} \text{ or } k = -1 \tag{5}$$
$$\text{As probability cannot be negative,} \tag{6}$$
$$k = \frac{1}{3} \tag{7}$$

2.

$$\text{Mean of the distribution}(\mu) = E(X) = \sum_k k p_X(k) \tag{8}$$
$$= 0.5(k) + 1(k^2) + 1.5(2k^2) + 2k \tag{9}$$
$$= 4k^2 + 2.5k \tag{10}$$
$$= (4)\frac{1}{9} + (2.5)\frac{1}{3} \tag{11}$$
$$= \frac{23}{18} \tag{12}$$