MATHS

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PROBABILITY DISTRIBUTIONS

Example

1. Suppose two coins are tossed once if X denotes the number of heads

Write the sample space

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2. Suppose two coins are tossed once if X denotes the number of heads

find Inverse image of (1)

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3. Suppose two coins are tossed once if X denotes the number of heads

.find The valuses of the random variable and the number of elements in its inverse image

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4. Suppose a pair of unbiased dice is rolled once if X denotes the total score of two dice write down

Sample space

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5. Suppose a pair of unbiased dice is rolled once if X denotes the total score of two dice write down

The values taken taken by random variable X

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6. Suppose a pair of unbiased dice is rolled once if X denotes the total score of two dice write down

The inverse image of 9

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7. Suppose a pair of unbiased dice is rolled once if X denotes the total score of two dice write down

The number of elments in inverse image of X

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8. Two fair coins are tossed simultaneously Find the probability mass function for number of tails occurred

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9. If the p.m (probability mass function) f(x) of a random varibale X is

x	1	2	3	4	5
$f(x)$	$\frac{1}{12}$	$\frac{3}{12}$	$\frac{5}{12}$	$\frac{2}{12}$	$\frac{1}{12}$

Find

$P(X \leq 3)$

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10. If the p.m (probability mass function) f(x) of a random varibale X is

x	1	2	3	4	5
$f(x)$	$\frac{1}{12}$	$\frac{3}{12}$	$\frac{5}{12}$	$\frac{2}{12}$	$\frac{1}{12}$

Find

$P(X > 2)$

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11. A six sided die is marked 2 on one face 3 on two of its faces and 4 on the remaining faces the die is rolled twice if X denotes the total score in two throws

Find the probability mass function

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12. A six sided die is marked '2' on one face, '3' on two of its faces, and '4' on remaining three faces. The die is thrown twice. If X denotes the total score in two throws, find the values of the random variable and number of points in its inverse images.

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13. A six sided die is marked 2 one one face 3 on two of its faces and 4 on the remaining faces the die is rolled twice if X denotes the total score in two thross

Find $P(4 < x < 7)$

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14. A six sided die is marked 2 on one face 3 on two of its faces and 4 on the remaining faces the die is rolled twice if X denotes the total score in two throws

Find $P(X > 5)$

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15. Find the rpobability mass function f(x) of the discrete random variable X whose cumulative distribution function f(x) is given by

$$\begin{cases} 0 & -\infty < x < -2 \\ 0.3 & -2 \leq x < -1 \\ 0.45 & -1 \leq x < 0 \\ 0.7 & 0 \leq x < 1 \\ 1 & 1 \leq x < \infty \end{cases}$$

Also find $P(x < 0)$

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16. Find the rpobability mass function f(x) of the discrete random variable X whose cumulative distribution function f(x) is given by

$$\begin{cases} 0 & -\infty < x < -2 \\ 0.3 & -2 \leq x < -1 \\ 0.45 & -1 \leq x < 0 \\ 0.7 & 0 \leq x < 1 \\ 1 & 1 \leq x < \infty \end{cases}$$

$P(X \geq -1)$

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17. A random variable X has the following probability mass function

x	0	1	2	3	4	5	6
$f(x)$	k	$3k$	$5k$	$7k$	$9k$	$11k$	$13k$

Find k

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18. A random variable X has the following probability mass function

Find

$(a) P(x < 4), (b)(x \geq 5), (c) P(3 < x < 5), (d) P(x \leq 5)$

x	0	1	2	3	4	5	6
$f(x)$	k	$3k$	$5k$	$7k$	$9k$	$11k$	$13k$

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19. Find the constant C such that the function

$f(x) = C(2x + 3x^2) 1 < x < 3$

=0 otherwise

is a density functino and compute

$P(1.5 < x < 2.5)$

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20. Find the constant C such that the function

$f(x) = C(2x + 3x^2) 1 < x < 3$

=0 otherwise

is a density functino and compute

$P(x \leq 2)$

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21. Find the constant C such that the function

$f(x) = C(2x + 3x^2) 1 < x < 3$

=0 otherwise

is a density functino and compute

$P(x \geq 1.5)$

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22. Find the constant C such that the function

$f(x) = C(2x + 3x^2) 1 < x < 3$

=0 otherwise

is a density functino and compute

$P(1 \leq x < 2)$

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23. If x is the random variable with probability mass function given by

$$f(x) = \begin{cases} x + 1 & 1 \leq x < 2 \\ -x + 1 & 2 \leq x < 3 \\ 0 & \text{otherwise} \end{cases}$$

Find The distrubution function find also

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24. If x is the random variable with probability mass function given by

$$f(x) = \begin{cases} x+1 & 1 \leq x < 2 \\ -x+1 & 2 \leq x < 3 \\ 0 & \text{otherwise} \end{cases}$$

Find $P(1.1 < x < 25)$

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25. If X is the random varibale with distribution function F(x) given by

$$F(x) = \begin{cases} 0 & -\infty < x < 0 \\ \frac{3}{2}\left(x - \frac{x^3}{3}\right) & 0 \leq x < 1 \\ 1 & 3 \leq x < \infty \end{cases}$$

Find probability density function f(x)

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26. If X is the random varibale with distribution function

F(x) given by

$$F(x) = \begin{cases} 0 & -\infty < x < 0 \\ \frac{3}{2}\left(x - \frac{x^3}{3}\right) & 0 \leq x < 1 \\ 1 & 3 \leq x < \infty \end{cases}$$

Find $P(0.3 < x < 0.5)$

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27. A continuous random varibale X has probability density function $f(x) = kx^2 0 \leq x < 1$ find k find distrubution function

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28. A continuous random varibale X has probability density function $f(x) = kx^2 0 \leq x < 1$ find k find $P(X < 5)$

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29. A continuous random varibale X has probability density function $f(x) = kx^2 0 \leq x < 1$ find k

$P(1 < x < 5)$

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30. A continuous random varibale X has probability density function $f(x) = kx^2 0 \leq x < 1$ find k $(X > 6)$

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31. Let x be a random variable denoting the life time of an electrical equipment having probability density

fucntion

$$F(x) = \mathrm{ke}^{-3x} \quad \text{for} x > 0$$
$$= 0 \quad \text{for} x \leq 0$$

Find Value of k=0

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32. Let x be a random variable denoting the life time of an electrical equipment having probability density fucntion

$$F(x) = \mathrm{ke}^{-3x} \quad \text{for} x > 0$$
$$= 0 \quad \text{for} x \leq 0$$

Distrubution fumnction of x

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33. Let x be a random variable denoting the life time of an electrical equipment having probability density fucntion

$$F(x) = \mathrm{ke}^{-3x} \quad \text{for} x > 0$$
$$= 0 \quad \text{for} x \leq 0$$

$P(X < 2)$

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34. Let x be a random variable denoting the life time of an electrical equipment having probability density fucntion

$$F(x) = \mathrm{ke}^{-3x} \quad \text{for} x > 0$$
$$= 0 \quad \text{for} x \leq 0$$

$P(X \geq 4)$

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35. The following is a probability density function of a random variable X given by

x	1	2	3	4	5
$f(x)$	k^2	$3k^2$	$6k^2$	k	$2k$

Find (i) The value of k

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36. The following is a probability density function of a random variable X given by

x	1	2	3	4	5
$f(x)$	k^2	$3k^2$	$6k^2$	k	$2k$

Standard deviation of x

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37. Find the binomial distrubution find the mean and variance of X for the following

Six fair coins are tossed once and X denotes the number of heads

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38. Find the binomial distrubution find the mean and variance of X for the following

A fair die is thrown 8 tiems and X denotes the number of times 2 appeared

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39. Four coins are tossed once,find the probabiity of getting(i)exactly two heads(ii)atleast 2 heads(iii)atmost 2 heads.

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40. Four coins are tossed simultaneously what is probability of getting

at least two heads

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41. Four coins are tossed once,find the probabiity of getting(i)exactly two heads(ii)atleast 2 heads(iii)atmost 2 heads.

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42. Given the on an average 20% of the product is defective the items are sold in consignment of 10 and it is guaranteed that not more than 1 item will be defective what is the probability that an item will fial to meet the guaranteed quality

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43. The mean and variance of a binomial variate x are respectively 2 and 1.5 then P(X=0) is

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44. The mean and variance of binomial variate X are respectively 2 And 1.5 find

$P(x = 2)$

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45. The mean and variance of binomial variate X are respectively 2 And 1.5 find

$P(x \geq 2)$

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46. The mean and variance of binomial variate X are respectively 2 And 1.5 find

$P(x < 2)$

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47. A die is thrown 120 times and getting 1 or 5 is considered a success find the mean and variance of the number success

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Exercise 11 1

1. Suppose X is the number of tails occurred when three fair coins are tossed once simultaneously. Find the values of the random variable X and number of points in its inverse images.

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2. In a pack of 52 playing cards two cards are drawn at random simultaneously if the number of black cards drawn is a ranodm variable find the valties of the random variable and number of points in its inverse images

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3. An urn contains 5 mangoes and 4 apples. Three fruits are taken at random. If the number of apples taken is a random variable, then find the values of the random variable and number of points in its inverse images.

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4. Two balls are chosen randomly from an urn containing 6 red and 8 black balls. Suppose that we win Rs. 15 for each red ball selected and we lose Rs. 10 for each black ball selected. X denotes the winning amount, then find the values of X and number of points in its inverse images.

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5. A six sided die is marked '2' on one face, '3' on two of its faces, and '4' on remaining three faces. The die is thrown twice. If X denotes the total score in two throws, find the values of the random variable and number of points in its inverse images.

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Exercise 11 2

1. Three fair coins are tossed simultaneously. Find the probability mass function for number of heads

occurred.

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2. A six sided die is marked '1' on one face, '3' on two of its faces, and '5' on remaining three faces. The die is thrown twice. If X denotes the total score in two throws, find

the probability mass function

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3. A six sided die is marked '1' on one face, '3' on two of its faces, and '5' on remaining three faces. The die is

thrown twice. If X denotes the total score in two throws, find

the cumculative distribution function

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4. A six sided die is marked '1' on one face, '3' on two of its faces, and '5' on remaining three faces. The die is thrown twice. If X denotes the total score in two throws, find

$P(4 \leq X \leq 10)$

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5. A six sided die is marked '1' on one face, '3' on two of its faces, and '5' on remaining three faces. The die is thrown twice. If X denotes the total score in two throws, find

$P(X \geq 6)$

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6. Find the probability mass function and cumculative distribution function of number of girl child in families with 4 children, assuming equal probabilities for boys and girls.

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7. Suppose a discrete random variable can only take the values 0, 1, and 2. The probability mass function is defined by

$$f(x) = \begin{cases} \frac{x^2+1}{k}, & \text{for x=0,1,2} \\ 0 & \text{otherwise} \end{cases}$$

Find (i) the value of k (ii) cumculative distribution function (iii) $P(X \geq 1)$.

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8. Suppose a discrete random variable can only take the values 0, 1, and 2. The probability mass function is defined by

$$f(x) = \begin{cases} \frac{x^2+1}{k}, & \text{for x=0,1,2} \\ 0 & \text{otherwise} \end{cases}$$

Find (i) the value of k (ii) cumculative distribution function (iii) $P(X \geq 1)$.

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9. Suppose a discrete random variable can only take the values 0, 1, and 2. The probability mass function is defined by

$$f(x) = \begin{cases} \frac{x^2+1}{k}, & \text{for x=0,1,2} \\ 0 & \text{otherwise} \end{cases}$$

Find (i) the value of k (ii) cumculative distribution function (iii) $P(X \geq 1)$.

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10. The cumculative distribution function of a discrete random variable is given by

$$F(x) = \begin{cases} 0 & -\infty < x < -1 \\ 0.15 & -1 \leq x < 0 \\ 0.35 & 0 \leq x < 1 \\ 0.60 & 1 \leq x < 2 \\ 0.85 & 2 \leq x < 3 \\ 1 & 3 \leq x < \infty \end{cases}$$

Find (i) the probability mass function (ii) $P(X < 1)$ and (iii) $P(X \geq 2)$.

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11. The cumculative distribution function of a discrete random variable is given by

$$F(x) = \begin{cases} 0 & -\infty < x < -1 \\ 0.15 & -1 \leq x < 0 \\ 0.35 & 0 \leq x < 1 \\ 0.60 & 1 \leq x < 2 \\ 0.85 & 2 \leq x < 3 \\ 1 & 3 \leq x < \infty \end{cases}$$

Find (i) the probability mass function (ii) $P(X < 1)$ and (iii) $P(X \geq 2)$.

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12. The cumculative distribution function of a discrete random variable is given by

$$F(x) = \begin{cases} 0 & -\infty < x < -1 \\ 0.15 & -1 \leq x < 0 \\ 0.35 & 0 \leq x < 1 \\ 0.60 & 1 \leq x < 2 \\ 0.85 & 2 \leq x < 3 \\ 1 & 3 \leq x < \infty \end{cases}$$

Find (i) the probability mass function (ii) $P(X < 1)$ and (iii) $P(X \geq 2)$.

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13. A random varibale x has the following probability mass function

x	1	2	3	4	5
$f(x)$	k^2	$2k^2$	$3k^2$	$2k$	$3k$

Find the value of k

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14. A random varibale x has the following probability mass function

x	1	2	3	4	5
$f(x)$	k^2	$2k^2$	$3k^2$	$2k$	$3k$

$P(2 \leq X < 5)$

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15. A random varibale x has the following probability mass function

x	1	2	3	4	5
$f(x)$	k^2	$2k^2$	$3k^2$	$2k$	$3k$

$P(3 < X)$

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16. The cumculative distribution function of a discrete random variable is given by

$$F(x) = \begin{cases} 0 & \text{for } -\infty < x < 0 \\ \frac{1}{2} & \text{for } 0 \leq x < 1 \\ \frac{3}{5} & \text{for } 1 \leq x < 2 \\ \frac{4}{5} & \text{for } 2 \leq x < 3 \\ \frac{9}{10} & \text{for } 3 \leq x < 4 \\ 1 & \text{for } 4 \leq x < \infty \end{cases}$$

Find (i) the probability mass function (ii) $P(X < 3)$ and (iii) $P(X \geq 2)$.

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17. The cumulative distrubution function of adiscrete random variable is given by

$$0 \quad f \text{ or } -\infty < x < 0$$

$$f(x) = \begin{cases} \frac{1}{2} & f \text{ or } 0 \leq x < 1 \\ \frac{3}{5} & f \text{ or } 1 \leq x < 2 \\ \frac{4}{5} & f \text{ or } 2 \leq x < 3 \\ \frac{9}{10} & f \text{ or } 3 \leq x < 4 \\ 1 & f \text{ or } 4 \leq x < \infty \end{cases}$$

$P(X \leq 3)$

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18. The cumculative distribution function of a discrete random variable is given by

$$F(x) = \begin{cases} 0 & \text{for } -\infty < x < 0 \\ \frac{1}{2} & \text{for } 0 \leq x < 1 \\ \frac{3}{5} & \text{for } 1 \leq x < 2 \\ \frac{4}{5} & \text{for } 2 \leq x < 3 \\ \frac{9}{10} & \text{for } 3 \leq x < 4 \\ 1 & \text{for } 4 \leq x < \infty \end{cases}$$

Find (i) the probability mass function (ii) $P(X < 3)$ and (iii) $P(X \geq 2)$.

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Exercise 11 3

1. The probability density function of X is given by $f(x) = \begin{cases} kxe^{-2x} & \text{for } x > 0 \\ 0 & \text{for } x \leq 0 \end{cases}$ Find the value of k.

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2. The probability density function of X is

$$f(x) = \begin{cases} x & 0 < x < 1 \\ 2 - x & 1 \leq x < 2 \\ 0 & \text{otherwise} \end{cases}$$

Find

$P(0.2 \leq X < 0.6)$

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3. The probability density function of X is

$$f(x) = \begin{cases} x & 0 < x < 1 \\ 2 - x & 1 \leq x < 2 \\ 0 & \text{otherwise} \end{cases}$$

Find

$P(1.2 \leq X < 1.8)$

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4. The probability density function of X is

$$f(x) = \begin{cases} x & 0 < x < 1 \\ 2 - x & 1 \leq x < 2 \\ 0 & \text{otherwise} \end{cases}$$

Find

$P(0.5 \leq X < 1.5)$

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5. Suppose the amount of milk sold daily at a milk booth is distributed with a minimum of 200 litres and a maximum of 600 litres with probability density function

$$f(x) = \begin{cases} k & 200 \leq x \leq 600 \\ 0 & \text{otherwise} \end{cases}$$

Find

the value of k

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6. Suppose the amount of milk sold daily at a milk booth is distributed with a minimum of 200 litres and a maximum of 600 litres with probability density function

$$f(x) = \begin{cases} k & 200 \leq x \leq 600 \\ 0 & \text{otherwise} \end{cases}$$

Find

the distribution function

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7. Suppose the amount of milk sold daily at a milk booth is distributed with a minimum of 200 litres and a maximum of 600 litres with probability density function

$$f(x) = \begin{cases} k & 200 \leq x \leq 600 \\ 0 & \text{otherwise} \end{cases}$$

Find

the value of k

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8. The probability density function of X is given by

$$f(x) = \begin{cases} ke^{-\frac{x}{3}} & \text{for} \quad x > 0 \\ 0 & \text{for} \quad x \leq 0 \end{cases}$$

Find

the value of k

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9. The probability density function of X is given by

$$f(x) = \begin{cases} ke^{-\frac{x}{3}} & \text{for } x > 0 \\ 0 & \text{for } x \leq 0 \end{cases}$$

Find

the distribution function

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10. The probability density function of X is given by

$$f(x) = \begin{cases} ke^{-\frac{x}{3}} & \text{for } x > 0 \\ 0 & \text{for } x \leq 0 \end{cases}$$

Find

$P(X < 3)$

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11. The probability density function of X is given by

$$f(x) = \begin{cases} ke^{-\frac{x}{3}} & \text{for } x > 0 \\ 0 & \text{for } x \leq 0 \end{cases}$$

Find

$P(5 \leq X)$

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12. The probability density function of X is given by

$$f(x) = \begin{cases} ke^{-\frac{x}{3}} & \text{for } x > 0 \\ 0 & \text{for } x \leq 0 \end{cases}$$

Find

$P(X \leq 4)$

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13. If X is the random variable with probability density function f(x) is given by

$$f(x) = \begin{cases} x+1 & -1 \le x < 0 \\ -x+1 & 0 \le x < 1 \\ 0 & \text{otherwise} \end{cases}$$

then find (i) the distribution function F(x) (ii) $P(-0.5 \le X \le 0.5)$

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14. If X is the random variable with probability density function f(x) is given by

$$f(x) = \begin{cases} x+1 & -1 \le x < 0 \\ -x+1 & 0 \le x < 1 \\ 0 & \text{otherwise} \end{cases}$$

then find (i) the distribution function F(x) (ii) $P(-0.5 \leq X \leq 0.5)$

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15. If X is the random variable with distribution function F(x) given by,

$$F(x) = \begin{cases} 0 & x < 0 \\ \frac{1}{2}(x^2 + x) & 0 \leq x < 1 \\ 1 & x \leq 1 \end{cases}$$

then find (i) the probability density function f(x) (ii) $P(0.3 \leq X \leq 0.6)$

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16. If X is the random variable with distribution function F(x) given by,

$$F(x) = \begin{cases} 0 & x < 0 \\ \frac{1}{2}\left(x^2 + x\right) & 0 \leq x < 1 \\ 1 & x \leq 1 \end{cases}$$

then find (i) the probability density function f(x) (ii) $P(0.3 \leq X \leq 0.6)$

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Exercise 11 4

1. For the random variable X with the given probability mass function as below, find the mean and variance.

$$f(x) = \begin{cases} \frac{1}{10} & x = 2,5 \\ \frac{1}{5} & x = 0,1,3,4 \end{cases}$$

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2. For the random variable X with the given probability mass function as below, find the mean and variance.

$$f(x) = \begin{cases} \frac{4-x}{6} & x = 1, 2, 3 \end{cases}$$

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3. For the random variable X with the given probability mass function as below, find the mean and variance.

$$F(x) = \begin{cases} 2(x-1) & 1 < x < 2 \\ 0 & \text{otherwise} \end{cases}$$

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4. For the random variable X with the given probability mass function as below, find the mean and variance.

$$F(x) = \begin{cases} \frac{1}{2}e^{-\frac{x}{2}} & \text{for} \quad x > 0 \\ 0 & \text{otherwise} \end{cases}$$

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5. Two balls are drawn in succession without replacement from an urn containing four red balls and three black balls. Let X be the possible outcomes drawing red balls. Find the probability mass function and mean for X.

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6. If μ and σ^2 are the mean and variance of the discrete random variable X, and $E(X+3)=10$ and $E(X+3)^2=116$, find μ and σ^2.

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7. Four fair coins are tossed once. Find the probability mass function, mean and variance for number of heads occurred.

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8. A commuter train arrives punctually at a station every half hour. Each morning, a student leaves his house to the train station. Let x denote the amount of time, in minutes, that the student waits for the train from the time he reaches the train station. It is known that the pdf of X is $f(x) = \begin{cases} \frac{1}{30} & 0 < x < 30 \\ 0 & \text{elsewhere} \end{cases}$. Obtain interpret the expected value of the random variable X.

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9. The time to failure in thousands of hours of an electronic equipment used in a manufactured computer has the density function

$$f(x) = \begin{cases} 3e^{-3x} & x > 0 \\ 0 & \text{elsewhere} \end{cases}$$

Find the expected life of this electronic equipment.

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10. The probability density function of the random variable X is given by

$$f(x) = \begin{cases} 16xe^{-4x} & \text{for } x > 0 \\ 0 & \text{for } x \leq 0 \end{cases}$$ find the mean and variance of X

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11. A lottery with 600 tickets gives one prize of Rs. 200, four prizes of Rs. 100, and six prizes of Rs. 50. If the

ticket costs is Rs. 2, find the expected winning amount of a ticket.

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Exercise 11 5

1. Compute $P(X = K)$ for the binomial distribution B(n,p) where

$n = 6, p = \frac{1}{3}, k = 3$

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2. Compute $P(X = K)$ for the binomial distribution B(n,p) where

$n = 10, p = \frac{1}{5}$ k=4

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3. Compute $P(X = K)$ for the binomial distribution B(n,p) where

$n = 9, p = \frac{1}{2}, k = 7$

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4. The probability that Mr. Q hits a target at any trial is $\frac{1}{4}$. Suppose he tries at the target 10 times. Find the probability that he hits the target (i) exactly 4 times (ii) at least one time.

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5. The probability that Mr. Q hits a target at any trial is $\frac{1}{4}$. Suppose he tries at the target 10 times. Find the probability that he hits the target (i) exactly 4 times (ii) at least one time.

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6. Using binomial distrubution find the mean and variance of X for the following experiments

A fair coin is tossed 100 times and X denote the number of heads

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7. Using binomial distrubution find the mean and variance of X for the following experiments

A fair die is tossed 240 times and X denote the number of times that four appeared

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8. The probability that a certain kind of component will survive a electrical test is $\frac{3}{4}$. Find the probability that exactly 3 of the 5 components tested survive .

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9. A retailer purchases a certain kind of electronic device from a manufacturer. The manufacturer indicates that the defective rate of the device is 5%. The inspector of the retailer randomly picks 10 items from a shipment. What is the probability that there will be (i) at least one defective item (ii) exactly two defective items.

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10. A retailer purchases a certain kind of electronic device from a manufacturer. The manufacturer indicates that the defective rate of the device is 5%. The inspector of the retailer randomly picks 10 items from a shipment. What is the probability that there will be (i) at least one defective item (ii) exactly two defective items.

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11. If the probability that fluoreacent light has a useful life of at least 600 hours is 0.9 find the probabilites that

among 12 such lights

exactly 10 will have a usefull life of at least 600 hours

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12. If the probability that fluoreacent light has a useful life of at least 600 hours is 0.9 find the probabilites that among 12 such lights

at least 11 will have a useful life of at least 600 hours

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13. If the probability that fluoreacent light has a useful life of at least 600 hours is 0.9 find the probabilites that

among 12 such lights

at least 2 will not have a useful of at least 600 hours

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14. The mean and standard deviation of a binomial variate X are respectively 6 and 2. Find (i) the probability mass function (ii) P(X=3) (iii) $P(X \geq 2)$.

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15. The mean and standard deviation of a binomial variate X are respectively 6 and 2. Find (i) the probability mass function (ii) P(X=3) (iii) $P(X \geq 2)$.

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16. The mean and standard deviation of a binomial variate X are respectively 6 and 2. Find (i) the probability mass function (ii) P(X=3) (iii) $P(X \geq 2)$.

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17. If X X-B(n,p)such that 4P(X=4)=P(X=2)and n=6 find distribution mean and standard deviation

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18. In a binomial distrubution consisting of 5 independent trials the probability of 1 and 2 successers are 0.4096 and 0.2048 respectively find the mean and variance of the random variable

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Exercise 11 6

1. Let X be random variable with probability density function

$$f(x) = \begin{cases} \frac{2}{x^3} & x \geq 1 \\ 0 & x < 1 \end{cases}$$

Which of the following statement is correct

A. both mean and variance exist

B. mean exists but variance does not exist

C. both mean and variance does not exist

D. variance exists abut mean does not exist

Answer: b

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2. A rod of length 2l is broken into two pieces at random. The probability density function of the shorter of the two pieces is

$$f(x) = \begin{cases} \frac{1}{l} & 0 < x \geq l \\ 0 & l \leq x < 2l \end{cases}$$

The mean and variance of the shorter of the two pieces are respectively

A. $\frac{l}{2}, \frac{l^2}{3}$

B. $\frac{l}{2}, \frac{l^2}{6}$

C. $l, \frac{l^2}{12}$

D. $\frac{l}{2}, \frac{l^2}{12}$

Answer: d

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3. Consider a game where the player tosses a six sided fair die. If the face that comes up is 6, the player wins

Rs. 36, otherwise he loses Rs. k^2, where k is the face that comes up k = {1, 2, 3, 4, 5}.

The expected amount to win at this game in Rs. is

A. $\frac{19}{6}$

B. $-\frac{19}{6}$

C. $\frac{3}{2}$

D. $-\frac{3}{2}$

Answer: b

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4. A pair of dice numbered 1, 2, 3, 4, 5, 6 of a six-sided die and 1, 2, 3, 4 of a four-sided die is rolled and the sum is determined. Let the random variable X denote this sum. Then the number of elements in the inverse image of 7 is

A. 1

B. 2

C. 3

D. 4

Answer: d

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5. A random variable X has binominal distribution with n = 25 and p = 0.8 then standard deviation of X is

A. 6

B. 4

C. 3

D. 2

Answer: d

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6. Let X represent the difference between the number of heads and the number of tails obtained when a coin

is tossed n times. Then the possible values of X are

A. i+2n=0,2,..n

B. 2i-n,i=0,1,2..n

C. n-l,i=0,1,2..n

D. 2i+2n,i=0,1,2..n

Answer: b

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7. If the function $f(x) = \frac{1}{12}$ for $a < x < b$, represents a probability density function of a

continuous random variable X, then which of the following cannot be the value of a and b?

A. 0 and 12

B. 5 and 17

C. 7 and 19

D. 16 and 24

Answer: d

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8. Four buses carrying 160 students from the same school arrive at a football stadium. The buses carry,

respectively, 42, 36, 34, and 48 students. One of the students is randomly selected. Let X denote the number of students that were on the bus carrying the randomly selected student. Let Y denote the number of students on that bus. Then E[X] and E[Y] respectively are

A. 50,40

B. 40,50

C. 40,75,40

D. 41,41

Answer: c

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9. Two coins are to be flipped. The first coin will land on heads with probability 0.6, the second with probability 0.5. Assume that the results of the flips are independent, and let X equal the total number of heads that result. The value of E[X] is

A. 0.11

B. 1.1

C. 11

D. 1

Answer: b

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10. On a multiple-choice exam with 3 possible destructive for each of the 5 questions, the probability that a student will get 4 or more correct answers just by guessing is

A. $\frac{11}{243}$

B. $\frac{3}{8}$

C. $\frac{1}{243}$

D. $\frac{5}{243}$

Answer: a

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11. If P{X=0}=1-P{X=1}. If E{X}=3Var(X), then P{X=0} is

A. $\frac{2}{3}$

B. $\frac{2}{5}$

C. $\frac{1}{5}$

D. $\frac{1}{3}$

Answer: d

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12. If X is a binomial random variable with expected value 6 and variance 2.4, then P(X=5) is

A. $\left(\frac{10}{5}\right)\left(\frac{3}{5}\right)^{6}\left(\frac{2}{5}\right)^{4}$

B. $\left(\frac{10}{5}\right)\left(\frac{3}{5}\right)^{5}$

C. $\left(\frac{10}{5}\right)\left(\frac{3}{5}\right)^{4}\left(\frac{2}{5}\right)^{6}$

D. $\left(\frac{10}{5}\right)\left(\frac{3}{5}\right)^{5}\left(\frac{2}{5}\right)^{5}$

Answer: d

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13. The random variable X has the probability density function $f(x) = \begin{cases} ax+b & 0<x<1 \\ 0 & \text{otherwise} \end{cases}$ and $E(X) = \frac{7}{12}$, then a and b are respectively

A. 1 and $\frac{1}{2}$

B. $\frac{1}{2}$ and 1

C. 2 and 1

D. 1 and 2

Answer: a

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14. Suppose that X takes on one of the values 0, 1, and 2.

If for some constant k, P(X=i)=k P(X=i-1)i=1,2 and P(X=0)= $\frac{1}{7}$ then the value of k is

A. 1

B. 2

C. 3

D. 4

Answer: b

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15. Which of the following is a discrete random variable?

I. The number of cars crossing a particular signal in a day.

II. The number of customers in a queue to buy train tickets at a moment.

III. The time taken to complete a telephone call.

A. I and II

B. II only

C. III only

D. II and III

Answer: a

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16. If $f(x) = \begin{cases} 2x & 0 \leq x \leq a \\ 0 & \text{otherwise} \end{cases}$ is a probability density function of a random variable, then the value of a is

A. 1

B. 2

C. 3

D. 4

Answer: a

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17. The probability function of a random variable is defined as

x	-2	-1	0	1	2
$f(x)$	k	$2k$	$3k$	$4k$	$5k$

Then E(X) is equal to

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18. Let X have a Bernoulli distribution with mean 0.4, then the variance of (2X-3) is

A. 0.24

B. 0.48

C. 0.6

D. 0.96

Answer: d

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19. If in 6 trials, X is a binomial variate which follows the relation $9P(X=4)=P(X=2)$, then the probability of success

is

A. 0.125

B. 0.25

C. 0.375

D. 0.75

Answer: b

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20. A computer salesperson knows from his past experience that he sells computers to one in every twenty customers who enter the showroom. What is

the probability that he will sell a computer to exactly two of the next three customers?

A. $\frac{57}{20^3}$

B. $\frac{57}{20^2}$

C. $\frac{19}{20^3}$

D. $\frac{57}{20}$

Answer: a

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Problems For Practice

1. A random variable x has the following probability distribution

x	0	1	2	3
$P(X=x)$	a	$\frac{a}{2}$	$\frac{a}{2}$	a

Then $P(1 \leq X \leq 2)$ is

A. $\frac{1}{3}$

B. $\frac{1}{2}$

C. $\frac{2}{3}$

D. $\frac{1}{4}$

Answer: a

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2. X is a ranodm variable having the following of probability mass function

x	-2	3	1
$f(x)$	$\frac{k}{6}$	$\frac{k}{4}$	$\frac{k}{12}$

Then the value of $E(x^2)$ is :

A. 2

B. 6

C. 4

D. 3

Answer: b

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3. If $F(x) = \begin{cases} kx^3 & 0 < x < 2 \\ 0 & \text{otherwise} \end{cases}$ is probability density function find k

A. 1

B. $\frac{1}{2}$

C. $\frac{1}{4}$

D. $\frac{1}{8}$

Answer: c

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4. If X is a continuous random variable then $P(X \geq a) =$ _____.

A. $P(a < a)$

B. $1 - P(x > a)$

C. $1 - P(x < a)$

D. $1 - P(x \leq a - 1)$

Answer: c

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5. If a continous random variable $f(x) = \frac{k}{x^2 + 16} - \infty < x < \infty$ then the value of k is

A. $\frac{\pi}{4}$

B. $\frac{\pi}{2}$

C. $\frac{3}{\pi}$

D. $\frac{4}{PI}$

Answer: d

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6. If $f(x) = ae^{-2x} 0 < x < \infty$ is a probability density function of a random variable x then its variance is

A. $\frac{1}{4}$

B. $\frac{1}{2}$

C. 2

D. 4

Answer: a

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7. If X is a discrete random variable $P(X > a)$ is equal to

A. $p(x < A)$

B. $1 - p(X \leq a)$

C. $1 - P(X < a)$

D. 0

Answer: b

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8. For a binomial distrubution with mean 2 and variance $\frac{4}{3}$ p is equal to

A. $\frac{2}{3}$

B. $\frac{1}{3}$

C. $\frac{3}{4}$

D. $\frac{2}{\sqrt{3}}$

Answer: b

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9. If F(x) is a distribution function of a random variable then the false statement is

A. $0 \leq f(x) \leq 1$

B. $f(\infty) = 1$

C. $F(- \in f < y) = I$

D. $F(x) = f(x)$

Answer: c

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10. In a binomial distribution if n =5 P(X=3)=2(PX=2)then

A. p=2q

B. 2p=q

C. p=q

D. 5p=2q

Answer: a

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11. $F(X) = \frac{\pi}{2 + \tan^{-1}\frac{x}{\pi}} - \infty < x < \infty$ is a distribution of a continous random variable X then $P(X \leq 1)$ is

A. $\frac{3}{4}$

B. $\frac{1}{4}$

C. $\frac{1}{2}$

D. $\frac{\pi}{2}$

Answer: a

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12. A discrete random variable X has probability mass function P(x) then

A. $0 \leq p(x) \leq 1$

B. $p(x) \geq 1$

C. $p(x) \leq 0$

D. $\frac{\pi}{2}$

Answer: a

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13. In a packet of 50 pens 10 are red pens if 5 pen are selected what is the probability that atleast one ie red pen

A. $\left(\frac{4}{5}\right)^5$

B. $1 - \left(\frac{4}{5}\right)^5$

C. $5\left(\frac{1}{5}\right)^5$

D. $\frac{1}{4^5}$

Answer: b

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14. In 12 throw of a die getting 2 or 4 is considered as success then the mean number of success is

A. 4

B. 6

C. 24

D. 48

Answer: a

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15. Given E(X)=10, Var(X)=25 where X is a random variable and Y=aX-b is also a random variable with mean =0 and variance=1 , then a and b are

A. $a = 2, b = \frac{1}{5}$

B. $a = \frac{1}{5}, b = 2$

C. $a = 5, b = \frac{1}{2}$

D. $a = \frac{1}{2}, b = 5$

Answer: b

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16. The probability distribution of a discrete random variable x is given by

X	−1	0	1	2
$p(x)$	$\frac{1}{3}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{3}$

The value $6E\left(X^2\right) - Var(x)$ is

A. $\frac{6}{58}$

B. $\frac{58}{6}$

C. $\frac{113}{12}$

D. 2

Answer: c

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17. If mean =0 standard deviation =2 Then $E\left(X^2\right)$ is

A. 4

B. -4

C. 0

D. 2

Answer: a

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18. If $F(x) = \frac{A}{\pi} = \frac{1}{16 + x^2} - \infty < x < \infty$ is a pdf of a continous random variable x then the value of A is

A. 16

B. 8

C. 4

D. 1

Answer: c

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19. In a binomial distribution with mean 4 and variance $\frac{16}{5}$ then p is

A. $\frac{4}{5}$

B. $\frac{3}{5}$

C. $\frac{2}{5}$

D. $\frac{1}{5}$

Answer: d

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20. Given E(X+C)=8 and E(X-C)=12 The value of C is

A. -2

B. 4

C. -4

D. 2

Answer: a

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21. Var(5x-2)=?if Var(X)=1

A. 10

B. 5

C. 25

D. 1

Answer: c

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22. If $f(x) = k\left(2x - x^2\right), 0 \leq x \leq 1$ is probability density function of a continous random variable x then k is

A. $\frac{1}{6}$

B. $\frac{1}{2}$

C. $\frac{2}{5}$

D. $\frac{3}{2}$

Answer: d

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23. In 16 throws of a die getting an even number is called a success then the variance of the success is

A. 4

B. 6

C. 2

D. 256

Answer: a

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24. X is a random variable taking the values 3,4 and 12 with probabilites $\frac{1}{3}, \frac{1}{4}$ and $\frac{5}{12}$ then E(x) is

A. 5

B. 6

C. 7

D. 3

Answer: c

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25. If X is a discrete random variable which takes the values which takes the values 0,1 and 2 and P(x)=0)=$\frac{144}{169}$,P(X=1)=$\frac{15}{169}$ then P(x=2) is

A. $\frac{135}{169}$

B. $\frac{10}{169}$

C. $\frac{12}{169}$

D. $\frac{30}{169}$

Answer: b

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26. Variance =20 and $E(X^2)$ =276 for discrete random variable then the mean of the random variable is

A. 16

B. 5

C. 2

D. 14

Answer: a

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27. A random variable X has the following probability distribution

X	0	1	2	3	4	5
$P(X=x)$	$\frac{1}{4}$	$2a$	$3a$	$4a$	$5a$	$\frac{1}{4}$

Then $P(1 \leq x \leq 4)$ is

A. $\frac{10}{121}$

B. $\frac{2}{7}$

C. $\frac{1}{14}$

D. $\frac{1}{2}$

Answer: d

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28. A bag contain 6 white and 4 red balls if 3 balls are drawn at random the probability of getting 1 red ball and 2 white balls is

A. $\frac{1}{2}$

B. $\frac{2}{3}$

C. $\frac{3}{10}$

D. $\frac{2}{15}$

Answer: c

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29. 2 cards are drawn from a well shuffled of 52 cards the probability that they of the same colour is

A. $\frac{1}{2}$

B. $\frac{26}{51}$

C. $\frac{25}{51}$

D. $\frac{25}{102}$

Answer: c

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30. In 6 trails x is binomial variate which follows 4P(X=4)=P(X=2) then the probability of success is

A. $\frac{4}{5}$

B. $\frac{2}{3}$

C. $\frac{1}{2}$

D. $\frac{1}{3}$

Answer: d

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31. The probability function of a random variable is defined as

x	-2	-1	0	1	2
$f(x)$	$\frac{k}{3}$	$\frac{k}{3}$	$\frac{2k}{3}$	k^2	$4k^2$

Then k is

A. $\frac{1}{3}$

B. $\frac{1}{5}$

C. $\frac{1}{4}$

D. $\frac{1}{2}$

Answer: a

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32. If $f(x) = \frac{1}{9}x^2 0 \leq x < a$ is a probability density function of random variable then the value of a is

A. $\frac{1}{2}$

B. 2

C. 3

D. $\frac{1}{3}$

Answer: c

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33. If the function $f(x) = \frac{1}{10}$ for $a < x < b$ represent a probability density function of a continous random

variable then which of the following cannot be the values of a and b

A. 0 and 10

B. 2 and 12

C. 7 and 17

D. 5 and 25

Answer: d

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34. A random variable X has binomial distribution with n=36 and p =0.8 then standard deviation of x is

A. 2.4

B. 1.2

C. 3.6

D. 4.8

Answer: a

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35. A pari of dice numbered 1,2,3,4,5,6 of a six faced die each are rolled let x denote the sum of this then the number of element in the inverse image of 8 is

A. 3

B. 5

C. 4

D. 6

Answer: b

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36. The mean and variance of a binomial variate x are respectively 2 and 1.5 then P(X=0) is

A. $\frac{(3)^7}{2^8}$

B. $\left(\frac{1}{4}\right)^8$

C. $\frac{2^8}{3^7}$

D. $\left(\frac{3}{4}\right)^8$

Answer: d

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37. If X is a bernoulli 's random variable with parameter p then the variance σ^2 is

A. 1

B. p^2

C. $\frac{p}{q}$

D. pq

Answer: d

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38. If f(x)=$\lambda e^{-\lambda x}$, $x > 0$ is aprobability density function of X then its variance is :

A. $\frac{1}{\lambda^2}$

B. $\frac{2}{\lambda^2}$

C. λ

D. λ^2

Answer: a

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39. If `

X	40	10	−20
$f(x)$	$\frac{6}{66}$	$\frac{26}{66}$	$\frac{25}{66}$

then E(X) is

A. $\frac{4000}{1}$

B. 0

C. $\frac{410}{11}$

D. $\frac{4000}{11}$

Answer: b

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40. Given $F(x) = \begin{cases} 0 & x \leq 1 \\ x - \frac{1}{4} & 1 \leq x \leq 5 \\ 1 & x > 5 \end{cases}$

is cumulative distrubution of X find $P(2 < x < 4)$

A. $-\frac{1}{4}$

B. 0

C. $\frac{1}{2}$

D. $\frac{1}{3}$

Answer: c

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