MATHS

BOOKS - TARGET MATHS (HINGLISH)

PROBABILITY DISTRIBUTION

Classical Thinking

1. Let denote the number of fruits that are grown in a farm house in a particular day. The probability that X can take the value of x has the following form, where k is some unknown constant.

$$P(X=x)=\begin{cases} k & \text{if } x=0 \\ 2k & \text{if } x=1 \\ 3x & \text{if } x=2 \\ 0 & \text{otherwise} \end{cases}$$

Then the value of k is

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

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

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

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

Answer: D

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2. The p.m.f. of a r.v. is

$$P(X=x)=\begin{cases}\frac{1}{2^5}{}^5C_x, x=0,1,\ldots,5\\ 0, \text{otherwise}\end{cases}, \text{then } P(X\leq 2)=$$

A. $\frac{3}{32}$

B. $\frac{7}{32}$

C. $\frac{11}{32}$

D. $\frac{16}{32}$

Answer: D

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3. For a random variable X, if Var (X) = 4 and $E\left(X^2\right) = 13$, the value of E(X) is

A. 3

B. 4

C. 5

D. 6

Answer: A

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4. For a random variable X, if E(X) = 5 and V(X) = 6, then $E\left(X^2\right)$ is equal to

A. 19

B. 31

C. 61

D. 11

Answer: B

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5. A random variable X takes values 1,2,3 and 4 with probabilities $\frac{1}{6}, \frac{1}{3}, \frac{1}{3}, \frac{1}{6}$ respectively, then its mean and variance is equal to

A. $\frac{5}{2}, \frac{11}{12}$

B. $\frac{5}{2}, \frac{11}{16}$

C. $\frac{5}{3}, \frac{11}{16}$

D. $\frac{5}{3}, \frac{11}{12}$

Answer: A

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6. The p.d.f. of a random variable X is

$(f)x = \frac{1}{5}, 0 \leq x \leq 5$

$= 0$, otherwise

Then the value of $P(1 < X < 3)$ is

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

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

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

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

Answer: B

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7. The p.d.f. of a random variable X is

$(f)x = 2x, 0 \leq x \leq 1$

$= 0$, otherwise

Then the value of $P\left(\frac{1}{3} < X < \frac{1}{2}\right)$ is

A. $\frac{1}{36}$

B. $\frac{5}{36}$

C. $\frac{7}{36}$

D. $\frac{11}{36}$

Answer: B

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8. If the p.d.f of a random variable X is

$$F(x) = \begin{cases} 0.5x & 0 \leq x \leq 2 \\ 0 & \text{otherwise} \end{cases}$$

Then the value of $P(0.5 \leq X \leq 1.5)$ is

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

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

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

D. 1

Answer: B

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9. The p.d.f of a continous random variable X is

$f(x) = \frac{x}{8}, 0 < x < 4$

$= 0$, otherwise

Then the value of $P(X > 3)$ is

A. $\frac{3}{16}$

B. $\frac{5}{16}$

C. $\frac{7}{16}$

D. $\frac{9}{16}$

Answer: C

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10. Let X = time (in minutes) that lapses between the bell and the end of the lectures in cases of a collge professor. Suppose X has p.d.f

$$f(x) = \begin{cases} kx^2 & 0 \leq x \leq 2 \\ 0 & \text{otherwise} \end{cases}$$

Find the value of k.

A. $\frac{5}{8}$

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

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

D. $\frac{2}{8}$

Answer: B

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11. Thep.d.f of a continous random variable X is

$$f(x) = \frac{x^2}{3}, \ -1 < 1 < 2$$

0 = otherwise

Then the c.d.f of X is

A. $f(x) = x^3 + \frac{1}{9}$

B. $f(x) = \frac{x^3}{3} + \frac{1}{9}$

C. $f(x) = \frac{x^3}{9} + \frac{1}{9}$

D. $f(x) = \frac{x^3}{9}$

Answer: C

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Critical Thinking

1. Which of the following distribution of probabilities of a random variable X is the probability distribution ?

A. (A)

X	0	1	2	3
P(X)	0.3	0.2	0.4	0.1

B. (B)

X	0	1	2
P(X)	0.1	0.7	0.4

C. (C)

X	1	2	3	4
P(X)	0.5	0.5	0.2	0.3

D. (D)

X	2	3	4	5
P(X)	0.2	0.2	0.2	0.5

Answer: A

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2. A random variable X has the following probability distribution:

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P(0 lt X lt 4)` is

A. $\frac{11}{49}$

B. $\frac{15}{49}$

C. $\frac{20}{49}$

D. $\frac{40}{49}$

Answer: B

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3. The probability distribution of X is

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Then P(X is odd)=

A. 0.45

B. 0.55

C. 0.65

D. 0.75

Answer: B

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4. Find k ,such that the function

$$P(x) = \left\{ \left(k\binom{4}{x}, , x = 0,1,2,3,4, k > 0 \right), (0, \text{otherwise.}) \right.$$

is a probability mass function (p.m.f.)

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

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

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

D. $\frac{1}{16}$

Answer: D

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5. The p.m.f. of a.r.v. X is as follows:

$P(X=0)=3k^3$, $P(X=1)=4k-10k^2$, P(X=2)=5k-1, P(X=x)=0` for any other value of x, then value of k is

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

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

C. 1

D. 2

Answer: A

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6. The p.m.f. of a random variable X is

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If b= 2a, then

A. $a = \frac{1}{2}, b = \frac{1}{3}$

B. $a = \frac{1}{3}, b = \frac{1}{2}$

C. $a = \frac{1}{4}, b = \frac{1}{2}$

D. $a = \frac{1}{2}, b = \frac{1}{4}$

Answer: C

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7. Let X denote the number of hours you study during a randomly selected school day The probability that X can take the values x. has the

following form, where k is some unknown constant. `P(X=x)={0. 1 ,""""if""""x=0k x ,""""if""x=1""""or""""2k(5-x)

A. 0.35

B. 0.3

C. 0.15

D. 0.2

Answer: C

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8. Let X be a random variable which assumes values x_1, x_2, x_3, x_4 such that $2P(X = x_1) = 3P(X = x_2) = P(X = x_3) = 5P(X = x_4)$. Find the probability distribution of X.

A. (A)

X	x_1	x_2	x_3	x_4
P(X)	$\frac{15}{61}$	$\frac{10}{61}$	$\frac{30}{61}$	$\frac{6}{61}$

B. (B)

X	x_1	x_2	x_3	x_4
P(X)	$\frac{5}{16}$	$\frac{4}{16}$	$\frac{2}{16}$	$\frac{6}{16}$

C. (C)

X	x_1	x_2	x_3	x_4
P(X)	$\frac{3}{14}$	$\frac{4}{14}$	$\frac{7}{14}$	$\frac{1}{14}$

D. (D)

X	x_1	x_2	x_3	x_4
P(X)	$\frac{10}{31}$	$\frac{15}{31}$	$\frac{5}{31}$	$\frac{2}{31}$

Answer: A

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9. Three coins are tossed. Then the probability distribution of number of head is

A. (A)

X	0	1	2	3
P (X)	$\frac{1}{8}$	$\frac{5}{8}$	$\frac{5}{8}$	$\frac{1}{8}$

B. (B)

X	0	1	2	3
P (X)	$\frac{2}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{2}{8}$

C. (C)

X	0	1	2	3
P (X)	$\frac{1}{5}$	$\frac{2}{5}$	$\frac{2}{5}$	$\frac{1}{5}$

D. (D)

X	0	1	2	3
P (X)	$\frac{1}{8}$	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{1}{8}$

Answer: D

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10. A bag contains 4 red and 6 black balls. Three balls are drawn at random. Find the probability distribution o the number of red balls.

A. (A)

X	0	1	2	3
P(X)	$\frac{1}{9}$	$\frac{2}{9}$	$\frac{5}{6}$	$\frac{4}{6}$

B. (B)

X	0	1	2	3
P(X)	$\frac{1}{6}$	$\frac{1}{2}$	$\frac{3}{10}$	$\frac{1}{30}$

C. (C)

X	0	1	2	3
P(X)	$\frac{1}{5}$	$\frac{2}{3}$	$\frac{5}{9}$	$\frac{6}{9}$

D. (D)

X	0	1	2	3
P(X)	$\frac{1}{6}$	$\frac{2}{3}$	$\frac{4}{10}$	$\frac{3}{10}$

Answer: B

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11. Five defective mangoes are accidenty mixed with 15 good ones. Four mangoes are drawn at random from this lot. Then the probabilty distribution of the number of defective mangoes is

A. (A)

X	0	1	2	3	4
P (X)	$\frac{85}{323}$	$\frac{5}{323}$	$\frac{1}{969}$	$\frac{2}{969}$	$\frac{3}{969}$

B. (B)

X	0	1	2	3	4
P (X)	$\frac{91}{323}$	$\frac{85}{969}$	$\frac{3}{323}$	$\frac{1}{969}$	$\frac{3}{969}$

C. (C)

X	0	1	2	3	4
P (X)	$\frac{91}{323}$	$\frac{455}{969}$	$\frac{70}{323}$	$\frac{10}{323}$	$\frac{1}{969}$

D. (D)

X	0	1	2	3	4
P (X)	$\frac{455}{969}$	$\frac{85}{323}$	$\frac{263}{323}$	$\frac{25}{969}$	$\frac{2}{969}$

Answer: C

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12. Let the p.m.f. of a random variable X be -

$$P(x) = \frac{3-x}{10} \quad \text{for} \quad x = -1, 0, 1, 2$$

= 0 otherwise

Then E(X) is ..... .

A. 0

B. 1

C. 2

D. 3

Answer: A

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13. The p.m.f. of a r.v. X is $P(x) = \begin{cases} kx^2, x = 1,2,3,4 \\ 0, \text{otherwise} \end{cases}$, then E (X) =

A. $\frac{7}{3}$

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

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

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

Answer: C

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14. If the probability mass function of a discrete random variable X is

$P(x) = \frac{C}{x^3}, x = 1, 2, 3$

=0, otherwise

Then $E(X) =$

A. $\frac{343}{297}$

B. $\frac{294}{251}$

C. $\frac{297}{294}$

D. $\frac{251}{294}$

Answer: B

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15. A fair coin is tossed 3 times. Let X be the number of heads obtained.

Find E(X) and V(X).

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

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

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

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

Answer: B

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16. If a coin is tossed twice and X is the number of tails, then var(X)=

A. 0

B. 1

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

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

Answer: C

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17. Two dice are thrown simultaneously. If X denotes the number of sixes, find the expectation of X.

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

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

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

D. $\frac{5}{6}$

Answer: A

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18. A pair of dice is thrown and X denotes the sum of the numbers on uppermost faces. Then the expected value of X is

A. 12

B. 6

C. 7

D. 8

Answer: C

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19. The p.m.f. of a r.v. X is

P(x) =1/15, for x =1,2, ... , 14,15

= 0 otherwise.

Then, E(X) is equal to

A. 2

B. 4

C. 6

D. 8

Answer: D

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20. The p.m.f. of a r.v. X is $P(x) = \begin{cases} \frac{2x}{n(n+1)} & x = 1,2,\ldots,n \\ 0 & \text{otherwise} \end{cases}$

Then E(X) =

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

B. $\frac{2n+1}{3}$

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

D. $\frac{2n-1}{3}$

Answer: B

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21. A bakerman sells 5 types of cakes. Profit due to the sale of each type of cake is respectively Rs3, Rs 2.5, Rs 2, Rs 1.5, Rs 1. The demands for these cakes are $10\,\%$, $5\,\%$, $25\,\%$, $45\,\%$ and $15\,\%$ respectively.. What is he expected profit per cake?

A. 1.725

B. 1.572

C. 2.725

D. 2.572

Answer: A

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22. If a c.r.v. X has the probability density function

$f(x) = C\left(9 - x^2\right), 0 < x < 3$

= 0 , otherwise

Then, the value of C is

A. $\frac{1}{16}$

B. $\frac{1}{15}$

C. $\frac{2}{18}$

D. $\frac{1}{18}$

Answer: D

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23. If the p.d.f of a continuous random variable X is

$f(x) = kx^2(1-x), 0 < x < 1$

= 0 otherwise

Then the value of k is

A. 8

B. 10

C. 12

D. 16

Answer: C

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24. Let X is a continuous random variable with probability density function

$$f(x) = \begin{cases} \frac{x}{6} + k & 0 \leq x \leq 3 \\ 0 & \text{otherwise} \end{cases}$$

The value of k is equal to

A. $\frac{1}{12}$

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

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

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

Answer: A

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25. The p.d.f of a random variable X is given by

$f(x) = 3\left(1 - 2x^2\right), 0 < x < 1$

= 0 , otherwise

Find $P\left(\frac{1}{4} < X < \frac{1}{3}\right)$

A. $\frac{128}{752}$

B. $\frac{331}{752}$

C. $\frac{165}{864}$

D. $\frac{179}{864}$

Answer: D

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26. The p.d.f. of a continuous random variable X is $f(x) = \frac{K}{\sqrt{x}}, 0 < x < 4$

= 0 , otherwise

Then $P(X \geq 1)$ is equal to

A. 0.2

B. 0.3

C. 0.4

D. 0.5

Answer: D

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27. The p.d.f. of X is $f(x) = \begin{cases} \frac{x+2}{18}, -2 < x < 4 \\ 0, \text{otherwise} \end{cases}$, then $P(|X| < 1)$ =

A. $\frac{1}{9}$

B. $\frac{2}{9}$

C. $\frac{1}{7}$

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

Answer: B

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28. X is continuous random variable with probability density function $f(x) = \frac{x^2}{8}, 0 \leq x \leq 1$. Then, the value of $P(0.2 \leq X \leq 0.5)$ is

A. $\frac{0.117}{24}$

B. $\frac{0.112}{24}$

C. $\frac{0.117}{36}$

D. $\frac{0.112}{36}$

Answer: A

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29. If the p.d.f. of a r.v. X is

$f(x) = K.\, e^{-\theta x}, \theta > 0, 0 \leq x < \infty$

$= 0$, otherwise

Then, K =

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

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

C. θ

D. 2θ

Answer: C

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30. If p.d.f. of a a c.r.v. X is

$f(x) = ae^{-ax}, x \geq 0, a > 0$

$= 0$, otherwise.

If $P(0 < X < K) = 0.5$, then K =

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

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

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

D. $\frac{1}{a}\log a$

Answer: B

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31. The p.d.f. of a r.v. X is $f_X(x) = \begin{cases} \frac{k}{\sqrt{x}}, 0 < x < 4 \\ 0, \text{otherwise} \end{cases}$, then k =

A. x

B. $\sqrt{x}$

C. $2\sqrt{x}$

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

Answer: D

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32. The p.d.f. of a r.v. X is $f(x) = \begin{cases} \frac{1}{x^2}, 1 < x < \infty \\ 0, \text{otherwise} \end{cases}$. If $C_1 = \{x : 1 < x < 2\}$ and $C_2 = \{x : 4 < x < 5\}$, then $P(C_1 \cup C_2)$ =

A. $\frac{1}{20}$

B. $\frac{7}{20}$

C. $\frac{11}{20}$

D. $\frac{13}{20}$

Answer: C

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33. Let X = time (in minutes) that lapses between the bell and the end of the lectures in cases of a collge professor. Suppose X has p.d.f

$$f(x) = \begin{cases} kx^2 & 0 \leq x \leq 2 \\ 0 & \text{otherwise} \end{cases}$$

What is the probability that lecture ends within 1 minute of the bell ringing ?

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

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

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

D. $\frac{1}{16}$

Answer: C

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Competitive Thinking

1. A die is rolled .IF X denotes the number of positive divisors of the outcome then the range of the random variable X is

A. $\{1, 2, 3\}$

B. $\{1, 2, 3, 4\}$

C. $\{1, 2, 3, 4, 5, 6\}$

D. $\{1, 3, 5\}$

Answer: B

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2. A coin is tossed three times. If X denotes the absolute difference between the number of heads and the number of tails, then P(X=1)=

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

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

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

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

Answer: D

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3. If the probability function of a random variable X is defined by $P(X=k)=a\left(\frac{k+1}{2^k}\right)$ for $k=0,1,2,3,4,5$ then the probability that X takes a prime value is

A. $\frac{13}{20}$

B. $\frac{23}{60}$

C. $\frac{11}{20}$

D. $\frac{19}{60}$

Answer: B

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4. A random variable X is defined by

$$X = \begin{cases} 3 \text{ with probability } = \frac{1}{3} \\ 4 \text{ with probability } = \frac{1}{4} \\ 12 \text{ with probability } = \frac{5}{12} \end{cases}$$

Then, E(X) is

A. 6

B. 7

C. 5

D. 8

Answer: B

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5. A boy tosses faiir coin 3 times. If he gets Rs 2X for X heads, then his expected gain equals to Rs.....

A. 1

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

C. 3

D. 4

Answer: C

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6. A random variable X takes the value 1,2,3 and 4 such that $2P(X=1)=3P(X=2)=P(X=3)=5P(X=4)$. If σ^2 is the variance and μ is the mean of X then $\sigma^2+\mu^2=$

A. $\frac{421}{61}$

B. $\frac{570}{61}$

C. $\frac{149}{61}$

D. $\frac{3480}{3721}$

Answer: A

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7. The mean and standard deviation of random variable X are 10 and 5 respectively, then $E\left(\frac{X-15}{5}\right)^2$ = _____.

A. 4

B. 3

C. 2

D. 5

Answer: C

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8. A box contains 6 pens , 2 of which are defective Two pens are taken randomy from the bax .If r,v. X., : Number of defective pens obtained , then standard deviation of x=

A. $\pm \frac{4}{3\sqrt{5}}$

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

C. $\frac{16}{45}$

D. $\frac{4}{3\sqrt{5}}$

Answer: D

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9. IF r.v X : waiting time in minutes for bus and p.d.f of X is given by

$$f(x) = \begin{cases} \frac{1}{5} & 0 \leq x \leq 5 \\ 0 & \text{otherwise} , \end{cases}$$

then probabaility of waiting time not more than 4 minutes is

A. 0.3

B. 0.8

C. 0.2

D. 0.5

Answer: B

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Evaluation Test

1. A random variate X takes the values 0, 1, 2, 3 and its mean is 1.3. If $P(X=3)=2P(X=1)$ and $P(X=2)=0.3$, then $P(X=0)$ is equal to

A. 0.1

B. 0.2

C. 0.3

D. 0.4

Answer: D

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2. A random variable X takes values $-1, 0, 1, 2$ with probabilities $\frac{1+3p}{4}, \frac{1-p}{4}, \frac{1+2p}{4}, \frac{-14p}{4}$ respectively, where p varies over R. Then the minimum and maximum values of the mean of X are respectively

A. $-\frac{7}{4}$ and $\frac{1}{2}$

B. $-\frac{1}{16}$ and $\frac{5}{16}$

C. $-\frac{7}{4}$ and $\frac{5}{16}$

D. $-\frac{1}{16}$ and $\frac{5}{4}$

Answer: D

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3. If the probability density function of a random variable X is $f(x) = \frac{x}{2}$ in $0 \leq x \leq 2$, then $P(X > 1.5 \mid X > 1)$ is equal to

A. $\frac{7}{16}$

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

C. $\frac{7}{12}$

D. $\frac{21}{64}$

Answer: C

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4. If the random variable X takes the values $x_1, x_2, x_3 \ldots, x_{10}$ with probablilities P $(X = x_i) = ki$, then the value of k is equal to

A. $\frac{1}{10}$

B. $\frac{1}{15}$

C. $\frac{1}{55}$

D. 10

Answer: C

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5. A random variable X takes the values $0, 1, 2, 3, \ldots,$ with prbability $PX(=x) = k(x+1)\left(\frac{1}{5}\right)^x$, where k is a constant, then $P(X=0)$ is.

A. $\frac{16}{25}$

B. $\frac{17}{25}$

C. $\frac{18}{25}$

D. $\frac{19}{25}$

Answer: A

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