Statistics And Probability JEE Main PYQ - 1

Total Time: 25 Minute **Total Marks:** 40

Instructions

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1. Test will auto submit when the Time is up.
2. The Test comprises of multiple choice questions (MCQ) with one or more correct answers.
3. The clock in the top right corner will display the remaining time available for you to complete the examination.

Navigating & Answering a Question

1. The answer will be saved automatically upon clicking on an option amongst the given choices of answer.
2. To deselect your chosen answer, click on the clear response button.
3. The marking scheme will be displayed for each question on the top right corner of the test window.

Statistics And Probability

1. The mean of the data set comprising of 16 observations is 16. If one of the observatio d three new observations valued $3, 4$ and 5 added to the data, then the mean of the resultant data is **(+4, -1)**

[2015]

a. 16.8

b. 16

c. 15.8

d. 14

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2. A student scores the following marks in five tests : $45, 54, 41, 57, 43$. His score is not known for the sixth test. If the mean score is 48 in the six tests, then the standard deviation of the marks in six tests is **(+4, -1)**

[April. 08, 2019 (II)]

a. $\frac{10}{\sqrt{3}}$

b. $\frac{100}{\sqrt{3}}$

c. $\frac{100}{3}$

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

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3. All the students of a class performed poorly in Mathematics. The teacher decided to give grace marks of 10 to each of the students. Which of the following statistical measures will not change even after the grace marks were given? **(+4, -1)**

[2013]

a. Mean

b. Median

c. Mode

d. Variance

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4. The mean and variance of 20 observations are found to be 10 and 4, respectively. On rechecking, it was found that an observation 9 was incorrect and the correct observation was 11. Then the correct variance is : **(+4, -1)**

[1-Feb-2023 Shift 1]

a. 4.01

b. 3.99

c. 3.98

d. 4.02

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5. If the sum of the deviations of 50 observations from 30 is 50, then the mean of these observation is : **(+4, -1)**

[Jan. 12, 2019 (I)]

a. 50

b. 51

c. 30

d. 31

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6. The mean and variance of the marks obtained by the students in a test are 10 and 4 respectively Later, the marks of one of the students is increased from 8 to 12 If the new mean of the marks is 10.2, then their new variance is equal to : **(+4, -1)**

[25-Jan-2023 Shift1]

a. 3.92

b. 3.96

c. 4.04

d. 4.08

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7. The mean and variance of the marks obtained by the students in a test are 10 and 4 respectively Later, the marks of one of the students is increased from 8 to 12 If the new mean of the marks is 10.2, then their new variance is equal to : **(+4, -1)**

[31-Jan-2023 Shift 2]

a. 3.92

b. 3.96

c. 4.04

d. 4.08

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8. If the mean deviation about median for the number $3, 5, 7, 2k, 12, 16, 21, 24$ arranged in the ascending order, is 6 then the median is **(+4, -1)**

[25-Jul-2022-Shift-2]

a. 11.5

b. 10.5

c. 12

d. 11

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9. Three urns A, B and C contain 4 red, 6 black; 5 red, 5 black; and λ red, 4 black balls respectively One of the urns is selected at random and a ball is drawn If the ball drawn is red and the probability that it is drawn from urn C is 0.4 then the square of the length of the side of the largest equilateral triangle, inscribed in the parabola $y^2 = \lambda x$ with one vertex at the vertex of the parabola, is **(+4, -1)**

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10. A boy needs to select five courses from 12 available courses, out of which 5 courses are language courses If he can choose at most two language courses, then the number of ways he can choose five courses is **(+4, -1)**

[2021, 18 March Shift-I]

Answers

1. **Answer: d**

Explanation:

$\frac{a_1+a_2+a_3+\ldots\ldots+a_{15}+16}{16} = 16 \ldots\ldots (1)$

$\frac{a_1+a_2+a_3+\ldots\ldots+a_{15}+(3+4+5)}{18} = ?? \ldots\ldots (2)$

(1) $a_1 + a_2 + a_3 + \ldots\ldots + a_{15} = (16)^2 - 16$

now

(2) $\Rightarrow \frac{(16)^2-16+12}{18}$

$= \frac{256-4}{18} = \frac{252}{18} = 14$

$\Rightarrow$ mean $= 14$

Concepts:

1. Statistics:

Statistics is a field of mathematics concerned with the study of data collection, data analysis, data interpretation, data presentation, and data organization. Statistics is mainly used to acquire a better understanding of data and to focus on specific applications. Also, Statistics is the process of gathering, assessing, and summarising data in a mathematical form.

Mathematically there are two approaches for analyzing data in statistics that are widely used:

Descriptive Statistics -

Using measures of central tendency and measures of dispersion, the descriptive technique of statistics is utilized to describe the data collected and summarise the data and its attributes.

Inferential Statistics -

This statistical strategy is utilized to produce conclusions from data. Inferential statistics rely on statistical tests on samples to make inferences, and it does so by discovering variations between the two groups. The p-value is calculated and

differentiated to the probability of chance() = 0.05. If the p-value is less than or equivalent to, the p-value is considered statistically significant.

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2. Answer: a

Explanation:

Let x be the 6th observation

$\Rightarrow 45 + 54 + 41 + 57 + 43 + x = 48 \times 6 = 288$

$\Rightarrow x = 48$

variance = $= \left(\frac{\sum x_i^2}{6} - (\bar{x})^2\right)$

$\Rightarrow variance = \frac{14024}{6} - (48)^2$

$= \frac{100}{3}$

$\Rightarrow standard\,deviation = \frac{10}{\sqrt{3}}$

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3. **Answer: d**

Explanation:

If initially all m arks were x_i, then
$\sigma_1^2 = \frac{\sum (x_i - \overline{x})^2}{N}$
Now, each is increased by 10
$\therefore \sigma_1^2 = \frac{\sum[(x_i+10)-(\overline{x}+10)]^2}{N} = \sigma_1^2$
So, variance will not change whereas mean, median and mode will increase by 10.

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4. Answer: b

Explanation:

$\frac{\sum x_i}{20} = 10 \quad \Rightarrow \quad \sum x_i = 200 \quad \ldots (i)$
$\frac{\sum x_i^2}{20} = 100 = 4 \quad \Rightarrow \quad \sum x_i^2 = 2080 \quad \ldots (ii)$
Actual mean $= \frac{200-9+11}{20} = \frac{202}{20}$
Variance $= \frac{2080-81+121}{20} - \left(\frac{202}{20}\right)^2 = 3.99$

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5. Answer: d

Explanation:

$\sum_{i=1}^{50}(x_i - 30) = 50$
$\sum x_1 = 50 \times 30 = 50$
$\sum x_1 = 50 + 50 + 30$
$\text{Mean} = \bar{x} = \frac{\sum x_i}{n} = \frac{50 \times 30 + 50}{50} = 30 + 1 = 31$

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6. **Answer: b**

Explanation:

$$\sum_{i=1}^{n} x_i = 10n$$

$$\sum_{i=1}^{n} x_i - 8 + 12 = (10.2)n$$

$$n = 20$$

Now $\frac{\sum_{i=1}^{20} x_i^2}{20} - (10)^2 = 4 \Rightarrow \sum_{i=1}^{20} x_i^2 = 2080$

$$\frac{\sum_{i=1}^{20} x_i^2 - 8^2 + 12^2}{20} - (10.2)^2$$

$$= 108 - 104.04 = 3.96$$

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7. Answer: b

Explanation:

$$\sum_{i=1}^{n} x_i = 10n$$

$$\sum_{i=1}^{n} x_i - 8 + 12 = (10.2)n$$

$$\therefore n = 20$$

Now $\frac{\sum_{i=1}^{20} x_i^2}{20} - (10)^2 = 4 \Rightarrow \sum_{i=1}^{20} x_i^2 = 2080$

$$\frac{\sum_{i=1}^{20} x_i^2 - 8^2 + 12^2}{20} - (10.2)^2$$

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8. Answer: d

Explanation:

The correct answer is (D) : 11

$3, 5, 7, 2k, 12, 16, 21, 24$

Median $= \frac{2k+12}{2} = k + 6$

M.D. $= \frac{\Sigma|x_i - M|}{8} = 6$

$= (k + 3) + (k + 1) + (k - 1) + (6 - k) + (6 - k) + (10 - k) + (15 - k) + (18 - k) = 48$

$= 58 - 2k = 48$

$k = 5$

Median $= k + 6 = 11$

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9. **Answer: 432 - 432**

Explanation:

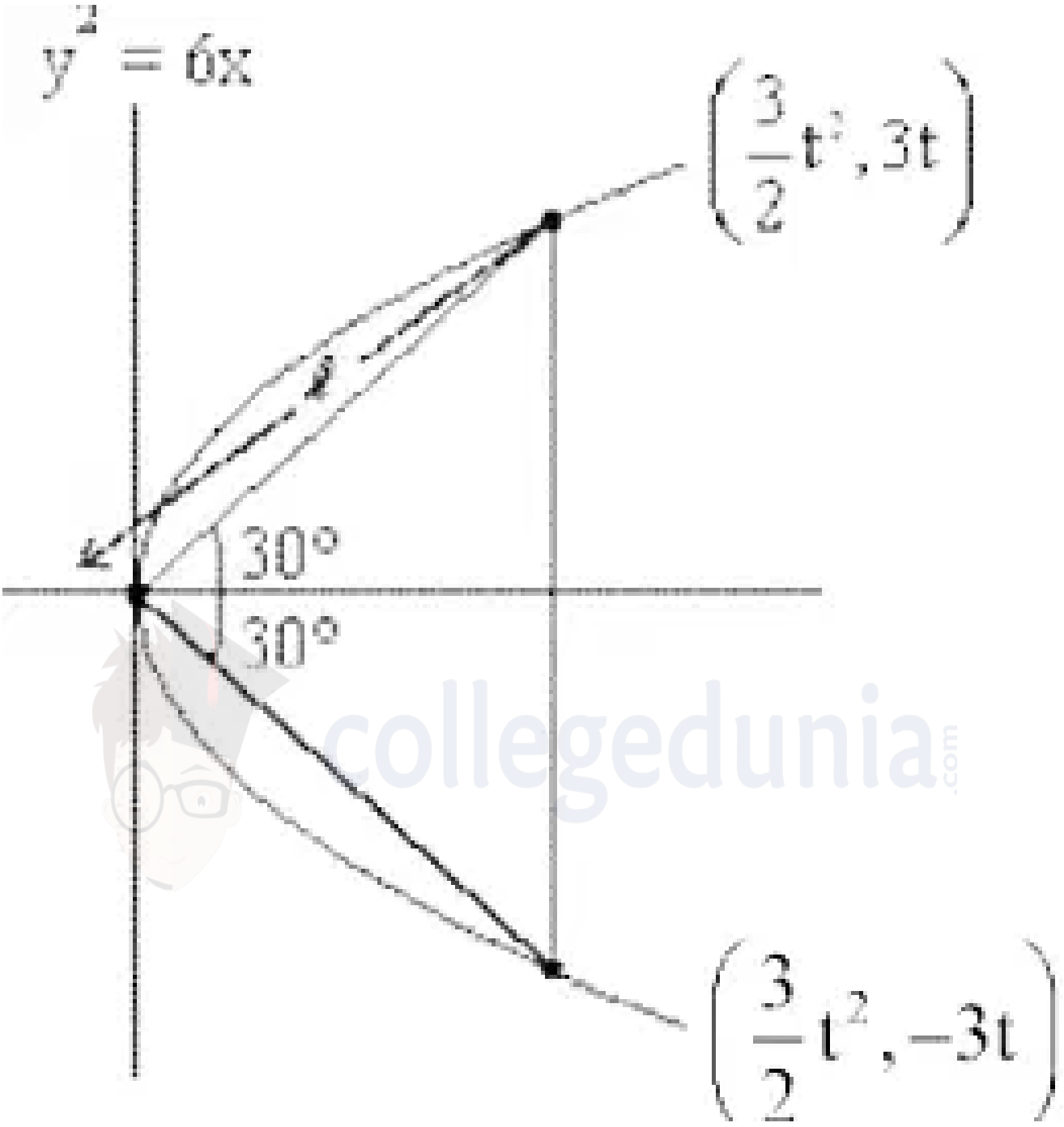
The correct answer is 432

Urn A		Urn B		Urn C	
Red	Black	Red	Black	Red	Black
4	6	5	5	λ	4

$$P\left(\frac{C}{R}\right) = \frac{P(C)P\left(\frac{R}{C}\right)}{P(A)P\left(\frac{R}{A}\right)+P(B)P\left(\frac{R}{B}\right)+P(C)P\left(\frac{R}{C}\right)}$$

$$0.4 = \frac{\frac{1}{3}\times\frac{\lambda}{(\lambda+4)}}{\frac{1}{3}\times\frac{4}{10}+\frac{1}{3}\times\frac{5}{10}+\frac{1}{3}\frac{\lambda}{(\lambda+4)}}$$

$$\Rightarrow \lambda = 6$$



$\tan 30^\circ = 3t = \frac{3}{2}t^2$

$\frac{1}{\sqrt{3}} = \frac{2}{t}$

$t = 2\sqrt{3}$

$\left(\frac{3}{2}t^2, 3t\right) = (18, 6\sqrt{3})$

$\ell^2 = 18^2 + (6\sqrt{3})^2$

$= 324 + 108$

$= 432$

Concepts:

1. Probability:

Probability is defined as the extent to which an event is likely to happen. It is measured by the ratio of the favorable outcome to the total number of possible outcomes.

The definitions of some important terms related to probability are given below:

Sample space

The set of possible results or outcomes in a trial is referred to as the sample space. For instance, when we flip a coin, the possible outcomes are heads or tails. On the other hand, when we roll a single die, the possible outcomes are 1, 2, 3, 4, 5, 6.

Sample point

In a sample space, a sample point is one of the possible results. For instance, when using a deck of cards, as an outcome, a sample point would be the ace of spades or the queen of hearts.

Experiment

When the results of a series of actions are always uncertain, this is referred to as a trial or an experiment. For Instance, choosing a card from a deck, tossing a coin, or rolling a die, the results are uncertain.

Event

An event is a single outcome that happens as a result of a trial or experiment. For instance, getting a three on a die or an eight of clubs when selecting a card from a deck are happenings of certain events.

Outcome

A possible outcome of a trial or experiment is referred to as a result of an outcome. For instance, tossing a coin could result in heads or tails. Here the possible outcomes are heads or tails. While the possible outcomes of dice thrown are 1, 2, 3, 4, 5, or 6.

10. **Answer: 546 - 546**

Explanation:

The correct answer is 546.
For at most two language courses
$={}^{5}C_{2} \times {}^{7}C_{3} + {}^{5}C_{1} \times {}^{7}C_{4} + {}^{7}C_{5}$
=546

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