

# MHT CET 2023 Question Paper Shift 1

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**Question 1. Find variance of first  $2n$  natural numbers.**

**Answer.**  $4n^2 - 1 / 12$

**Solution:**

To find the variance of the first  $2n$  natural numbers, we first need to find the mean of the sequence. The mean is simply the sum of the numbers divided by the total count of numbers:

$$\text{mean} = (1 + 2 + 3 + \dots + 2n) / 2n$$

Using the formula for the sum of an arithmetic series, we can simplify the expression for the mean to:

$$\text{mean} = (2n + 1) / 2$$

Next, we need to find the variance. The variance is defined as the average of the squared differences from the mean. In other words:

$$\text{variance} = [(1 - \text{mean})^2 + (2 - \text{mean})^2 + \dots + (2n - \text{mean})^2] / 2n$$

We can simplify this expression by expanding the squares and using the formula for the sum of the first  $n$  natural numbers:

$$\text{variance} = [n(2n + 1)(4n + 1) - 6n(2n + 1) + 6n^2] / (12n)$$

Simplifying this expression, we get:

$$\text{variance} = (4n^2 - 1) / 12$$

Therefore, the variance of the first  $2n$  natural numbers is  $(4n^2 - 1) / 12$ .

**Question 2. Mean + Variance = 1.8,  $n = 5$ ,  
Find  $p$ (probability of success).**

**Answer.**  $p = 1/5$

**Question 3. If  $X \sim (5, p)$   $P(X=3) = 5P(X=4)$ , find variance.**

**Answer.**  $50/49$

**Question 4.  $x^2 - 3xy + dy^2 + 3x - 5y + 2 = 0$ ;  $d \geq 0$  is  $\tan^{-1}(1/a)$  then the value of  $d$  is?**

**Question 5. The negation of inverse of the statement  
 $(p \wedge q) \rightarrow (p \vee \sim q)$**

**Question 6. The value of  $i^{248} + i^{246} + i^{244} + i^{242} + i^{240} + i^{238} + i^{236} + i^{234} + i^{232} + i^{230} + i^{228} + i^{226} + i^{224} + i^{222} + i^{220} + i^{218} + i^{216} + i^{214} + i^{212} + i^{210} + i^{208} + i^{206} + i^{204} + i^{202} + i^{200} + i^{198} + i^{196} + i^{194} + i^{192} + i^{190} + i^{188} + i^{186} + i^{184} + i^{182} + i^{180} + i^{178} + i^{176} + i^{174} + i^{172} + i^{170} + i^{168} + i^{166} + i^{164} + i^{162} + i^{160} + i^{158} + i^{156} + i^{154} + i^{152} + i^{150} + i^{148} + i^{146} + i^{144} + i^{142} + i^{140} + i^{138} + i^{136} + i^{134} + i^{132} + i^{130} + i^{128} + i^{126} + i^{124} + i^{122} + i^{120} + i^{118} + i^{116} + i^{114} + i^{112} + i^{110} + i^{108} + i^{106} + i^{104} + i^{102} + i^{100} + i^{98} + i^{96} + i^{94} + i^{92} + i^{90} + i^{88} + i^{86} + i^{84} + i^{82} + i^{80} + i^{78} + i^{76} + i^{74} + i^{72} + i^{70} + i^{68} + i^{66} + i^{64} + i^{62} + i^{60} + i^{58} + i^{56} + i^{54} + i^{52} + i^{50} + i^{48} + i^{46} + i^{44} + i^{42} + i^{40} + i^{38} + i^{36} + i^{34} + i^{32} + i^{30} + i^{28} + i^{26} + i^{24} + i^{22} + i^{20} + i^{18} + i^{16} + i^{14} + i^{12} + i^{10} + i^8 + i^6 + i^4 + i^2 + 1$  ?**

**Question 7. Diff  $\tan^{-1}(\sqrt{1+x^2} - 1/x)$  wrt  $\cos^{-1}(\sqrt{(1+\sqrt{1+x^2})/2\sqrt{1+x^2}})$**

**Question 8. Rolle Theorem  $f(x) = \sin x + \cos x$ . Find  $c \in [0, 2\pi]$**

**Question 9.  $\int \log(x^2 + a^2) / x^2 dx$**

**Question 10.  $y = \tan^{-1}(4 \sin 2x / \cos 2x - 6 \sin^2 x)$  dx**