Consider the statistics of two sets of observations as follows:

	Size	Mean	Variance
Observation I	10	2	2
Observation II	n	3	1

If the variance of the combined set of these two observations is $\frac{17}{9}$, then the value of n is equal to _____

Ans: For observation I ;

$$\frac{\Sigma x_i}{10} = 2 \implies \Sigma x_i = 20$$

$$\frac{\Sigma x_i^2}{10} - 2^2 = 2$$

$$\implies \Sigma x_i^2 = 60$$

For observation II :

$$\frac{\Sigma y_i}{n} = 3 \implies \Sigma y_i = 3n$$

$$\frac{\Sigma y_i^2}{n} - 3^2 = 1 \implies \Sigma y_i^2 = 10n$$

Now, combined variance,

$$\sigma^2 = \left[\frac{\Sigma(x_i^2 + y_i^2)}{10+n}\right] - \left[\frac{\Sigma(x_i + y_i)}{10+n}\right]^2$$

$$\implies \frac{17}{9} = \frac{60 + 10n}{10+n} - \left(\frac{20+3n}{10+n}\right)^2$$

$$\implies 17(n^2 + 20n + 100) = 9(n^2 + 40n + 200)$$

$$\implies 8n^2 - 20n - 100 = 0$$

$$\implies 2n^2 - 5n - 25 = 0$$

$$\implies n = 5$$