Mid

4: Gaussian Naive Bayes :-

Mean = All terms / term (μ)

Variance = $\sigma^2 = \frac{S}{n-1}$

S = ? (Wind − M.Wind)²

$$P(G) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{\left(-\frac{(V-\mu)^2}{2\sigma^2}\right)}$$

V = test data
μ = Mean
σ^2 = Variance
π = 3.14
e = 2.71

1. Find Mean (μ)
2. Find Variance
3. P(G) = ?
4. Gaussian Naive Bays
5. Normalize

Wind	Humidity	Rain
10	10	Yes
20	30	Yes → (4)
15	50	Yes
25	70	Yes (7)
20	60	No
40	20	No (3)
35	45	No → test → No

Step (1) :- Find Mean (μ)

	M.Wind	V.Wind	M.Humidity	V.Humidity
Yes	17.5	41.66	40	666.66
No	31.6	108.34	41.6	408.34

Step (2) :- Find Variance (σ^2)

(1): Variance of Wind by (Yes).

$$S = ((Wind - M.Wind)^2 + \dots)$$

$$S = (10-17.5)^2 + (20-17.5)^2 + (15-17.5)^2 + (25-17.5)^2$$

$$S = 125$$

$$\sigma^2 = \frac{S}{n-1} = \frac{125}{4-1}$$

$$\sigma^2 = 41.66$$

(2)- Variance of Wind by (No)

$$S = (20-31.6)^2 + (40-31.6)^2 + (35-31.6)^2$$

$$S = 216.68$$

$$\sigma^2 = \frac{S}{n-1} = \frac{216.68}{3-1}$$

$$\sigma^2 = 108.34$$

(9)- Variance of Humidity by (Yes).

$$S = (10-40)^2 + (30-40)^2 + (50-40)^2 + (70-40)^2$$

$$S = 2000$$

$$\sigma^2 = \frac{S}{n-1} = \frac{2000}{4-1}$$

$$\sigma^2 = 666.66$$

(b) 1- Variance of Humidity by (No) 1-

$S = (60-41.6)^2 + (20-41.6)^2 + (45-41.6)^2$

$S = 816.68$

$\sigma^2 = \frac{S}{n-1} = \frac{816.68}{3-1}$

$\sigma^2 = 408.34$

Step #03 1- $P(G) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{\left(\frac{-(V-\mu)^2}{2\sigma^2}\right)}$

(1) 1- Probability of **Wind**

$P(Wind/Yes) = \frac{1}{\sqrt{2\pi(41.66)}} e^{\left(-\frac{(35-17.5)^2}{2(41.66)}\right)}$

$P(Wind/Yes) = 0.00157$

~~$P(Wind/No) =$~~

$P(Wind/No) = \frac{1}{\sqrt{2\pi(108.34)}} e^{\left(\frac{(35-31.6)^2}{2(108.34)}\right)}$

$P(Wind/No) = $ ~~0.0167~~ 0.03634

② Probability of **Humidity** :-

$$P(\text{Humidity}/\text{Yes}) = \frac{1}{\sqrt{2\pi(666.66)}} e^{-\left(\frac{(45-40)^2}{2(666.66)}\right)}$$

$$P(\text{Humidity}/\text{Yes}) = 0.9516$$

$$P(\text{Humidity}/\text{No}) = \frac{1}{\sqrt{2\pi(408.34)}} e^{-\left(\frac{(45-41.6)^2}{2(408.34)}\right)}$$

$$P(\text{Humidity}/\text{No}) = 0.01946$$

$$P(\text{No}) = \frac{3}{7} \qquad P(\text{Yes}) = \frac{4}{7}$$

Step ④ :- Gaussian Naive Baise :-

$$V_{NB}(\text{Yes}) = P(\text{Yes}) \cdot P(\text{Wind}/\text{Yes}) \cdot P(\text{H}/\text{Yes})$$

$$V_{NB}(\text{Yes}) = (4/7)(0.00157)(0.01516)$$

$$V_{NB}(\text{Yes}) = 1.360 \times 10^{-5}$$

$$V_{NB}(No) = P(No) \cdot P(w/No) \cdot P(H/No)$$

$$V_{NB}(No) = (3/7)(0.03634)(0.0946)$$

$$\boxed{V_{NB}(No) = 3.0307 \times 10^{-4}}$$

Step (5) :- Normalization :-

$$V_{NB}(Yes) = \frac{V_{NB}(Yes)}{V_{NB}(Yes) + V_{NB}(No)}$$

$$= \frac{1.360 \times 10^{-5}}{1.360 \times 10^{-5} - 3.0307 \times 10^{-4}}$$

$$\Rightarrow \boxed{V_{NB}(Yes) = 0.04295}$$

$$V_{NB}(No) = \frac{V_{NB}(No)}{V_{NB}(No) + V_{NB}(Yes)}$$

$$= \frac{3.0307 \times 10^{-4}}{3.0307 \times 10^{-4} + 1.360 \times 10^{-5}}$$

$$\boxed{V_{NB}(No) = 0.95705}$$

$$\boxed{V_{NB}(No) > V_{NB}(Yes)}$$

So, Target is **No**.