Naive Bayes:

Naive Baye's methods are a set of supervised Learning algorithms based on Applying Baye's theorem with the naive assumptions of conditional independance between every pair of features given the value of class variables.

Bayes theorem state the following relationship Given class variables y and dependent Feature vector x_1 through x_n

$$P(y|x_1,\ldots,x_n) = \frac{P(y)\cdot P(x_1,\ldots,x_n|y)}{P(x_1,\ldots,x_n)}$$

$$\therefore \quad = \frac{P(y)\prod_{i=1}^{n}(x_i|y)}{P(x_1,\ldots,x_n)}$$

$$P(\cdot) \quad \boxed{P(y|x_1\ldots x_n) \propto P(y)\prod_{i=1}^{n}(x_i|y)}$$

Outlook	temp	Humidity	Windy	play
sunny	hot	High	False	No
sunny	hot	High	True	No
overcast	hot	High	False	Yes
rainy	mild	High	false	Yes
rainy	cool	Normal	false	Yes
rainy	cool	Normal	True	No
Overcast	cool	Normal	True	Yes
sunny	mild	high	False	No
sunny	cool	Normal	false	Yes
rainy	mild	Normal	false	Yes
sunny	mild	Normal	True	Yes
Overcast	mild	High	true	Yes
Overcast	hot	Normal	false	Yes
rainy	mild	High	True	No.

Outlook

~~Ho~~	Yes	NO	P(y)	P(N)
Sunny	2	3	$\frac{2}{9}$	3/5
overcast	4	0	4/9	0/5
Rainy	3	2	3/9	2/5
	9	5		

Play

	P(y)	P(N)
Yes	9	9/14
NO	5	5/14
	14	

temp:

	Yes	NO	P(y)	P(N)
Hot	2	2	2/9	2/5
mild	4	2	4/9	2/5
cool	3	1	3/9	1/5
	9	5		

Humidity

	yes	NO	P(y)	P(N)
High	3	4	3/9	4/5
Normal	6	1	6/9	1/5
	9	5		

Windy

	yes	NO	P(y)	P(N)
True	3	3	3/9	3/5
False	6	2	6/9	2/5
	9	5		

According to Naive Bayes theorem

$$P(A|B) = \frac{P(B|A) \cdot P(A)}{P(B)}$$

Suppose ~~I~~
If Today's outlook is rainy, temp is mild, Humidity is High and windy is false then tennis playing or not.

Let's calculate Today(rainy, mild, high, false).

$P(yes|today) = P(rainy|yes) * P(\cancel{Rainy}\ mild|yes) * P(High|yes) * P(false|yes) * P(yes)$

$$= \frac{3}{9} * \frac{4}{9} * \frac{3}{9} * \frac{6}{9} * \frac{9}{14}$$

$$\boxed{P(yes|today) = 0.0212}$$

$P(No|today) = P(rainy|No) * P(mild|No) * P(high|No) * P(false|No) * P(No)$

$$= \frac{8}{9} * \frac{2}{5} * \frac{2}{5} * \frac{4}{5} * \frac{2}{5} * \frac{5}{14}$$

$$\boxed{P(no|today) = 0.0183}$$

$$P(yes) = \frac{0.0212}{0.0212 + 0.0183}$$

$$\boxed{P(yes) = 0.537}$$

$P(NO) = 1 - P(Yes)$

$= 1 - 0.537$

$\boxed{P(No) = 0.463}$

In this scenario the probability of ~~B~~ yes is greater than no.

$\therefore$ $P(Yes) > P(No)$

$\underline{0.537 > 0.463}$

$\therefore$ In this perticular scenario, Outlook is rainy temp. is mild, Humidity is high and windy is false

$\therefore$ the output is **yes**. (means All conditions are satisfied so we can played a tennis)