Let  $E_1$  and  $E_2$  be two independent events such that  $P(E_1) = P_1$  and  $P(E_2) = P_2$ . Describe in words of the events whose probabilities are (i)  $P_1P_2$ (ii)  $(1 - P_1)P_2$ 

(iii) 
$$1 - (1 - P_1) (1 - P_2)$$
 (iv)  $P_1 + P_2 - 2P_1P_2$   
 $P(E_1) = P_1 \text{ and } P(E_2) = P_2$   
(i)  $P_1P_2 \Rightarrow P(E_1) \cdot P(E_2) = P(E_1 \cap E_2)$ 

So,  $E_1$  and  $E_2$  occur. ii)  $(1 - P_1) P_2 = P(E_1)' \cdot P(E_2) = P(E_1' \cap E_2)$ 

$$E_1$$
 does not occur but  $E_2$  occurs.  
 $(1 - P_1)(1 - P_2) = 1 - P(E_1)P(E_2)' = 1 - P(E_1' \cap E_2')$   
 $= 1 - [1 - P(E_1 \cup E_2)] = P(E_1 \cup E_2)$ 

So.  $E_1$  does not occur but  $E_2$  occurs. (ii)  $1 - (1 - P_1)(1 - P_2) = 1 - P(E_1)P(E_2)' = 1 - P(E_1' \cap E_2')$ 

So, 
$$E_1$$
 does not occur but  $E_2$  occurs.  

$$1 - (1 - P_1)(1 - P_2) = 1 - P(E_1)P(E_2)' = 1 - P(E_1' \cap E_2')$$

$$= 1 - [1 - P(E_1 \cup E_2)] = P(E_1 \cup E_2)$$
So, either  $E_1$  or  $E_2$  or both  $E_1$  and  $E_2$  occurs.

$$= 1 - [1 - P(E_1)P(E_2)] = 1 - P(E_1)P(E_2)$$

$$= 1 - [1 - P(E_1 \cup E_2)] = P(E_1 \cup E_2)$$
So, either  $E_1$  or  $E_2$  or both  $E_1$  and  $E_2$  occurs.
$$E_1 + P_2 - 2PP_3 = P(E_1) + P(E_2) - 2P(E_1) \cdot P(E_2)$$

either 
$$E_1$$
 or  $E_2$  or both  $E_1$  and  $E_2$  occurs.  
•  $P_2 - 2P_1P_2 = P(E_1) + P(E_2) - 2P(E_1) \cdot P(E_2)$ 

v)  $P_1 + P_2 - 2P_1P_2 = P(E_1) + P(E_2) - 2P(E_1) \cdot P(E_2)$  $= P(E_1) + P(E_2) - 2P(E_1 \cap E_2)$ 

 $= P(E_1 \cup E_2) - P(E_1 \cap E_2)$ 

So, either  $E_1$  or  $E_2$  occurs but not both.