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## Important Formulas of Probability

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## List of 21 Important Formulas of Probability

### Important Formulas of Probability

#### 1) Empirical Probability

$$fx \quad P_{\text{Empirical}} = \frac{n_{\text{Event Occurs}}}{n_{\text{Total Trials}}}$$

[Open Calculator !\[\]\(a870788d6ed9b8fd294b7654a8c8526b\_img.jpg\)](#)

$$ex \quad 0.7 = \frac{14}{20}$$

#### 2) Odds against

$$fx \quad O_A = \frac{n_L}{n_W}$$

[Open Calculator !\[\]\(c50c8b7b2cc2cf9ff925edec0ee94c0d\_img.jpg\)](#)

$$ex \quad 0.666667 = \frac{8}{12}$$

#### 3) Odds in Favor

$$fx \quad O_F = \frac{n_W}{n_L}$$

[Open Calculator !\[\]\(f60b7a900783ac3fd531bfd9c111be6d\_img.jpg\)](#)

$$ex \quad 1.5 = \frac{12}{8}$$

#### 4) Probability of Event

$$fx \quad P_{\text{Event}} = \frac{n_{\text{Favorable}}}{n_{\text{Total}}}$$

[Open Calculator !\[\]\(83bbbd261710c59db0214aa27b2edc0d\_img.jpg\)](#)

$$ex \quad 0.3 = \frac{3}{10}$$


#### 5) Probability of Failure

$$fx \quad q = \frac{n_L}{n_W + n_L}$$

[Open Calculator !\[\]\(f507db636256ac11a5525ef93ec6b8d7\_img.jpg\)](#)

$$ex \quad 0.4 = \frac{8}{12 + 8}$$




6) Probability of Success 

$$\text{fx } P_{BD} = \frac{n_W}{n_W + n_L}$$

Open Calculator 

$$\text{ex } 0.6 = \frac{12}{12 + 8}$$

Probability of Two or More Events 7) Probability of All Independent Events Occurring 

$$\text{fx } P_{(A \cap B \cap C)} = P_{(A)} \cdot P_{(B)} \cdot P_{(C)}$$

Open Calculator 

$$\text{ex } 0.08 = 0.5 \cdot 0.2 \cdot 0.8$$

8) Probability of Atleast One Event Occurring 

$$\text{fx } P_{(A \cup B \cup C)} = P_{(A)} + P_{(B)} + P_{(C)} - P_{(A \cap B)} - P_{(B \cap C)} - P_{(A \cap C)} + P_{(A \cap B \cap C)}$$

Open Calculator 

$$\text{ex } 0.92 = 0.5 + 0.2 + 0.8 - 0.1 - 0.16 - 0.4 + 0.08$$

9) Probability of Atleast Two Events Occurring 

$$\text{fx } P_{(\text{Atleast Two})} = (P_{(A)} \cdot P_{(B)}) + (P_{(A')} \cdot P_{(B)} \cdot P_{(C)}) + (P_{(A)} \cdot P_{(B')} \cdot P_{(C)})$$

Open Calculator 

$$\text{ex } 0.5 = (0.5 \cdot 0.2) + (0.5 \cdot 0.2 \cdot 0.8) + (0.5 \cdot 0.8 \cdot 0.8)$$

10) Probability of Dependent Events A and B Occurring Together 

$$\text{fx } P_{(A \cap B)} = P_{(A)} \cdot P_{(B|A)}$$

Open Calculator 

$$\text{ex } 0.1 = 0.5 \cdot 0.2$$

11) Probability of Event A Not Occurring 

$$\text{fx } P_{(A')} = 1 - P_{(A)}$$

Open Calculator 

$$\text{ex } 0.5 = 1 - 0.5$$

12) Probability of Event A Occurring given Event B occurs 

$$\text{fx } P_{(A|B)} = \frac{P_{(A \cap B)}}{P_{(B)}}$$

Open Calculator 

$$\text{ex } 0.5 = \frac{0.1}{0.2}$$



13) Probability of Event A Occurring given Event B occurs using Baye's Theorem 

$$\text{fx } P_{(A|B)} = \frac{P_{(B|A)} \cdot P_{(A)}}{P_{(B)}}$$

Open Calculator 

$$\text{ex } 0.5 = \frac{0.2 \cdot 0.5}{0.2}$$

14) Probability of Event A or B Occurring 

$$\text{fx } P_{(A \cup B)} = P_{(A)} + P_{(B)} - P_{(A \cap B)}$$

Open Calculator 


$$\text{ex } 0.6 = 0.5 + 0.2 - 0.1$$

15) Probability of Event A or B Occurring but Not Together 

$$\text{fx } P_{(A \Delta B)} = P_{(A)} + P_{(B)} - (2 \cdot P_{(A \cap B)})$$

Open Calculator 

$$\text{ex } 0.5 = 0.5 + 0.2 - (2 \cdot 0.1)$$

16) Probability of Exactly One Event Occurring 

fx

Open Calculator 

$$P_{(\text{Exactly One})} = (P_{(A)} \cdot P_{(B')} \cdot P_{(C')}) + (P_{(A')} \cdot P_{(B)} \cdot P_{(C')}) + (P_{(A')} \cdot P_{(B')} \cdot P_{(C)})$$

$$\text{ex } 0.42 = (0.5 \cdot 0.8 \cdot 0.2) + (0.5 \cdot 0.2 \cdot 0.2) + (0.5 \cdot 0.8 \cdot 0.8)$$

17) Probability of Exactly Two Events Occurring 

fx

Open Calculator 

$$P_{(\text{Exactly Two})} = (P_{(A')} \cdot P_{(B)} \cdot P_{(C)}) + (P_{(A)} \cdot P_{(B')} \cdot P_{(C)}) + (P_{(A)} \cdot P_{(B)} \cdot P_{(C')})$$

$$\text{ex } 0.42 = (0.5 \cdot 0.2 \cdot 0.8) + (0.5 \cdot 0.8 \cdot 0.8) + (0.5 \cdot 0.2 \cdot 0.2)$$

18) Probability of Independent Events A and B Occurring Together 

$$\text{fx } P_{(A \cap B)} = P_{(A)} \cdot P_{(B)}$$

Open Calculator 

$$\text{ex } 0.1 = 0.5 \cdot 0.2$$


19) Probability of Mutually Exclusive Events A or B Occurring 

$$\text{fx } P_{(A \cup B)} = P_{(A)} + P_{(B)}$$

Open Calculator 

$$\text{ex } 0.7 = 0.5 + 0.2$$




20) Probability of Neither of Events A or B Occurring 

$$fx \quad P_{((A \cup B)')} = 1 - (P_{(A)} + P_{(B)} - P_{(A \cap B)})$$

Open Calculator 

$$ex \quad 0.4 = 1 - (0.5 + 0.2 - 0.1)$$

21) Probability of None of Events Occurring 

$$fx \quad P_{((A \cup B \cup C)')} = 1 - (P_{(A)} + P_{(B)} + P_{(C)} - (P_{(A)} \cdot P_{(B)}) - (P_{(B)} \cdot P_{(C)}) - (P_{(C)} \cdot P_{(A)}) + (P_{(A)} \cdot P_{(B)} \cdot P_{(C)}))$$

Open Calculator 

$$ex \quad 0.08 = 1 - (0.5 + 0.2 + 0.8 - (0.5 \cdot 0.2) - (0.2 \cdot 0.8) - (0.8 \cdot 0.5) + (0.5 \cdot 0.2 \cdot 0.8))$$



## Variables Used

- $n_{\text{Event Occurs}}$  Number of Times Event Occurs
- $n_{\text{Favorable}}$  Number of Favorable Outcomes
- $n_L$  Number of Losses
- $n_{\text{Total Trials}}$  Total Number of Trials
- $n_{\text{Total}}$  Total Number of Outcomes
- $n_W$  Number of Wins
- $O_A$  Odds Against
- $O_F$  Odds in Favor
- $P_{((A \cup B)')}$  Probability of Non-Occurrence of Event A and B
- $P_{((A \cup B \cup C)')}$  Probability of Non Occurrence of Any Event
- $P_{(A)}$  Probability of Event A
- $P_{(A')}$  Probability of Non-Occurrence of Event A
- $P_{(A|B)}$  Probability of Event A given Event B Occurs
- $P_{(A \cap B)}$  Probability of Occurrence of Event A and Event B
- $P_{(A \cap B \cap C)}$  Probability of Occurrence of All Three Events
- $P_{(A \cap C)}$  Probability of Occurrence of Event A and Event C
- $P_{(A \cup B)}$  Probability of Occurrence of Event A or Event B
- $P_{(A \cup B \cup C)}$  Probability of Occurrence of Atleast One Event
- $P_{(\text{Atleast Two})}$  Probability of Occurrence of Atleast Two Events
- $P_{(A \Delta B)}$  Probability of Event A or B but Not Together
- $P_{(B)}$  Probability of Event B
- $P_{(B')}$  Probability of Non-Occurrence of Event B
- $P_{(B|A)}$  Probability of Event B given Event A Occurs
- $P_{(B \cap C)}$  Probability of Occurrence of Event B and Event C
- $P_{(C)}$  Probability of Event C
- $P_{(C')}$  Probability of Non-Occurrence of Event C
- $P_{(\text{Exactly One})}$  Probability of Occurrence of Exactly One Event
- $P_{(\text{Exactly Two})}$  Probability of Occurrence of Exactly Two Events
- $p_{BD}$  Probability of Success in Binomial Distribution
- $P_{\text{Empirical}}$  Empirical Probability
- $P_{\text{Event}}$  Probability of Event
- $q$  Probability of Failure



## Constants, Functions, Measurements used



## Check other formula lists

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