# Probability: Exercise 15.1

**Q.1 In a cricket match, batswoman hits a boundary 6 times out of 30 balls she plays. Find the probability that she did not hit a boundary.**

***Sol.*** In a cricket match, a batswoman hits a boundary 6 times out of 30 balls.
So, she missed the boundary (30 – 6) = 24 times out of 30 balls.
Therefore,

$$\text{Probability of not hitting of boundary} = \frac{Number\ of\ not\ hitting\ the\ boundary}{Total\ number\ of\ trials}$$

$$= \frac{24}{30}$$

$$= \frac{4}{5}$$

Thus, the probability that she does not hit a boundary is $\frac{4}{5}$.

**Q.2 1500 families with 2 children were selected randomly, and the following data were recorded:**

| Number of girls in a family | 2 | 1 | 0 |
|---|---|---|---|
| Number of families | 475 | 814 | 211 |

**Compute the probability of a family, chosen at random having**
**(i) 2 girls (ii) 1 girl (iii) No girl**
**Also check whether the sum of these probabilities is 1.**

***Sol.***

**(i)** Let $E_2$ be the event of families having two girls.

$$\text{So, } P(E_2) = \frac{Number\ of\ families\ having\ two\ girls}{Total\ number\ of\ families}$$

$$= \frac{475}{1500}$$

$$= \frac{19}{60}$$

**(ii)** Let $E_1$ be the event of families having one girl.

$$\text{So, } P(E_1) = \frac{Number\ of\ families\ having\ one\ girl}{Total\ number\ of\ femilies}$$

$$= \frac{814}{1500}$$

$$= \frac{407}{750}$$

**(iii)** Let $E_0$ be the event of families having no girl.

So, P ($E_0$) = $\frac{\textit{Number of families having no girl}}{\textit{Total number of girls}}$

$= \frac{211}{1500}$

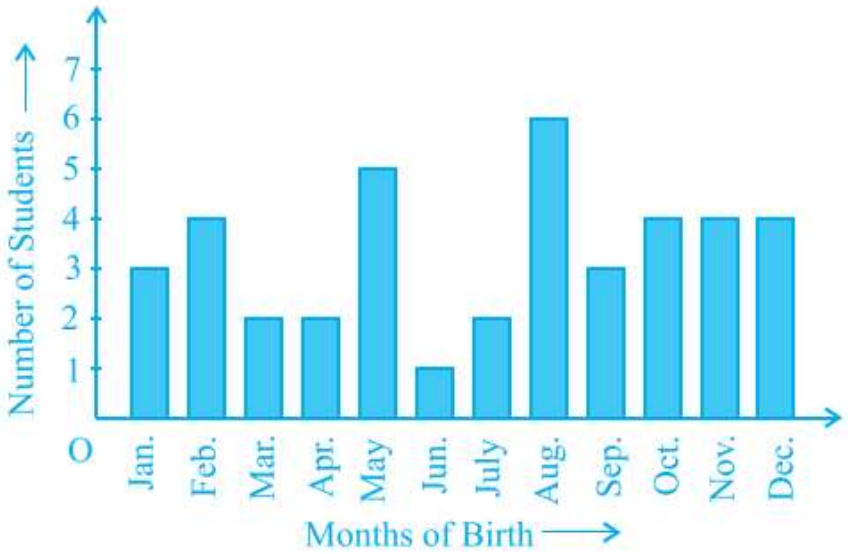
So, sum of probabilities = $P(E_0) + P(E_1) + P(E_2)$

$= \frac{211}{1500} + \frac{407}{750} + \frac{19}{60}$

$= 1$

**Q.3 Refer to Example 5, section 14.4 Chapter 14. Find the probability that a student of the class was born in August.**

***Sol.*** Graph:




From the graph only 6 students were born in August month out of 40 students of a particular section of class - IX.

Let P (E) be the Probability of a student of the class was born in August month.

So, P (E) = $\frac{\textit{Number of students born in August}}{\textit{Total number of students}}$

$= \frac{6}{40}$

$= \frac{3}{20}$

Thus, Probability of a student of the class was born in August month is $\frac{3}{20}$.

**Q.4 Three coins are tossed simultaneously 200 times with the following frequencies of different outcomes:**

| Outcome | 3 heads | 2 heads | 1 head | No head |
|---|---|---|---|---|
| Frequency | 23 | 72 | 77 | 28 |

**If the three coins are simultaneously tossed again, compute the probability of 2 heads coming up.**

***Sol.*** Since, in given event three coins are tossed 200 times.
So, the total number of trials = 200
Let P (E) be the probability of getting 2 heads.

$$\text{So, P (E)} = \frac{\textit{No. of outcomes having 2 heads}}{\textit{Total no. of trials}}$$

$$= \frac{72}{200}$$

$$= \frac{9}{25}$$

Thus, the probability of getting 2 heads is $\frac{9}{25}$.

**Q.5 An organisation selected 2400 families at random and surveyed them to determine a relationship between income level and the number of vehicles in a family. The information gathered is listed in the table below:**

| Monthly income (in ₹) | Vehicles per family | | | |
|---|---|---|---|---|
| | 0 | 1 | 2 | Above 2 |
| Less than 7000 | 10 | 160 | 25 | 0 |
| 7000 – 10000 | 0 | 305 | 27 | 2 |
| 10000 – 13000 | 1 | 535 | 29 | 1 |
| 13000 – 16000 | 2 | 469 | 59 | 25 |
| 16000 or more | 1 | 579 | 82 | 88 |

**Suppose a family is chosen. Find the probability that the family chosen is:**
**(i) earning Rs. 10000-13000 per month and owning exactly 2 vehicles.**
**(ii) Earning Rs. 16000 or more per month and owning exactly 1 vehicles.**
**(iii) Earning less than Rs. 7000 per month and does not own any vehicle.**
**(iv) Earning Rs. 13000 -16000 per month and owning more than 2 vehicles.**
**(v) Owning not more than 1 vehicle.**

***Sol.*** Since, total number of families = 2400
**(i)** Number of families having earning Rs 10000 - 13000 per month and owning exactly 2 vehicles are 29.
Let P ($E_1$) be the probability of families earning Rs 10000 - 13000 per month and owning exactly 2 vehicles

$$\text{So, P}(E_1) = \frac{29}{2400}$$

**(ii)** Number of families having earning Rs. 16000 or more per month and owning exactly 1 vehicle are 579.
Let P ($E_2$) be the probability of families earning Rs. 16000 or more per month and owning exactly 1 vehicle.

So, $P(E_2) = \frac{579}{2400} = \frac{193}{800}$

**(iii)** Number of families having earning less than Rs. 7000 per month and does not own any vehicle are 10.
Let $P(E_3)$ be the families earning less than Rs. 7000 per month and does not own any vehicle.

So, $P(E_3) = \frac{10}{2400} = \frac{1}{240}$

**(iv)** Number of families having earning Rs. 13000 - 16000 per month and owning more than 2 vehicles are 25.
Let $P(E_4)$ be the probability of families earning Rs. 13000 - 16000 per month and owning more than two vehicles.

So, $P(E_4) = \frac{25}{2400} = \frac{1}{96}$

**(v)** Now, number of families owning not more than 1 vehicle = Families having no vehicle + Families having 1 vehicle

$= (10 + 0 + 1 + 2 + 1) + (160 + 305 + 535 + 469 + 579)$
$= 14 + 2048$
$= 2062$

Let $P(E_5)$ be the probability of families owning not more than 1 vehicle

$= \frac{2062}{2400}$

$= \frac{1031}{1200}$

**Q.6 Refer to Table 14.7 Chapter 14.**
**(i) Find the probability that a student obtained less than 20% in the mathematics test.**
**(ii) Find the probability that a student obtained marks 60 or above.**
***Sol.*** Table:

Table 14.7

| Marks | Number of students |
|---|---|
| 0 - 20 | 7 |
| 20 - 30 | 10 |
| 30 - 40 | 10 |
| 40 - 50 | 20 |
| 50 - 60 | 20 |
| 60 - 70 | 15 |
| 70 - above | 8 |
| **Total** | 90 |

From the table, total number of students in mathematics = 90
**(i)** Therefore, the number of student who obtained less than 20% marks in the mathematics test = 7
Let $P(E_1)$ be the probability of a student obtaining less than 20% marks.

So, $P(E) = \frac{7}{90}$

**(ii)** And number of students who obtained marks 60 or above = (students in 60 - 70) + (students above 70)
= 15 + 8 = 23

Let $P(E_2)$ be the probability of a student obtaining marks 60 and above.

So, $P(E_2) = \frac{23}{90}$

**Q.7 To know the opinion of the students about the subject statistics, a survey of 200 students was conducted. The data is recorded in the following table.**

| Opinion | Number of students |
|---|---|
| like | 135 |
| dislike | 65 |

**Find the probability that a student chosen at random:**
**(i) likes statistics, (ii) does not like it.**

***Sol.*** Since, total number of students = 200

**(i)** Let $P(E_1)$ be the probability of a student likes statistics.

$$\text{So, } P(E_1) = \frac{\textit{Number of students who like statistics}}{\textit{Total number of students}}$$

$$= \frac{135}{200} = \frac{27}{40}$$

**(ii)** Let $P(E_2)$ be the probability of a student does not like statistics.

$$\text{So, } P(E_2) = \frac{\textit{Number of students who does not like statistics}}{\textit{Total number of students}}$$

$$= \frac{65}{200} = \frac{13}{40}$$

**Q.8 Refer to Q.2, Ex 14.2. What is the empirical probability that an engineer lives :**
**(i) less than 7 km from her place of work?**
**(ii) More than or equal to 7 km from her place of work?**
**(iii) Within $\frac{1}{2}$ km from her place of work?**

***Sol.*** Frequency distribution table:

| Distances (in km) | Tally Marks | Frequency |
|---|---|---|
| 0 – 5 | 𝍸 | 5 |
| 5 – 10 | 𝍸 𝍸 I | 11 |
| 10 – 15 | 𝍸 𝍸 I | 11 |
| 15 – 20 | 𝍸 IIII | 9 |
| 20 – 25 | I | 1 |
| 25 – 30 | I | 1 |
| 30 – 35 | II | 2 |
| Total | | 40 |

From the frequency distribution table, total number of engineers = 40

**(i)** Since, number of engineers who lives less than 7 km from their place of work = 9.

Let $P(E_1)$ be the probability of an engineer lives less than 7 km from her place of work.

So, $P(E_1) = \frac{9}{40}$

**(ii)** Now, number of engineers who lives more than or equal to 7km from their place of work = 31

Let $P(E_2)$ be the probability of an engineer lives less than or equal to 7 km from her place of work

So, $P(E_2) = \frac{31}{40}$.

**(iii)** And number of engineer who lives within 12 km from their place of work = 0

Let $P(E_3)$ be the probability of an engineer lives with 12 km from her place of work.

$P(E_3) = \frac{0}{40} = 0$.

**Q.9 Activity: Note the frequency of two- wheeler, three - wheeler and four - wheeler going past during a time interval, in front of your school gate.**
**Find the probability that any one vehicle out of the total vehicles you have observed is a two wheeler.**

***Sol.*** This is an activity based problem. You need to collect the data and find the required probability.

**Q.10 Activity: Ask all the students in your class to write a 3-digit number. Choose any student from the room at random. What is the probability that the number written by her/him is divisible by 3? Remember that a number is divisible by 3, if the sum of its digits is divisible by 3.**

***Sol.*** This is an activity based problem. You need to ask all the students of your class and do as directed and find the required probability.

**Q.11 Eleven bags of wheat flour, each marked 5 kg , actually contained the following weights of flour (in kg) :**

**4.97 5.05 5.08 5.03 5.00 5.06 5.08 4.98 5.04 5.07 5.00**

**Find the probability that any of these bags chosen at random contains more than 5kg of flour.**

***Sol.*** From the given data, total number of wheat bags = 11

And number of bags which have more than 5 kg = 7

Let P(E) be the probability of a bag contains more than 5kg.

So, P(E) = $\frac{No.\ of\ bags\ which\ have\ more\ than\ 5\ kg}{total\ number\ of\ wheat\ bags}$

$= \frac{7}{11}$

**Q.12 In Q.5 Exercise 14.2 you were asked to prepare a frequency distribution table, regarding the concentration of sulphur dioxide in the air in parts per million of a certain city for 30 days. Using this table, find the probability of the concentration of sulphur dioxide in the interval 0.12 - 0.16 on any of these days.**

***Sol.*** Frequency distribution table:

| Concentration of Sulphur dioxide (in ppm) | Frequency |
|---|---|
| 0.00 – 0.04 | 4 |
| 0.04 – 0.08 | 9 |
| 0.08 – 0.12 | 9 |
| 0.12 – 0.16 | 2 |
| 0.16 – 0.20 | 4 |
| 0.20 – 0.24 | 2 |
| Total | 30 |

From the frequency distribution table, total number of days = 30

Since, number of days in which concentration of $SO_2$ in 0.12 - 0.16 = 2

Let P(E) be the probability of concentration of $SO_2$ in 0.12 - 0.16 on any day.

So, P(E) = $\frac{No.\ of\ days\ in\ which\ conc.\ of\ SO_2\ in\ 0.12-0.16}{total\ number\ of\ days}$

$= \frac{2}{30} = \frac{1}{15}$

**Q.13 In Q. 1, Exercise 14.2, you were asked to prepare a frequency distribution table regarding the blood group of 30 students of a class. Use this table to determine the probability that a student of this class, selected at random, has blood group AB.**

***Sol.*** Frequency distribution table:

| Blood group | Number of students |
|---|---|
| A | 9 |
| B | 6 |
| O | 12 |
| AB | 3 |
| Total | 30 |

From the frequency distribution table, total number of students = 30

Since, number of students which have blood group AB = 3

Let P(E) be the probability of number of students which have blood group AB.

So, $P(E) = \frac{Number\ of\ students\ which\ have\ blood\ group\ AB}{total\ number\ of\ students}$

$= \frac{3}{30} = \frac{1}{10}$