

# Probability Practice Exercises

1. A jar contains four coins: a nickel (5¢), a dime (10¢), a quarter (25¢), and a half-dollar (50¢). Three coins are randomly selected without replacement from the jar.
  - (a) List all the possible outcomes in sample space  $S$ .
  - (b) What is the probability that the selection will contain the half-dollar?
  - (c) What is the probability that the total amount drawn will equal 65¢ or less?
  - (d) Which interpretations of probability are you applying?

2. In a genetics experiment, the researcher mated two *Drosophila* fruit flies and observed the traits of 300 offspring. The results are shown in the table.

Eye Color	Wing Size	
	Normal	Miniature
Normal	140	6
Vermillion	3	151

One of these offspring is randomly selected and observed for the two genetic traits.

- (a) What is the probability that the fly has normal eye color and normal wing size?
  - (b) What is the probability that the fly has vermillion eyes?
  - (c) What is the probability that the fly has either vermillion eyes or miniature wings, or both?
  - (d) Which interpretations of probability are you applying?
3. City residents were surveyed recently to determine readership of newspapers. 50% of the residents read the morning paper, 60% read the evening paper and 20% read both newspapers. Find the probability that a resident selected at random reads the morning or evening paper.
  - 4- The experience of a train passenger is that the train is cancelled with probability 0.02. When it does run, it has probability 0.9 of being on time.
    - (a) Find the probability that the train runs on time
    - (b) Given that the train is not on time, find the probability that it has been cancelled.

5- In a group of students 60% are female and 40% are male. A third of the female students study french but only a quarter of the male students study french.

A student is chosen at random from the group.

- (a) Show that the probability that the chosen student is female and studies french is 0.2
- (b) Calculate the probability that the chosen student studies french
- (c) Given that the chosen student does study french, calculate the conditional probability that the chosen student is female

6- Of the patients in an emergency unit, 30% have a sports injury. Pas records for this emergency unit suggest that :

A patient with sports injury has a probability of 0.2 of being admitted to hospital

A patient who doesn't have a sports injury has a probability of 0.4 of being admitted to hospital

Now, a patient is chosen at random from those in the emergency unit.

- (a) What is the probability that the chosen patient has a sports injury
- (b) What is the probability that the chosen patient has a sports injury and is admitted to hospital
- (c) Show that the probability that the chosen patient is admitted to hospital is 0.34
- (d) Given that the chosen patient is admitted to hospital, find the conditional probability that the patient has a sports injury

7- Darren and Charles are friends who often go to the cinema together. On such visits there is a probability of 0.4 that Darren will buy popcorn. The probability that Charles will buy popcorn is 0.7 if Darren buys popcorn and 0.35 if he doesn't.

When Darren and Charles visit the cinema together:

- (a) Find the probability that both buy popcorn
- (b) Show that the probability that neither buys popcorn is 0.39
- (c) Find the probability that exactly one of them buys popcorn

Sarah sometimes join Darren and Charles on their cinema visits. On these occasions, the probability that sarah buys popcorn is 0.55 if both of charles and darren buy popcorn and 0.25 if exactly one of darren and charles buys popcorn.

When Darren, Sarah and Charles visit Cinema together:

- (d) What is the probability that the three of them buy popcorn.
- (e) Charles and Sarah buy popcorn but Daren doesn't

8- Following a flood, 120 tins were recovered from Lee's corner shop. Unfortunately, the water had washed off all the labels. Of the tins, 50 contained pet food, 20 contained peas, 35 contained beans and the rest contained soup.

- (a) Lee selects a tin at random, what is the probability that it contains soup?
- (b) Lee selects a tin at random, what is the probability that it doesn't contain pet food?
- (c) Lee selects two tins at random (without replacement), what is the probability that both contain peas?
- (d) Lee selects two tins at random (without replacement), what is the probability that one contains pet food and the other contains peas?
- (e) Lee selects 3 tins at random (without replacement). What is the probability that one contains pet food, one contains peas and one contains beans?
- (f) Find the probability that Lee will have to open more than two tins before he finds one that doesn't contain pet food.

9- A school employs 75 teachers. The following table summarizes their length of service at the school, classified by gender.

	< 3 years	3 years to 8 years	> 8 years
Female	12	20	13
Male	8	15	7

- (a) Find the probability that a randomly selected teacher is a female.
- (b) Find the probability that a randomly selected teacher is female given that the teacher has more than 8 years service.
- (c) Find the probability that a randomly selected teacher is female given that the teacher has less than 3 years service.
- (d) State, giving a reason, whether or not the event of selecting a female teacher is independent of the event of selecting a teacher with less than 3 years service.

10- A group of students bought, in total, 25 items of clothing at two shops: Mango and Iora. The following table shows how many tops, jeans and sweaters were bought at each of the two shops:

	Tops	Jeans	Sweaters
Mango	3	7	5
Iora	2	5	3

One item of clothing is chosen at random from these 25 items:

- What is the probability that the chosen item is a top?
- What is the probability that the chosen item was bought from Iora?
- What is the probability that the chosen item is a top and was bought from Iora?
- State with a reason whether the events (chosen item is a top) and (chosen item was bought from iora) are independent.
- Given that the chosen item is not a top, find the conditional probability that it was bought from Iora.

(11)

A volunteer for the Health Literacy Center was investigating the attitudes of students towards smoking on campus. A random sample of 730 students from all four grade levels was taken. Each student was given the statement "Smoking is dangerous for your health" and asked whether they agreed, had no opinion or disagreed. The following contingency table summarizes the results.

- Complete the following table knowing that
  - 387 Male students participated
  - 277 students agreed and 97 students had no opinion
  - 154 from those who agreed were female
  - Only 36 from the males who participated had no opinion

	Agree (A)	No Opinion (N)	Disagree (D)	Totals
Male (M)				
Female (F)				
Totals				

- Among the participants, what is the probability that a student agreed  $P(A)$ ?

- (c) Show whether the events of students agreeing (A) and being a female student (F) are independent
- (d) What is the probability that a student is a female given that the student had no opinion  $P(F|N)$ ? What is the probability that a student disagreed, given that the student is Male  $P(D|M)$ ?
- (d) Use Bayes' Theorem to calculate the probability  $P(M|A)$ .

(12) Two letters are posted on the same day.

Letter A is sent by first-class post and has a probability of 0.9 of being delivered next day. Letter B is sent by second-class post and has a probability of only 0.3 if being delivered the next day.

- (a) Find the probability that both letters are delivered the next day
- (b) Find the probability that neither letter is delivered the next day
- (c) Find the probability that at least one of the letters is delivered the next day
- (d) Given that at least one of the letters is delivered the next day, find the probability that letter A is delivered the next day.

Solutions:

- 1- (b) =  $\frac{3}{4}$ , c =  $\frac{1}{2}$ , classical interpretation
- 2-  $\frac{7}{15}$ ,  $\frac{77}{150}$ ,  $\frac{8}{15}$ , Relative frequency interpretation
- 3- 0.9
- 4- 0.882, 0.1694
- 5- 0.2, 0.3,  $\frac{0.2}{0.3}$
- 6- 0.3, 0.06, 0.34, 0.17647
- 7- 0.28, 0.39, 0.33, 0.154, 0.0525
- 8- 0.125, 0.583, 0.0266, 0.140, 0.125, 0.172
- 9- 0.6, 0.65, 0.6, independent
- 10-  $\frac{1}{5}$ ,  $\frac{2}{5}$ ,  $\frac{2}{25}$ , independent,  $\frac{2}{5}$

11-

(a)

	Agree	No Opinion	Disagree	Totals
Male	123	36	228	387
Female	154	61	128	343
Totals	277	97	356	730

(b)  $P(A) = 277/730$  (c) not independent. (d)  $\frac{61}{97}$ ,  $\frac{228}{387}$  (e) 0.44404

(12) (a) 0.27, (b) 0.07, (c) 0.93, (d) 0.9677