

Name _____

Date _____

13.2 Calculating probabilities — worked answers

Calculate the probability of an event with equally likely outcomes, and use the fact that an event and its complement total 1. · 50 questions

A · Fluency — Count, divide and simplify.

- 1 An ordinary six-sided dice is rolled. What is the probability of **an even number**?
Answer: $\frac{1}{2}$
There are 6 equally likely outcomes and 3 of them give an even number, so the probability is $\frac{3}{6} = \frac{1}{2}$.
- 2 An ordinary six-sided dice is rolled. What is the probability of **a 6**?
Answer: $\frac{1}{6}$
There are 6 equally likely outcomes and 1 of them give a 6, so the probability is $\frac{1}{6} = \frac{1}{6}$.
- 3 An ordinary six-sided dice is rolled. What is the probability of **a number less than 3**?
Answer: $\frac{1}{3}$
There are 6 equally likely outcomes and 2 of them give a number less than 3, so the probability is $\frac{2}{6} = \frac{1}{3}$.
- 4 An ordinary six-sided dice is rolled. What is the probability of **a number greater than 4**?
Answer: $\frac{1}{3}$
There are 6 equally likely outcomes and 2 of them give a number greater than 4, so the probability is $\frac{2}{6} = \frac{1}{3}$.
- 5 An ordinary six-sided dice is rolled. What is the probability of **an odd number**?
Answer: $\frac{1}{2}$
There are 6 equally likely outcomes and 3 of them give an odd number, so the probability is $\frac{3}{6} = \frac{1}{2}$.
- 6 An ordinary six-sided dice is rolled. What is the probability of **a number more than 6**?
Answer: 0
There are 6 equally likely outcomes and 0 of them give a number more than 6, so the probability is $\frac{0}{6} = 0$.
- 7 An ordinary six-sided dice is rolled. What is the probability of **a number less than 7**?
Answer: 1
There are 6 equally likely outcomes and 6 of them give a number less than 7, so the probability is $\frac{6}{6} = 1$.
- 8 An ordinary six-sided dice is rolled. What is the probability of **a prime number**?
Answer: $\frac{1}{2}$
There are 6 equally likely outcomes and 3 of them give a prime number, so the probability is $\frac{3}{6} = \frac{1}{2}$.

- 9 An ordinary six-sided dice is rolled. What is the probability of **a multiple of 3**?

Answer: 1/3

There are 6 equally likely outcomes and 2 of them give a multiple of 3, so the probability is $2/6 = 1/3$.

- 10 An ordinary six-sided dice is rolled. What is the probability of **a 1 or a 2**?

Answer: 1/3

There are 6 equally likely outcomes and 2 of them give a 1 or a 2, so the probability is $2/6 = 1/3$.

- 11 A bag holds 5 counters, of which 3 are red. One is taken at random. What is the probability it is red?

Answer: 3/5

3 favourable outcomes out of 5 equally likely ones: $3/5 = 3/5$.

- 12 A bag holds 5 counters, of which 3 are red. What is the probability of **not** red?

Answer: 2/5

Either it is red or it is not, and the two probabilities add to 1: $1 - 3/5 = 2/5$.

- 13 A bag holds 6 counters, of which 4 are blue. One is taken at random. What is the probability it is blue?

Answer: 2/3

4 favourable outcomes out of 6 equally likely ones: $4/6 = 2/3$.

- 14 A bag holds 6 counters, of which 4 are blue. What is the probability of **not** blue?

Answer: 1/3

Either it is blue or it is not, and the two probabilities add to 1: $1 - 4/6 = 1/3$.

- 15 A bag holds 8 counters, of which 2 are green. One is taken at random. What is the probability it is green?

Answer: 1/4

2 favourable outcomes out of 8 equally likely ones: $2/8 = 1/4$.

- 16 A bag holds 8 counters, of which 2 are green. What is the probability of **not** green?

Answer: 3/4

Either it is green or it is not, and the two probabilities add to 1: $1 - 2/8 = 3/4$.

- 17 A bag holds 10 counters, of which 7 are yellow. One is taken at random. What is the probability it is yellow?

Answer: 7/10

7 favourable outcomes out of 10 equally likely ones: $7/10 = 7/10$.

- 18 A bag holds 10 counters, of which 7 are yellow. What is the probability of **not** yellow?

Answer: 3/10

Either it is yellow or it is not, and the two probabilities add to 1: $1 - 7/10 = 3/10$.

- 19 A bag holds 12 counters, of which 5 are black. One is taken at random. What is the probability it is black?

Answer: 5/12

5 favourable outcomes out of 12 equally likely ones: $5/12 = 5/12$.

- 20 A bag holds 12 counters, of which 5 are black. What is the probability of **not** black?

Answer: 7/12

Either it is black or it is not, and the two probabilities add to 1: $1 - 5/12 = 7/12$.

- 21** A bag holds 9 counters, of which 6 are white. One is taken at random. What is the probability it is white?

Answer: $\frac{2}{3}$

6 favourable outcomes out of 9 equally likely ones: $\frac{6}{9} = \frac{2}{3}$.

- 22** A bag holds 9 counters, of which 6 are white. What is the probability of **not** white?

Answer: $\frac{1}{3}$

Either it is white or it is not, and the two probabilities add to 1: $1 - \frac{6}{9} = \frac{1}{3}$.

- 23** The probability of an event is $\frac{1}{2}$. What is the probability it does **not** happen? Give it as a decimal.

Answer: 0.5

$1 - \frac{1}{2} = \frac{1}{2} = 0.5$.

- 24** The probability of an event is $\frac{1}{4}$. What is the probability it does **not** happen? Give it as a decimal.

Answer: 0.75

$1 - \frac{1}{4} = \frac{3}{4} = 0.75$.

- 25** The probability of an event is $\frac{3}{10}$. What is the probability it does **not** happen? Give it as a decimal.

Answer: 0.7

$1 - \frac{3}{10} = \frac{7}{10} = 0.7$.

- 26** The probability of an event is $\frac{2}{5}$. What is the probability it does **not** happen? Give it as a decimal.

Answer: 0.6

$1 - \frac{2}{5} = \frac{3}{5} = 0.6$.

- 27** The probability of an event is $\frac{7}{20}$. What is the probability it does **not** happen? Give it as a decimal.

Answer: 0.65

$1 - \frac{7}{20} = \frac{13}{20} = 0.65$.

- 28** The probability of an event is $\frac{9}{25}$. What is the probability it does **not** happen? Give it as a decimal.

Answer: 0.64

$1 - \frac{9}{25} = \frac{16}{25} = 0.64$.

B · Reasoning — The formula, and when it applies.

- 29** How do you calculate a probability when outcomes are equally likely?

- ☐ Guess
- ☐ Favourable outcomes $\div$ total outcomes
- ☐ Total outcomes $\div$ favourable outcomes
- ☐ Add the outcomes

Answer: Favourable outcomes $\div$ total outcomes

The count you want, over the count of everything possible.

30 What does “equally likely” mean?

- ☐ There are many outcomes
- ☐ Each outcome has the same chance
- ☐ The outcomes are numbers
- ☐ Nothing

Answer: Each outcome has the same chance

A fair dice has six equally likely outcomes. A drawing pin landing point-up or point-down does not.

31 Why must you count the total outcomes carefully?

- ☐ It looks neat
- ☐ It is the denominator, so an error changes every answer
- ☐ It is not important
- ☐ To find the mean

Answer: It is the denominator, so an error changes every answer

Miscounting the bag is the commonest error in this section.

32 The probabilities of all possible outcomes add to ...

- ☐ 0
- ☐ $1/2$
- ☐ 1
- ☐ 100

Answer: 1

Something must happen.

33 If $P(\text{event}) = 2/7$, what is $P(\text{not event})$?

- ☐ $2/7$
- ☐ $5/7$
- ☐ $7/2$
- ☐ $1/7$

Answer: $5/7$

$1 - 2/7 = 5/7$.

34 Is a drawing pin equally likely to land point-up or point-down?

- ☐ Yes
- ☐ No

Answer: No

Its shape makes one more likely. The equally-likely formula does not apply, so you would have to experiment instead.

35 Two events are **mutually exclusive** when ...

- ☐ they are equally likely
- ☐ they cannot both happen
- ☐ they always happen
- ☐ they have the same probability

Answer: they cannot both happen

Rolling a 2 and rolling a 5 on one roll cannot both happen.

36 For two mutually exclusive events, $P(A \text{ or } B)$ is ...

- ☐ $P(A) \times P(B)$
- ☐ $P(A) + P(B)$
- ☐ $P(A) - P(B)$
- ☐ 1

Answer: $P(A) + P(B)$

Because no outcome is counted twice.

C · Challenge — Combined events and working backwards.

37 A bag holds 4 red, 5 blue and 3 green counters. What is the probability of red or green?

Answer: $7/12$

$4 + 3 = 7$ favourable out of 12: $7/12$. The events are mutually exclusive, so the probabilities add.

38 A bag holds 4 red, 5 blue and 3 green counters. What is the probability of not blue?

Answer: $7/12$

$1 - 5/12 = 7/12$ — the same answer, reached another way.

39 A bag has 20 counters and $P(\text{red}) = 1/4$. How many are red?

Answer: 5

$1/4$ of 20 = 5.

40 A bag has red and blue counters only. $P(\text{red}) = 3/8$ and there are 24 counters. How many are blue?

Answer: 15

$P(\text{blue}) = 5/8$, and $5/8$ of 24 = 15.

41 A fair dice is rolled. What is the probability of a prime number or a 6?

Answer: $2/3$

Primes are 2, 3, 5 — three outcomes — plus the 6 makes four: $4/6 = 2/3$.

42 A spinner has 5 equal sectors numbered 1 to 5. It is spun 60 times. About how many times would you expect a 3?

Answer: 12

$P(3) = 1/5$, and $1/5$ of 60 = 12.

D · Word problems — Bags, cards, classes and spinners.

43 A class of 30 has 18 girls. One learner is chosen at random. What is the probability of a girl?

Answer: $3/5$

$18/30 = 3/5$.

44 A pack of 52 cards has 13 hearts. What is the probability of drawing a heart?

Answer: $1/4$

$13/52 = 1/4$.

45 A raffle sells 200 tickets and you buy 5. What is the probability you win?

Answer: $1/40$

$5/200 = 1/40$.

- 46** A box has 15 pens, 6 of them broken. What is the probability of picking a working one?

Answer: 3/5

$15 - 6 = 9$ working, so $9/15 = 3/5$.

- 47** A bag has 24 sweets and $P(\text{red}) = 1/3$. How many are red?

Answer: 8

$1/3$ of 24 = 8.

- 48** A spinner has 8 equal sectors, 3 of them blue. Out of 40 spins, about how many would be blue?

Answer: 15

$P(\text{blue}) = 3/8$, and $3/8$ of 40 = 15.

- 49** A month is chosen at random. What is the probability it starts with J?

Answer: 1/4

January, June and July: $3/12 = 1/4$.

- 50** A letter is chosen at random from MATHEMATICS. What is the probability it is an M?

Answer: 2/11

MATHEMATICS has 11 letters, two of which are M.