Merit Tutoring

Year 4 Mathematics

Worksheet 51: Likelihood & Language

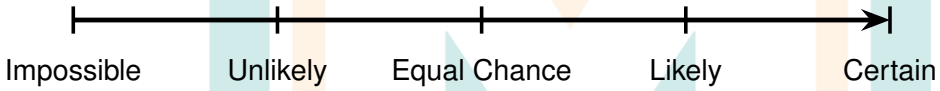
Australian Curriculum v9.0 — AC9M4P01

Name: _____ Date: _____

Section 1: Fluency — The Chance Scale

Use the probability scale to understand how likely events are to happen.

The Probability Scale



1. Where would you place this event on the scale: ”The sun will rise tomorrow”?

Answer: _____

2. Where would you place this event on the scale: ”You will grow 2 metres taller tonight”?

Answer: _____

3. Where would you place this event on the scale: ”Tossing ’Heads’ on a fair coin”?

Answer: _____

4. Where would you place this event on the scale: ”It will rain somewhere in Australia today”?

Answer: _____

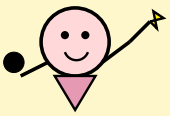
5. Which is more likely: Rolling a number less than 7 on a standard die, or rolling an 8?
Answer: _____

6. True or False: An impossible event can never happen.
Answer: _____

7. True or False: A certain event will always happen.
Answer: _____

8. Give an example of an event that has an equal chance of happening or not happening.
Answer: _____

Reward Box



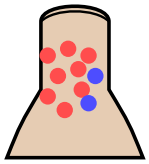
Probability Pro!

Why did the student bring a ladder to the probability test?
Because they heard the chances were 'high'!

Section 2: Reasoning — Ordering Outcomes

Look at the scenarios and decide which outcomes are more or less likely.

Marble Bag



8 Red, 2 Blue

9. If you pick one marble from this bag without looking, which colour is 'likely' to be picked?

Answer: _____

10. Which colour is 'unlikely' to be picked?

Answer: _____

11. Is it impossible to pick a blue marble? Explain your answer.

Answer: _____

_____

12. A bag has 5 green counters and 5 yellow counters. If you pick one, is it more likely to be green, yellow, or equally likely to be either?

Answer: _____

13. A box has 10 chocolates: 9 milk chocolate and 1 dark chocolate. Which type is more likely to be chosen?

Answer: _____

14. Order these events from least likely to most likely:

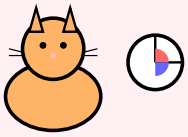
- A: Rolling a 6 on a standard die
- B: Picking a red card from a bag with 10 red cards and 2 blue cards

- C: Getting a tail when tossing a fair coin

Answer: _____

15. If there are 20 lollies in a jar and 15 are strawberry flavour, describe the likelihood of picking a strawberry lolly.
Answer: _____

Reward Box



Chance Champion!

What did the dice say to the coin?
"You're two-faced!"

Section 3: Fluency — Independent Events

Understand whether one event affects another event.

16. If I toss a coin and get 'Heads', does that make it more likely to get 'Tails' on the next toss? Explain why or why not.

Answer: _____

_____

17. If I roll a die and get a '6', does that change the chance of rolling a '6' on the next roll?
Answer: _____

18. True or False: When you toss a coin, the result of one toss affects the result of the next toss.

Answer: _____

19. I spin a spinner 3 times and get 'Red' each time. Is it more likely to get a different colour on the 4th spin?

Answer: _____

_____

20. Explain what 'independent events' means in your own words.

Answer: _____

_____

21. Give an example of an independent event from everyday life.

Answer: _____

22. If you flip a coin 10 times and get Heads every time, what are the chances of getting Heads on the 11th flip?

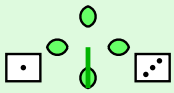
Answer: _____

23. Is rolling two dice at the same time an example of independent events? Why?

Answer: _____

_____

Reward Box



Probability Pro!

Why was the probability book always confident?

Because it knew all the outcomes!

End of Worksheet 51 — Great Probability Thinking!

Year 4 Mathematics

Worksheet 51: Answer Key

Likelihood & Language

Section 1: Fluency — The Chance Scale

Answers with explanations

1. Answer: **Certain**
Explanation: The sun rises every day, so this event is certain to happen.

2. Answer: **Impossible**
Explanation: It is physically impossible for a person to grow 2 metres taller in one night.

3. Answer: **Equal Chance** (or 50-50)
Explanation: A fair coin has two sides (Heads and Tails), so there is an equal chance of getting either result.

4. Answer: **Likely** (or Certain, depending on interpretation)
Explanation: Australia is a large country with varied climates, so it is very likely (almost certain) that it will rain somewhere in Australia on any given day.

5. Answer: **Rolling a number less than 7 on a standard die**
Explanation: A standard die has numbers 1 to 6, so rolling less than 7 is certain. Rolling an 8 is impossible because 8 is not on the die.

6. Answer: **True**
Explanation: By definition, an impossible event has no chance of occurring, so it can never happen.

7. Answer: **True**

Explanation: A certain event has a 100% chance of happening, so it will always occur.

8. Answer: **Examples may vary.**
Sample answers: Flipping a coin and getting Heads; spinning a spinner with equal sections; choosing from two identical options. Any event with exactly 50% probability is correct.

Section 2: Reasoning — Ordering Outcomes

Worked solutions

9. Answer: **Red**
Explanation: There are 8 red marbles and only 2 blue marbles, so red is more likely to be picked (8 out of 10 chances).

10. Answer: **Blue**
Explanation: There are only 2 blue marbles compared to 8 red marbles, so blue is unlikely to be picked (2 out of 10 chances).

11. Answer: **No, it is not impossible.**
Explanation: There are 2 blue marbles in the bag, so it is possible (though unlikely) to pick one. It would only be impossible if there were no blue marbles at all.

12. Answer: **Equally likely to be either** (or equal chance)
Explanation: With 5 green and 5 yellow counters, there is an equal chance (50-50) of picking either colour.

13. Answer: **Milk chocolate**
Explanation: 9 out of 10 chocolates are milk chocolate, making it much more likely to be chosen than dark chocolate.

14. Answer: **A, C, B** (least to most likely)
Explanation: A (rolling a 6) = 1/6 chance 17%; C (tossing tails) = 1/2 = 50%; B (picking red) = 10/12 83%. Therefore, A is least likely, C is in the middle,

and B is most likely.

15. Answer: **Likely** (or very likely)
Explanation: 15 out of 20 lollies are strawberry (75%), which makes picking a strawberry lolly likely.

Section 3: Fluency — Independent Events

Complete answers with reasoning

16. Answer: **No, it does not make Tails more likely.**
Explanation: Each coin toss is independent. The coin has no memory of previous tosses, so the chance of getting Tails is always 50%, regardless of what happened before.

17. Answer: **No, it does not change the chance.**
Explanation: Each roll of the die is independent. The chance of rolling a 6 is always 1/6 (approximately 17%), no matter what was rolled previously.

18. Answer: **False**
Explanation: Coin tosses are independent events. Each toss has the same 50% chance of Heads or Tails, regardless of previous results.

19. Answer: **No, the chances remain the same.**
Explanation: The spinner doesn't "remember" previous spins. Each spin is independent, so the probability of each colour stays the same every time you spin.

20. Answer: **Sample answer: Independent events are events where one outcome does not affect the other.**
Explanation: Independent events occur when the result of one trial has no influence on the result of another trial. Examples include coin tosses, dice rolls, and spinner spins (when conditions don't change).

21. Answer: **Examples may vary.**

Sample answers: Whether it rains today doesn't affect whether you pass a maths test; drawing a card from a deck and replacing it before drawing again; flipping a coin twice in a row.

22. Answer: **50%** (or equal chance, or 1/2)
Explanation: Each coin flip is independent. Even though Heads came up 10 times in a row (which is rare), the 11th flip still has a 50-50 chance of being Heads or Tails.

23. Answer: **Yes, it is an example of independent events.**
Explanation: The result of one die does not affect the result of the other die. Each die rolls independently, so they are independent events.

Outstanding Achievement!

You have successfully mastered describing likelihood using probability language, ordering outcomes by their chances of occurring, and understanding independent events. These skills form the foundation of probability thinking!

Year 4 Mathematics

Worksheet 52: Experiments & Variation

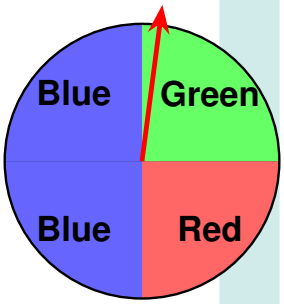
Australian Curriculum v9.0 — AC9M4P02

Name: _____ Date: _____

Section 1: Visual Modeling — Spinners

Use the spinner to answer questions about expected outcomes.

Spinner with 4 Sections



1. If you spin this spinner 20 times, which colour do you expect to see most often?

Answer: _____

2. Why do you expect that colour to appear most often?

Answer: _____

_____

3. If you spin this spinner 20 times, about how many times would you expect to get Blue?

Working: _____

Answer: About _____ times

4. If you spin 20 times, about how many times would you expect to get Red?
Answer: About _____ times

5. If you actually did the experiment and got Blue 12 times out of 20 spins, would that be surprising? Explain.

Answer: _____

_____

6. What is the difference between 'expected results' and 'actual results'?

Answer: _____

_____

7. If you spin the spinner 4 times and get a different colour each time, does this mean the spinner is fair? Explain.

Answer: _____

_____

8. True or False: If you spin 100 times, your actual results will be closer to the expected results than if you only spin 10 times.
Answer: _____

Reward Box

Chance Champion!

Why did the spinner go to school?

To get a well-rounded education!

Section 2: Problem Solving — Describing Variation

Understand why results vary in chance experiments.

9. Sam rolled a die 6 times and got a '4' three times. Does this mean the die is unfair, or is it just variation? Explain your thinking.

Answer: _____

_____

_____

10. Emma tossed a coin 10 times and got 7 Heads and 3 Tails. What should she do to get results closer to the expected 50-50?

Answer: _____

11. Why do we get different results each time we repeat a chance experiment?

Answer: _____

_____

12. A class conducted an experiment: they tossed a coin 10 times each. Different students got different results. Is this normal? Why?

Answer: _____

_____

13. If you roll a die 30 times, would you expect to get each number (1, 2, 3, 4, 5, 6) exactly 5 times? Why or why not?

Answer: _____

_____

14. True or False: Doing more trials in an experiment usually gives results closer to what we expect.

Answer: _____

15. Complete this sentence: "Variation in results happens because chance events are _____."

Reward Box

Probability Pro!

What do you call a die that's always changing its mind?

A vari-able!

Section 3: Challenge — Dependent Events

Explore how one event can affect another event.

16. There are 5 chocolates in a box: 3 caramel and 2 mint. I eat one caramel chocolate. Are the chances of picking a caramel next the same as before? Why or why not?

Answer: _____

_____

_____

17. What is the difference between independent events and dependent events?

Answer: _____

_____

18. A bag has 4 red marbles and 1 blue marble. You pick one marble and do NOT put it back. Is the second pick independent or dependent? Explain.

Answer: _____

_____

19. You draw a card from a deck and then put it back before drawing again. Are these events independent or dependent?

Answer: _____

20. There are 10 lollies in a jar: 6 strawberry and 4 lemon. You eat 2 strawberry lollies. How many lollies are left? How many are strawberry?

Working: _____

Answer: _____ lollies left, _____ are strawberry

21. Using the scenario from Question 20, is it now more likely, less likely, or equally likely to pick a strawberry lolly compared to before?
Answer: _____

22. Give an example of a dependent event from everyday life.

Answer: _____

_____

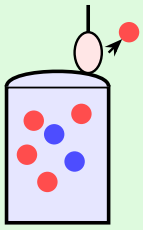
23. Explain in your own words why removing an item from a bag and not replacing it makes the next pick a dependent event.

Answer: _____

_____

_____

Reward Box



Chance Champion!

Why did the marble get worried?
Because it knew its chances were decreasing!

End of Worksheet 52 — Excellent Probability Work!

Year 4 Mathematics

Worksheet 52: Answer Key

Experiments & Variation

Section 1: Visual Modeling — Spinners

Answers with explanations

1. Answer: **Blue**
Explanation: Blue takes up 2 out of 4 sections (half the spinner), so it is most likely to appear.

2. Answer: **Blue covers half the spinner (2 out of 4 sections).**
Explanation: Since Blue occupies the largest portion of the spinner (50%), it has the highest probability of being landed on.

3. Answer: About **10 times**
Working: Blue is 2/4 = 1/2 of the spinner. 1/2 of 20 spins = 10 spins. We expect Blue about 10 times.

4. Answer: About **5 times**
Explanation: Red is 1/4 of the spinner. 1/4 of 20 spins = 5 spins.

5. Answer: **No, not very surprising** (or somewhat surprising but normal variation)
Explanation: We expected about 10 Blues out of 20 spins, and getting 12 is close to the expected result. This difference (2 more than expected) is normal variation in probability experiments.

6. Answer: **Expected results are what we predict will happen based on probability; actual results are what really happens when we do the experiment.**
Explanation: Expected results are calculated using mathematics and prob-

ability theory. Actual results are obtained through conducting real experiments, and they often differ from expected results due to chance variation.

7. Answer: **No, not necessarily. This is just one possible outcome.**
Explanation: With only 4 spins, many different outcomes are possible due to variation. To determine if the spinner is fair, we would need many more trials (like 100 or 1000) to see if the results match the expected probabilities.

8. Answer: **True**
Explanation: The law of large numbers tells us that as we increase the number of trials, our actual results tend to get closer to the expected (theoretical) results. More trials reduce the impact of random variation.

Section 2: Problem Solving — Describing Variation

Worked solutions

9. Answer: **It is likely just variation, not an unfair die.**
Explanation: With only 6 rolls, any outcome is possible due to chance variation. We expect each number to appear once on average, but getting three 4s in 6 rolls is not extremely unusual. To determine if a die is unfair, we would need to conduct many more trials (like 60 or 600 rolls) and compare the results to expected outcomes.

10. Answer: **Do more tosses** (or repeat the experiment with more trials)
Explanation: With more tosses (like 50 or 100), the results tend to get closer to the expected 50-50 split due to the law of large numbers. Ten tosses is a small sample size.

11. Answer: **Because chance events are unpredictable and random.**
Explanation: Probability describes what we expect over many trials, but individual trials are random. Each experiment produces different results because randomness means we cannot predict exactly what will happen each time.

12. Answer: **Yes, this is completely normal.**

Explanation: Each student's 10 tosses represent a small sample, and variation is expected in small samples. Different students will naturally get different results—some might get 6 Heads, others 4 Heads, etc. This variation demonstrates the unpredictable nature of chance.

13. Answer: **No, probably not exactly 5 times each.**
Explanation: We expect each number to appear about 5 times on average (30 ÷ 6 = 5), but due to variation, the actual results will vary. Some numbers might appear 3 times, others 7 times. Getting exactly 5 of each would be rare, though the results should be reasonably close to 5 for each number.

14. Answer: **True**
Explanation: This is the law of large numbers—more trials lead to results that more closely match the theoretical probability.

15. Answer: **unpredictable** (or random, or not certain)
Explanation: Chance events are by nature unpredictable and random, which causes variation in results.

Section 3: Challenge — Dependent Events

Complete answers with reasoning

16. Answer: **No, the chances have changed (decreased).**
Explanation: Originally, there were 3 caramel out of 5 chocolates (3/5 = 60%). After eating one caramel, there are now 2 caramel out of 4 remaining chocolates (2/4 = 1/2 = 50%). The chance of picking caramel has decreased because the composition of the box has changed. This is a dependent event.

17. Answer: **Independent events don't affect each other; dependent events do affect each other.**
Explanation: In independent events, the outcome of one event has no impact on the probability of another event (e.g., coin tosses). In dependent events, the outcome of one event changes the probability of the next event (e.g., drawing marbles without replacement).

18. Answer: **Dependent**

Explanation: The second pick is dependent on the first because after removing one marble, there are fewer marbles in the bag and the probabilities have changed. If you picked the blue marble first, the second pick can only be red (100% chance). If you picked a red marble first, there are 3 red and 1 blue left, changing the probabilities from the original 4 red and 1 blue.

19. Answer: **Independent**

Explanation: When you replace the card before drawing again, the deck returns to its original state, so the second draw has the same probabilities as the first draw. The first event does not affect the second, making them independent.

20. Answer: **8 lollies left, 4 are strawberry**

Working: Started with 10 lollies, ate 2, so 10 - 2 = 8 lollies left. Started with 6 strawberry, ate 2 strawberry, so 6 - 2 = 4 strawberry remaining.

21. Answer: **Less likely**

Explanation: Originally, 6 out of 10 lollies were strawberry (60%). Now, 4 out of 8 are strawberry (50%). The probability has decreased from 60% to 50%, so it's less likely to pick strawberry than before.

22. Answer: **Examples may vary.**

Sample answers: Eating snacks from a packet (fewer left each time); drawing names from a hat for prizes without replacement; choosing students to present when each student only presents once; drawing cards from a deck without replacing them.

23. Answer: **Sample answer: Because removing an item changes what's left in the bag, so the probabilities for the next pick are different.**

Explanation: The first pick changes the total number of items and possibly changes the number of each type of item remaining. This changes the fractions/probabilities for the second pick. Since the first event affects the second, they are dependent events. If we replaced the item, the probabilities would stay the same (independent).

Outstanding Achievement!

You have successfully mastered conducting and analyzing chance experiments, understanding variation in results, and distinguishing between independent and dependent events. You now understand that actual results vary from expected results due to randomness, and that more trials lead to results closer to predictions. Excellent probability work!