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Repeated Chance Experiments - Year 4

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Repeated Chance Experiments



1

PREDICT

2

REPEAT

3

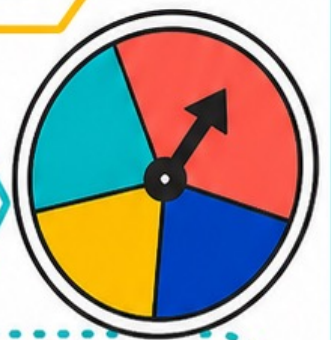
RECORD

4

COMPARE

5

EXPLAIN

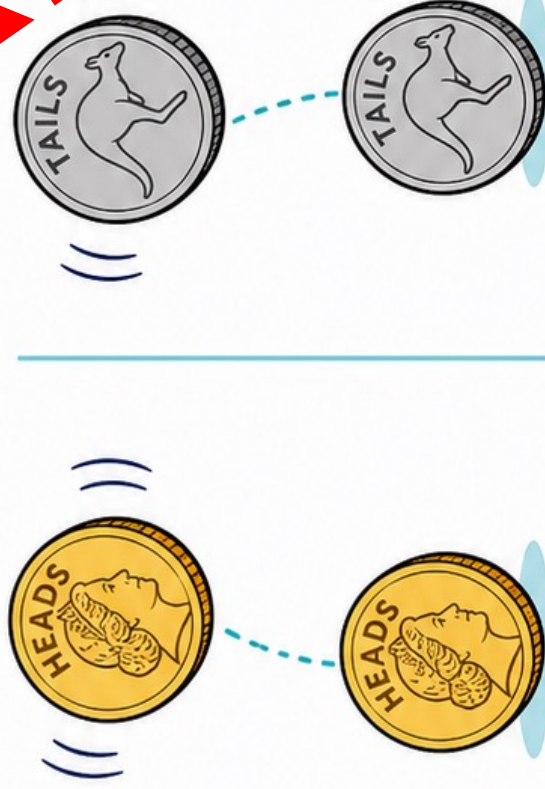


Repeat the same chance action, record every outcome and use the evidence to explain what you notice.

Does the Past Change the Next Chance?

INDEPENDENT

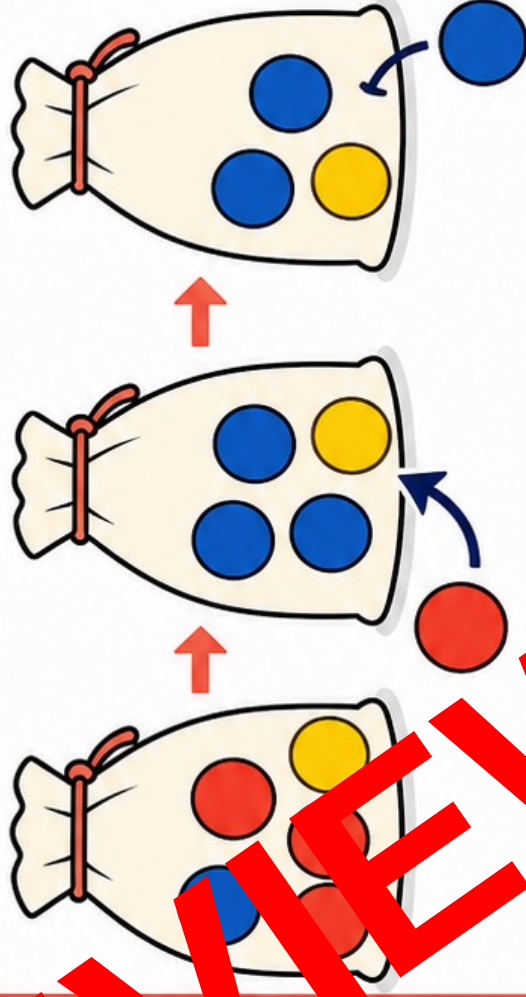
The next chance stays the same



Example: each fair coin toss

DEPENDENT

An earlier result changes what remains.



Example: counters drawn without replacement

? Ask: Did the first outcome change the possible next outcomes?

Spinner Investigation - Design

Name: _____

Colour the 8 sections so your spinner follows every rule.



BLUE: most likely



YELLOW: less likely



RED: least likely



GREEN: impossible



I predict blue will appear
about ____ times in 40 spins.

I predict yellow will appear
about ____ times in 40 spins.

I predict red will appear
about ____ times in 40 spins.

Green should appear
____ times.

Spinner Investigation - Test

Name: _____

Spin 40 times. Record B, Y, R or G in every box.

	1	2	3	4	5	6	7	8	9	10
Spins 1-10										
Spins 11-20										
Spins 21-30										
Spins 31-40										

BLUE total: _____

YELLOW total: _____

RED total: _____

GREEN total: _____

Which result was closest to your prediction?

What variation did you notice?

What would you change before testing again?

First-Move Noughts and Crosses

Names: _____



Play 12 games. Alternate who starts.
X always goes first. Record each winner or draw on Page 2.



1

2

3

4

5

6

7

8

9

10

11

12



First-Move Results



Names: _____

Game	Starter	Result	Strategy note
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			

First-player wins: ____

Second-player wins: ____

Draws: ____

What relationship do you notice?

What would you test next?

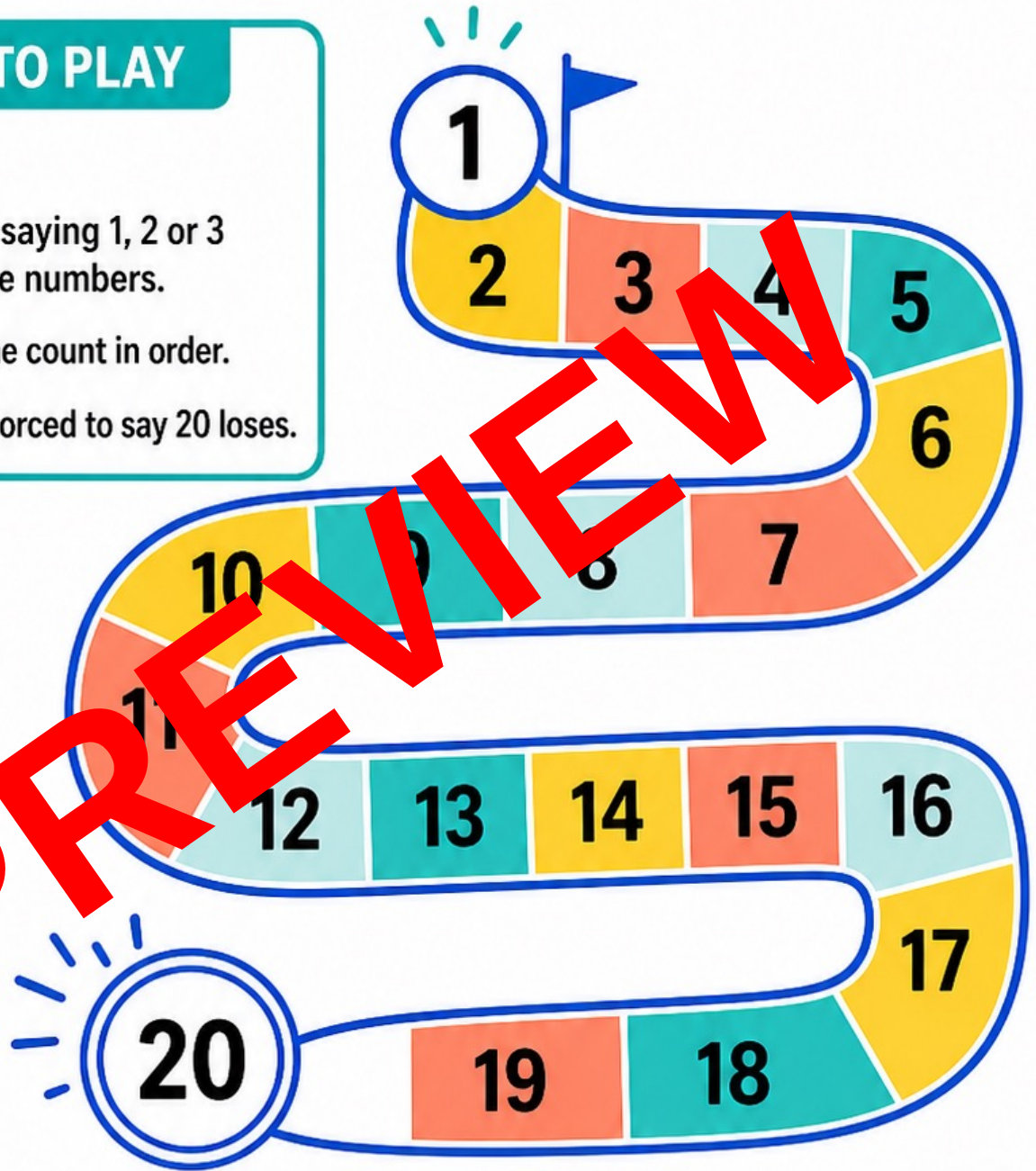


Race to Twenty

Names: _____

HOW TO PLAY

1. Start at 1.
2. Take turns saying 1, 2 or 3 consecutive numbers.
3. Continue the count in order.
4. The player forced to say 20 loses.



Example

Player A: 1, 2

Player B: 3, 4, 5

Player A: 6



Play several times. Test whether starting first or changing strategy affects the result.



Race to Twenty - Strategy Lab

Names: _____



My prediction: Starting first will / will not affect the result because

Game	Starter	Winner	Strategy note
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

First player wins: _____

Second-player wins: _____



What pattern do you notice?



Write one strategy that seemed to work.



How could you test that strategy fairly?

Possible Outcomes and Likelihood - Part 1

Name: _____

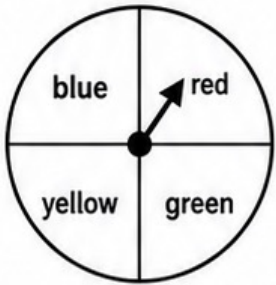
A. Write all possible outcomes.



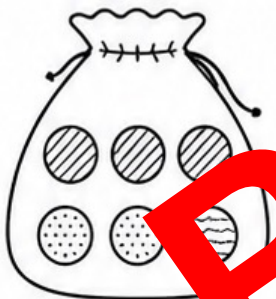
1. Toss a fair coin.



2. Roll a standard six-sided die.



3. Spin a spinner with 4 equal sections: blue, red, yellow and green.



4. Draw one counter from a bag with 3 blue, 2 red and 1 yellow counter.

B. Order each mixed set from least likely to most likely.

5. Mixed set: Draw red | Draw blue | Draw yellow

LEAST LIKELY





MOST LIKELY

6. Mixed set: Roll an odd number | Roll a number less than 6 | Roll a 1

LEAST LIKELY





MOST LIKELY

Possible Outcomes and Likelihood - Part 1

Name: ANSWERS

A. Write all possible outcomes.



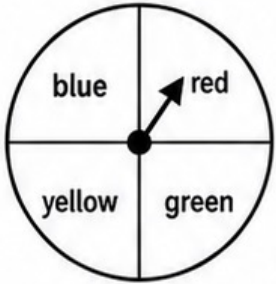
1. Toss a fair coin.

Heads, tails



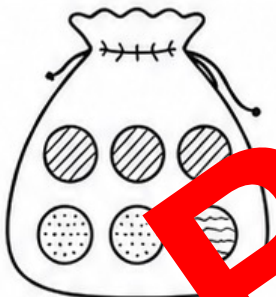
2. Roll a standard six-sided die.

1, 2, 3, 4, 5, 6



3. Spin a spinner with 4 equal sections: blue, red, yellow and green.

blue, red, yellow, green



4. Draw one counter from a bag with 3 blue, 2 red and 1 yellow counter.

blue, red, yellow

B. Order each mixed set from least likely to most likely.

5. Mixed set: Draw red | Draw blue | Draw yellow

LEAST LIKELY

Draw yellow



Draw red



Draw blue

MOST LIKELY

6. Mixed set: Roll an odd number | Roll a number less than 6 | Roll a 1

LEAST LIKELY

Roll a 1



Roll an odd number



Roll a number less than 6

MOST LIKELY

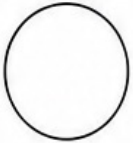
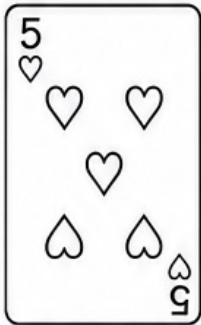
Possible Outcomes and Likelihood - Part 2

Name: _____

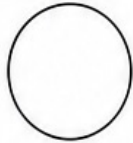
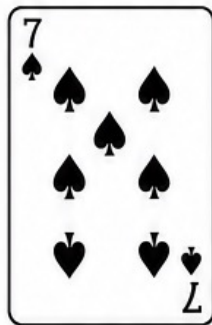
Use a standard deck of 52 cards with no jokers.

A. Write each probability as a fraction out of 52.

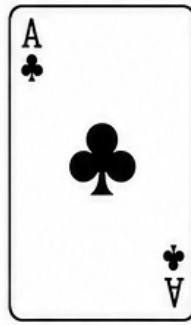
1. Draw a heart



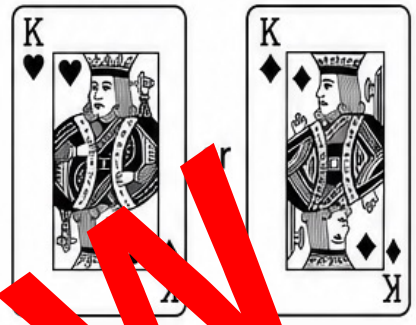
2. Draw a black card



3. Draw an ace



4. Draw a red king



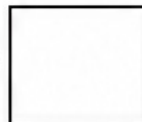
B. Compare the outcomes.

5. Are you more likely to draw a black 2 or a red king? Explain.

6. Are you less likely to draw a club or a red card? Explain.

7. Order from least likely to most likely: a spade | a queen | a red card | the 6 of diamonds

LEAST LIKELY



MOST LIKELY

C. Overlapping outcomes

8. Can one card be both a queen and a red card? Give an example.

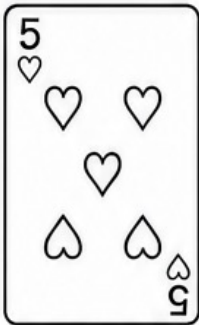
Possible Outcomes and Likelihood - Part 2

Name: **ANSWERS**

Use a standard deck of 52 cards with no jokers.

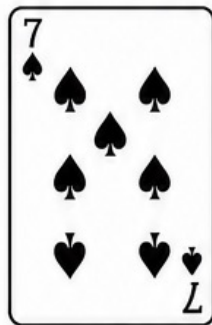
A. Write each probability as a fraction out of 52.

1. Draw a heart



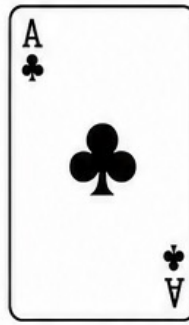
13/52

2. Draw a black card



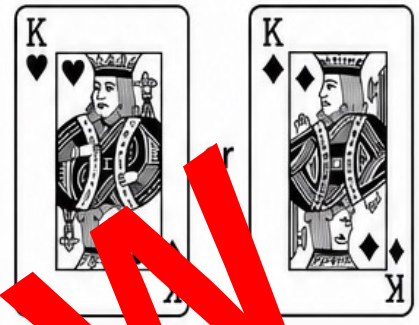
26/52

3. Draw an ace



4/52

4. Draw a red king



2/52

B. Compare the outcomes.

5. Are you more likely to draw a black 2 or a red king? Explain.

Equally likely: 2/52

6. Are you less likely to draw a club or a red card? Explain.

A club is less likely: 13/52 compared with 26/52.

7. Order from least likely to most likely: a spade | a queen | a red card | the 6 of diamonds

LEAST LIKELY

6 of diamonds



a queen



a spade



a red card

MOST LIKELY

C. Overlapping outcomes

8. Can one card be both a queen and a red card? Give an example.

Yes. Queen of hearts or queen of diamonds.



Coin Toss Investigation - Trial A



Name: _____

Flip a fair coin 30 times. Record H for heads or T for tails.

A. Predict

I predict I will get more: ☐ HEADS / ☐ TAILS / ☐ ABOUT THE SAME

My reason: _____

B. Record 30 flips

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30

C. Totals

HEADS

TAILS

D. Explain

Did your result match your prediction? Use your totals as evidence.



Coin Toss Investigation - Trial B



Name: _____

Flip the same fair coin 30 more times. Record H for heads or T for tails.

A. Record 30 more flips

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30

B. Trial B totals

HEADS _____	TAILS _____
-----------------------	-----------------------

C. Compare

1. How were Trial A and Trial B alike?

2. How were they different?

3. If Trial A ended with five heads in a row, would the next flip be more likely to be tails? Explain.

D. Conclusion

What do repeated coin tosses show about variation and the chance of the next outcome?

Independent or Dependent? - Part 1

Name: _____

For each scenario, tick Independent or Dependent.

SCENARIO		INDEPENDENT	DEPENDENT
1. Toss a fair coin, then toss it again.		☐	☐
2. Roll a fair die, then roll it again.		☐	☐
3. Draw a counter from a bag and do not replace it before the next draw.		☐	☐
4. Draw a counter, replace it and mix the bag before the next draw.		☐	☐
5. Spin the same fair spinner twice.		☐	☐
6. Draw a card, keep it out, then draw another card.		☐	☐
7. Cover a space on a game board so it cannot be used next turn.		☐	☐
8. Rain is forecast before deciding whether an outdoor carnival can run.		☐	☐

Explain two choices

Scenario number: ____ My reason:

Scenario number: ____ My reason:

Independent or Dependent? - Part 1

Name: **ANSWERS**

For each scenario, tick Independent or Dependent.

SCENARIO	INDEPENDENT	DEPENDENT
1. Toss a fair coin, then toss it again. 	☒	☐
2. Roll a fair die, then roll it again. 	☒	☐
3. Draw a counter from a bag and do not replace it before the next draw. 	☐	☒
4. Draw a counter, replace it and mix the bag before the next draw. 	☒	☐
5. Spin the same fair spinner twice. 	☒	☐
6. Draw a card, keep it out, then draw another card. 	☐	☒
7. Cover a space on a game board so it cannot be used next turn. 	☐	☒
8. Rain is forecast before deciding whether an outdoor carnival can run. 	☐	☒

Explain two choices

Scenario number: 1 My reason:

The first toss does not change the chance of heads or tails on the next toss.

Scenario number: 3 My reason:

Without replacement, the first draw changes what remains in the bag.

Independent or Dependent? - Part 2

Name: _____

Decide whether the first event changes the chance of what happens next.
Explain with evidence.

1. Weather and an outdoor event



A school carnival is planned outdoors. Heavy rain begins. Does the weather change the chance that the outdoor carnival can run? Explain.

Independent / Dependent

☐☐

2. Counters without replacement



A bag has 3 blue and 2 red counters. A blue counter is drawn and not replaced. Does the first draw change the chance of blue on the next draw? Explain.

Independent / Dependent

☐☐

3. A run of heads



A fair coin shows heads four times in a row. Does this change the chance of heads on the next toss? Explain.

Independent / Dependent

☐☐

4. First-player results



Across 20 games, the first player won 12, the second player won 5 and 3 were draws. Does the result of Game 20 change the chance in Game 21? What relationship does the evidence suggest?

Independent / Dependent

☐☐

Independent or Dependent? - Part 2

Name: **ANSWERS**

Decide whether the first event changes the chance of what happens next.
Explain with evidence.

1. Weather and an outdoor event



A school carnival is planned outdoors. Heavy rain begins. Does the weather change the chance that the outdoor carnival can run? Explain.

Independent / Dependent



Dependent. Heavy rain lowers the chance the outdoor carnival can run.

2. Counters without replacement



A bag has 3 blue and 2 red counters. A blue counter is drawn and not replaced. Does the first draw change the chance of blue on the next draw? Explain.

Independent / Dependent



Dependent. Blue changes from $\frac{3}{5}$ before the draw to $\frac{2}{4}$ after it.

3. A runner heads



A fair coin shows heads four times in a row. Does this change the chance of heads on the next toss? Explain.

Independent / Dependent



Independent. A fair coin is still $\frac{1}{2}$ heads on the next toss.

4. First-player results



Across 20 games, the first player won 12, the second player won 5 and 3 were draws. Does the result of Game 20 change the chance in Game 21? What relationship does the evidence suggest?

Independent / Dependent

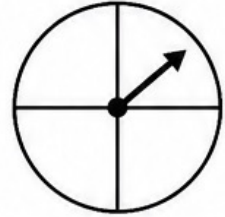


Independent. Game 20 does not cause Game 21. The evidence suggests the first player may have an advantage.

Comparing Repeated Results - Part 1

Name: _____

Three groups spun the same equal four-colour spinner 40 times.



GROUP	BLUE	RED	YELLOW	GREEN	TOTAL
Group A	12	8	11	9	
Group B	7	13	10	10	
Group C	11	9	8	12	

Use the data

1. Calculate the total for each group.

A

C

2. For Group A, which colour was most frequent? _____ Least frequent? _____

3. For Group B, which colour was most frequent? _____ Least frequent? _____

4. For Group C, which colour was most frequent? _____ Least frequent? _____

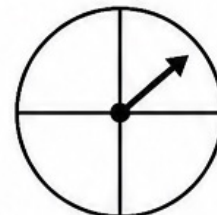
5. Did all three groups get exactly the same results? YES / ☐ NO ☐

6. Give two examples that show variation between the groups.

Comparing Repeated Results - Part 1

Name: **ANSWERS**

Three groups spun the same equal four-colour spinner 40 times.



GROUP	BLUE	RED	YELLOW	GREEN	TOTAL
Group A	12	8	11	9	40
Group B	7	13	10	10	40
Group C	11	9	8	12	40

Use the data

1. Calculate the total for each group.

A

40

40

C

40

2. For Group A, which colour was most frequent? **Blue** Least frequent? **Red**

3. For Group B, which colour was most frequent? **Red** Least frequent? **Blue**

4. For Group C, which colour was most frequent? **Green** Least frequent? **Yellow**

5. Did all three groups get exactly the same results? YES / ☐ NO ☒

6. Give two examples that show variation between the groups.

Blue varied: A 12, B 7, C 11.

Red varied: A 8, B 13, C 9.

Comparing Repeated Results - Part 2

Name: _____

Combine the results from Groups A, B and C. Then use the evidence.

COLOUR	GROUP A	GROUP B	GROUP C	COMBINED TOTAL
Blue	12	7	11	
Red	8	13	9	
Yellow	11	10	8	
Green	9	10	12	

Analyse the combined evidence

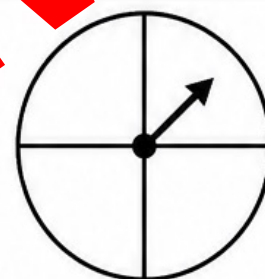
1. Find the combined total for each colour

Blue ____

Red ____

Yellow ____

Green ____



2. How many spins were carried out altogether? _____

3. If the spinner is equal, about how many of each colour would you expect in 120 spins? _____

4. Which colour was most frequent? _____ Which was least frequent? _____ What was the difference? _____

5. Are the combined results broadly consistent with an equal spinner? YES / NO



6. Why did the three groups get different results even though they used the same spinner?

Comparing Repeated Results - Part 2

Name: ANSWERS

Combine the results from Groups A, B and C. Then use the evidence.

COLOUR	GROUP A	GROUP B	GROUP C	COMBINED TOTAL
Blue	12	7	11	30
Red	8	13	9	30
Yellow	11	10	8	29
Green	9	10	12	31

Analyse the combined evidence

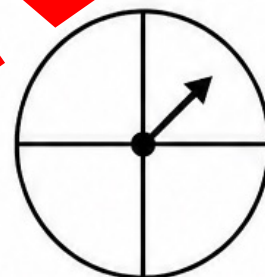
1. Find the combined total for each colour.

Blue 30

Red 30

Yellow 29

Green 31



2. How many spins were carried out altogether? 120

3. If the spinner is equal, about how many of each colour would you expect in 120 spins? 30

4. Which colour was most frequent? Green Which was least frequent? Yellow What was the difference? 2

5. Are the combined results broadly consistent with an equal spinner? YES / NO



6. Why did the three groups get different results even though they used the same spinner?

Chance produces variation, so repeated groups do not
have to match exactly. The combined totals are still
close to the expected 30 for each colour.

Plan a Chance Experiment - Part 1

Name: _____

Design a *fair* repeated chance experiment that another group can follow.

1. My question

What chance question will I investigate?

2. Chance device

What will I use? Tick one.

☐ coin



☐ die



☐ spinner



☐ bag



☐ cards



☐ other: _____

3. Possible outcomes

List every possible outcome.

4. My prediction

What do I think will happen most and least often? Why?

5. What stays the same?

List the conditions I will keep fair for every trial.

6. Number of trials

Choose enough trials to see variation.

7. How I will record

Describe my tally, table or recording method.

Plan a Chance Experiment - Part 2

Name: _____

Carry out the experiment from Part 1. Record every trial, then explain the evidence.

A. Record 25 trials

1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20
21	22	23	24	25

B. Summarise

OUTCOME	TALLY	TOTAL

C. Analyse and explain

1. Did the most frequent outcome match my prediction? Explain with totals.

2. What variation did I notice across the trials?

3. What relationship did I notice between the possible outcomes?

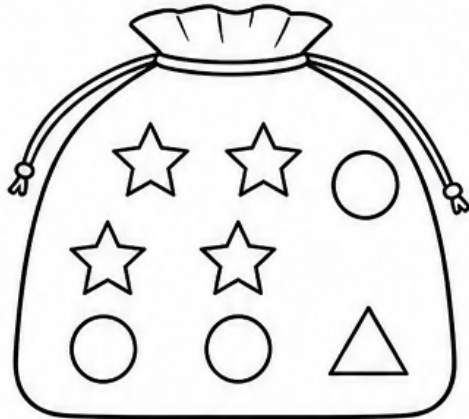
4. My evidence-based conclusion:

5. One useful next test:

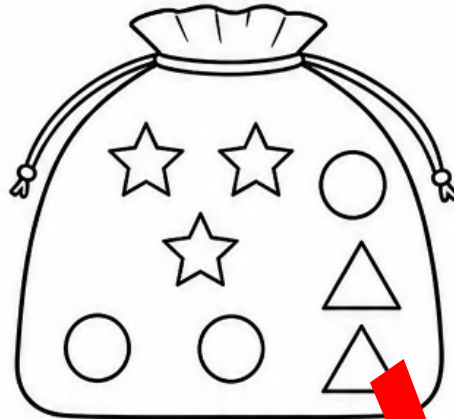
Carnival Chance Investigation - Assessment Part 1

Name: _____

At the carnival, a player draws one token from a bag. A star wins the top prize.



BAG A: 4 stars, 3 circles, 1 triangle



BAG B: 3 stars, 3 circles, 2 triangles

Show what you know

1. List every possible type of token in both bags.

2. For Bag A, which outcome is most likely? _____ Least likely? _____

3. For Bag B, which outcome is most likely? _____ Least likely? _____

4. Write the chance of drawing a star as a fraction.

Bag A _____ / 8

Bag B _____ / 8

5. Which bag gives a better chance of a star? Explain with fractions.

6. Write one similarity and one difference between the bags.

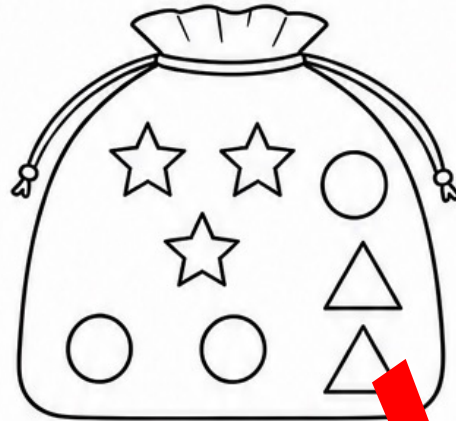
Carnival Chance Investigation - Assessment Part 1

Name: **ANSWERS**

At the carnival, a player draws one token from a bag. A star wins the top prize.



BAG A: 4 stars, 3 circles, 1 triangle



BAG B: 3 stars, 3 circles, 2 triangles

Show what you know

1. List every possible type of token in both bags.

Star, circle and triangle.

2. For Bag A, which outcome is most likely? **star** Least likely? **triangle**

3. For Bag B, which outcome is most likely? **star & circle** Least likely? **triangle**

4. Write the chance of drawing a star as a fraction.

Bag A **4** / 8

Bag B **3** / 8

5. Which bag gives a better chance of a star? Explain with fractions.

Bag A. Its chance is 4/8, which is greater than Bag B's 3/8.

6. Write one similarity and one difference between the bags.

Similarity: both bags have 8 tokens and the same three outcome types.

Difference: Bag A has more stars and fewer triangles.

Carnival Chance Investigation - Assessment Part 2

Name: _____



Each token was replaced and the bag was mixed after every draw.
Study the results from 40 draws.



BAG	STARS	CIRCLES	TRIANGLES	TOTAL
Bag A	21	14	5	
Bag B	16	15	9	

Use evidence to explain

1. Calculate each total.

Bag A _____

Bag B _____

2. Which outcome was most and least frequent for each bag?

Bag A most: _____ least: _____

Bag B most: _____ least: _____

3. Do the results support the claim that Bag A gives a better chance of a star? Explain with numbers.

4. Describe one example of variation between expected and actual results.

5. Why does replacement make one draw independent of the next?

6. Propose a fair repeat test that another group could follow.

Carnival Chance Investigation - Assessment Part 2

Name: **ANSWERS**



Each token was replaced and the bag was mixed after every draw.
Study the results from 40 draws.



BAG	STARS	CIRCLES	TRIANGLES	TOTAL
Bag A	21	14	5	40
Bag B	16	15	9	40

Use evidence to explain

1. Calculate each total.

Bag A **40**

Bag B **40**

2. Which outcome was most and least frequent for each bag?

Bag A most: **stars** least: **triangles**

Bag B most: **stars** least: **triangles**

3. Do the results support the claim that Bag A gives a better chance of a star? Explain with numbers.

Yes. Bag A produced 21 stars, compared with 16 stars from Bag B.

4. Describe one example of variation between expected and actual results.

Bag A expected about 20 stars but recorded 21, one more than expected.

5. Why does replacement make one draw independent of the next?

Replacement restores the same 8-token mix, so the first draw does not change the chance on the next draw.

6. Propose a fair repeat test that another group could follow.

Use the same bag for 40 draws. Replace and mix after every draw, use the same method and record every result.

Repeated Chance Experiments Rubric

Student: _____ Date: _____

BEGINNING	DEVELOPING	ACHIEVING	CONFIDENT	EXCEEDING
1. Identifying outcomes and likelihood				
Names few outcomes. ☐	Names some outcomes with support. ☐	List outcomes and compares likely and less likely. ☐	Explains likelihood using fractions or counts. ☐	Justifies complex comparisons and overlapping outcomes. ☐
2. Conducting and recording repeated trials				
Needs support to follow a trial. ☐	Completes trials; records partly. ☐	Conducts fair repeated trials and records accurately. ☐	Maintains controls and checks totals. ☐	Refines the method and records efficiently. ☐
3. Comparing variations and relationships				
States results only. ☐	Notifies a simple difference. ☐	Compares results and describes variation. ☐	Uses totals to explain patterns and relationships. ☐	Evaluates evidence across multiple trials. ☐
4. Explaining independent and dependent outcomes with evidence				
Cannot yet identify whether chance changes. ☐	Identifies some examples with support. ☐	Distinguishes independent and dependent outcomes. ☐	Explains how an earlier event changes or does not change the next chance. ☐	Justifies nuanced cases using evidence and fair-chance reasoning. ☐

Repeated Chance Experiments

PREVIEW



Learning Goal

Predict, represent, record, compare and explain
to investigate chance outcomes with evidence.



Possible Outcomes

An outcome is something that can happen.

Coin: heads or tails

Die: 1, 2, 3, 4, 5 or 6

Sumner or its labelled sections



Likelihood Is Not Certainty

impossible → unlikely → even chance → likely → certain

A likely outcome can still fail to happen.



The Experiment Cycle

PREDICT → REPEAT → RECORD → COMPARE → EXPLAIN



Why Repeat?

One trial is weak evidence.

Many fair trials have a pattern — and natural variation.



Keep It Fair

Use the same chance or vice and method.

Change only the question you are testing.

Record every trial.



Independent Outcomes

Five heads do not make tails more likely.

A fair coin is still $1/2$ heads and $1/2$ tails.

One toss does not control the next toss.



Dependent Outcomes

A first event can change what remains.

Without replacement, the next probabilities change.



Compare Repeated Results

Fair groups can get different totals.

Compare counts, describe variation and look for relationships.



Games Reveal Relationships

Does going first matter?

Does a strategy change results?

Repeat the games before deciding.



Plan an Investigation

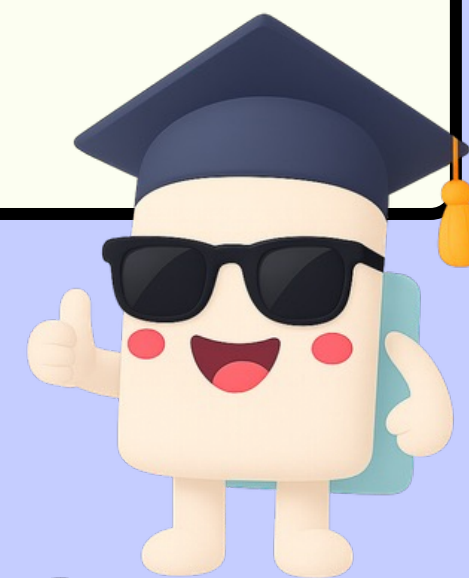
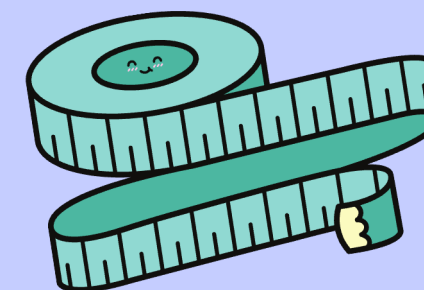
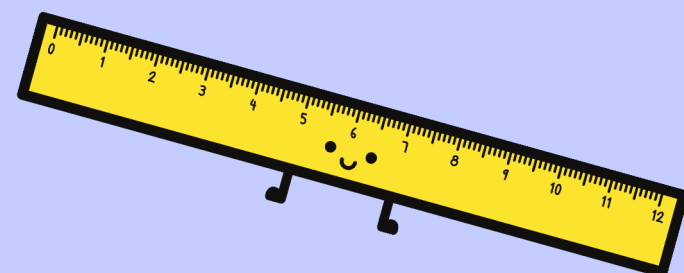
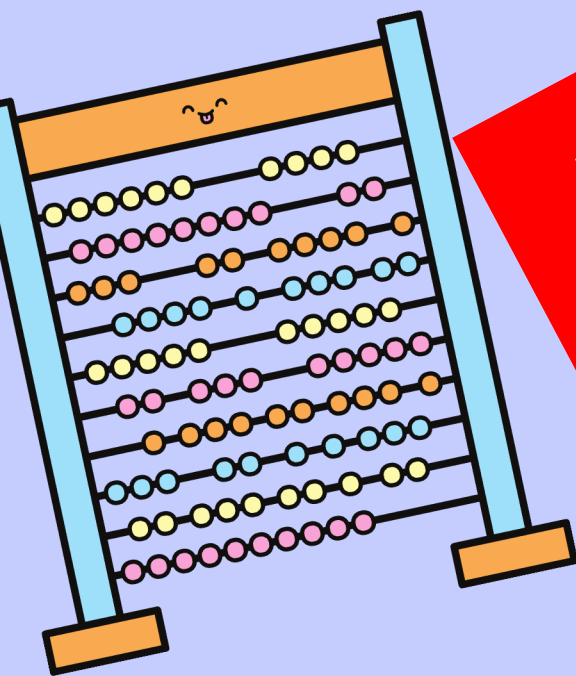
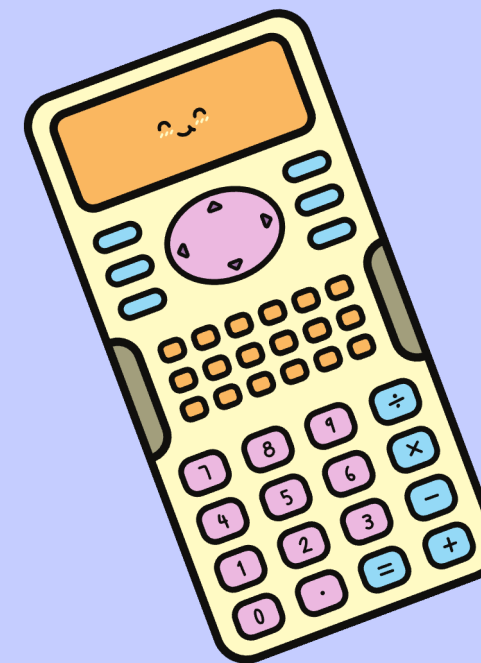
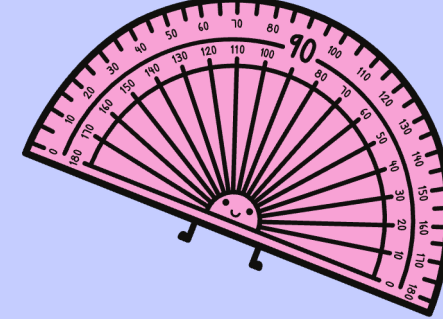
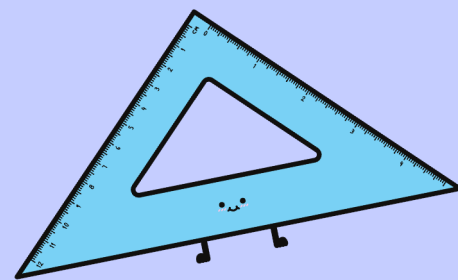
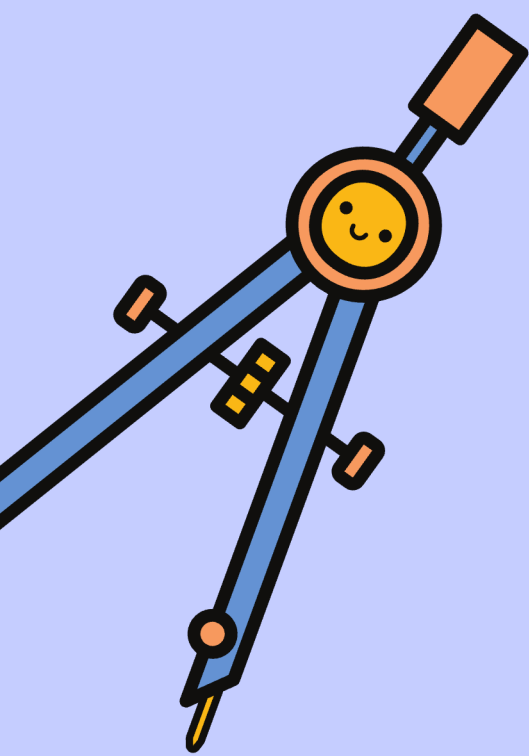
Ask a testable question.

Choose enough fair trials.

Record every result.

Use the evidence to answer.





PREVIEW

Will Done.
What will you repeat,
reorder and compare?

Repeated Chance Experiments Quiz

PREVIEW



Question 1

Why repeat a chance experiment?

- A. Guarantee the result
- B. Collect evidence about outcomes
- C. Change the rules each time
- D. Avoid recording



Answer 1

B. Collect evidence about outcomes.

Repeated trials give us data to compare.



Question 2

True or false?

After five heads, a fair coin is more likely to land tails next.



Answer 2

False

Each fair coin toss is independent.

The next toss is still $1/2$ heads and $1/2$ tails.



Question 3

List every possible outcome
when rolling a standard six-sided die.



Answer 3

1, 2, 3, 4, 5 and 6

PREVIEW



Question 4

Which event is independent?

- A. Tossing a fair coin twice
- B. Rolling a fair die twice
- C. Drawing a second counter without replacing the first
- D. Spinning a fair spinner twice



Answer 4

C. Drawing without replacement.

The first draw changes what remains.



Question 5

Trial A: 2 heads, 8 tails

Trial B: 9 heads, 11 tails

State one similarity and one difference.



Answer 5

Similarity: both trials used 10 flips and were close to even.

Difference: their exact totals varied.



Question 6

True or false?

Different results from two or more repeated experiments

automatically prove the device is unfair.



Answer 6

also
Variation is expected in repeated chance experiments.



Question 7

Which is the fairest test?

- A. Change the spinner halfways
- B. Use the same spinner and method for 40 spins; record every result
- C. Stop when a favourite colour wins
- D. Skip results that look unusual



Answer 7

B. Keep the conditions consistent
and record every trial.



Question 8

Why might a small number of trials
not match the expected pattern?



Answer 8

Chance variation is common in small samples.

More for trials provides better evidence.



Question 9

First players won 16 of 20 games. What is the best conclusion?

- A. The first player will always win
- B. Going first may matter and should be tested again
- C. The game is impossible to study
- D. Only the last game counts



Answer 9

B. The evidence suggests a relationship.

Another repeated study would strengthen the conclusion.



Question 10

Name the five steps
of the investigation cycle.

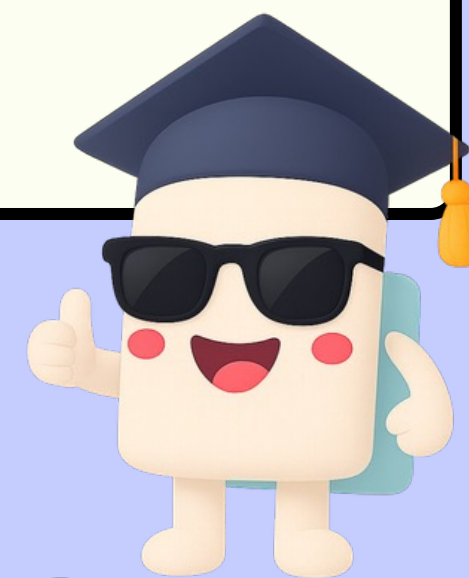
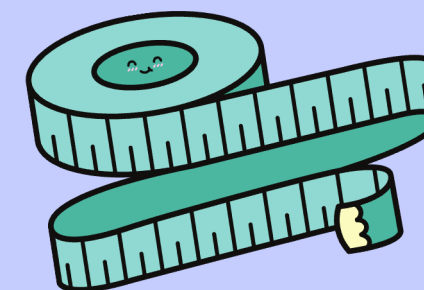
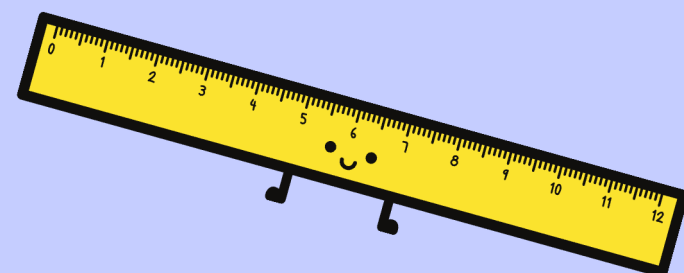
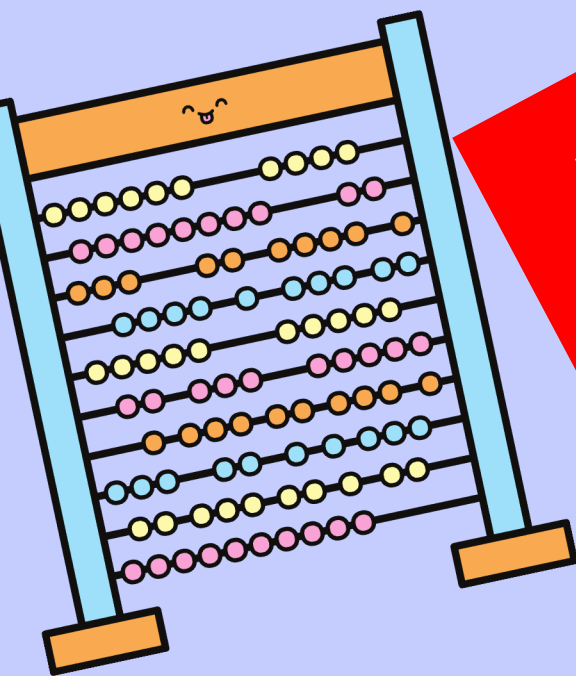
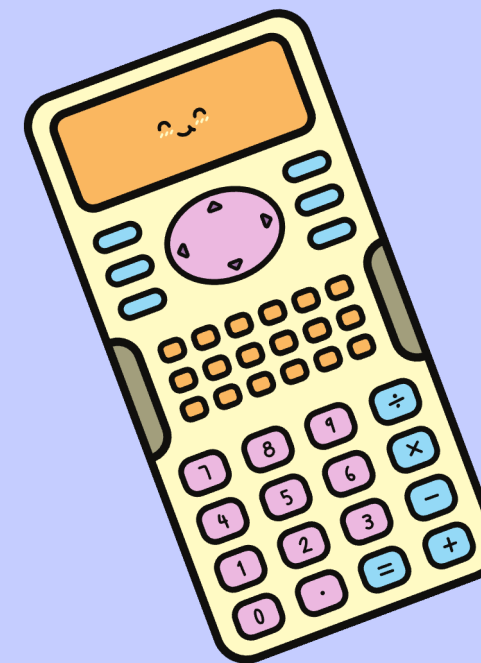
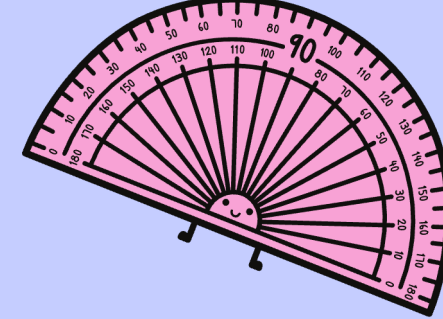
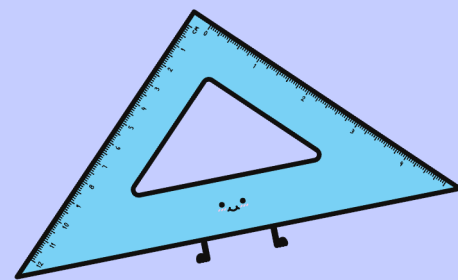
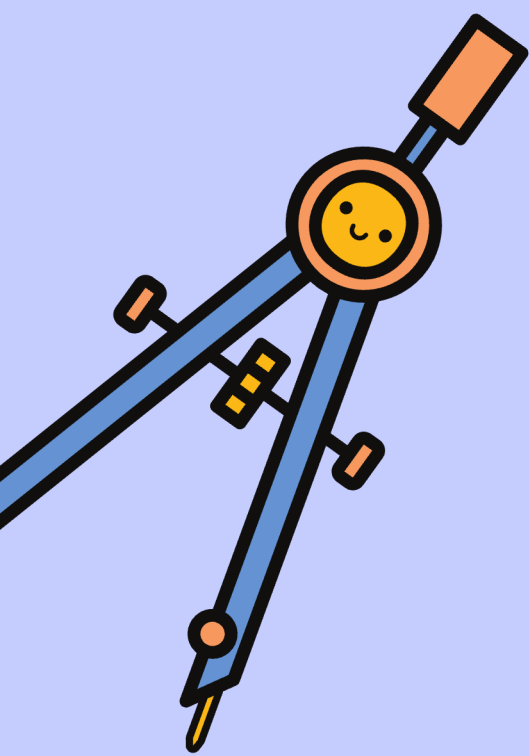
PREVIEW



Answer 10

PREDICT → RECOMMEND → RECOMMEND → COMPARE → EXPLAIN





PREVIEW

Quiz Complete!
Use evidence,
not guesses.