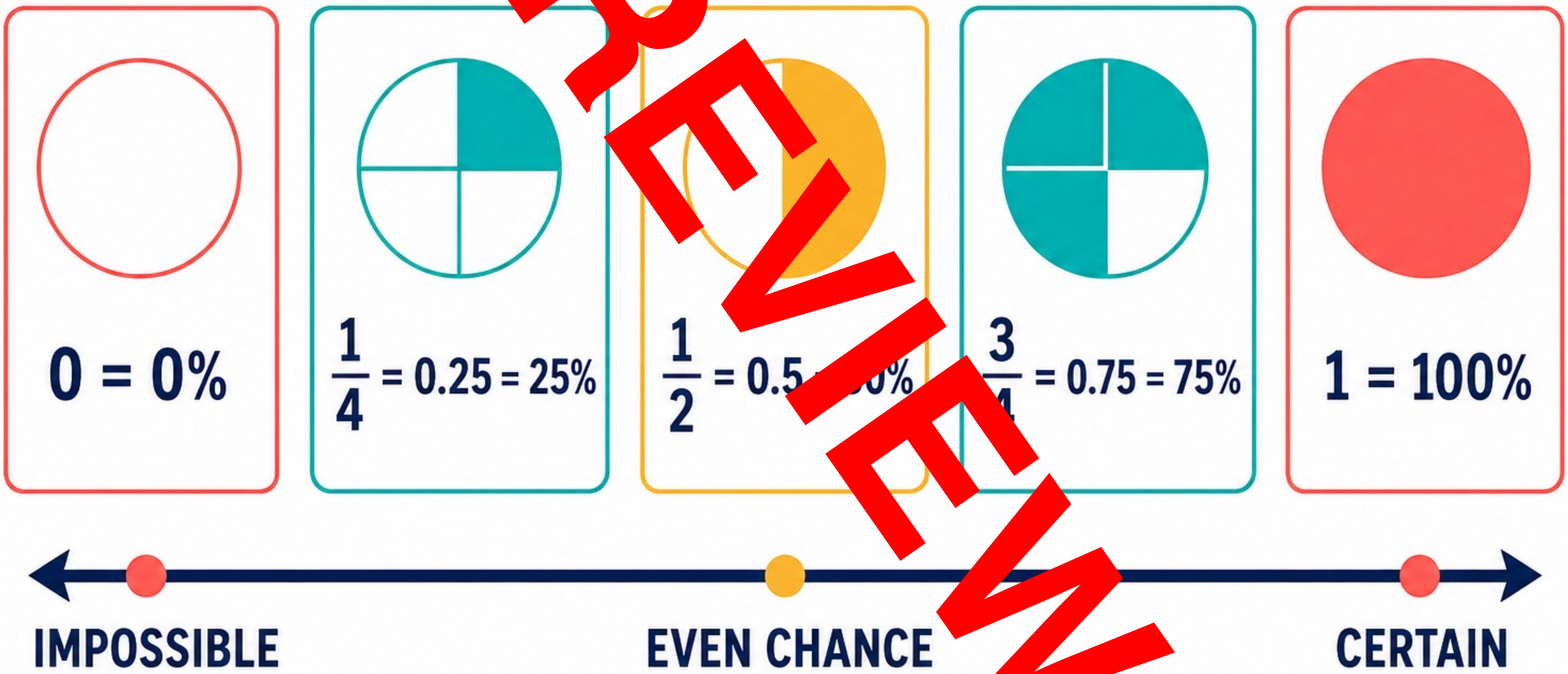
Probability - Year 6

PROBABILITY SCALE

0	0.25	0.5	0.75	1
0%	25%	50%	75%	100%
IMPOSSIBLE	UNLIKELY	EVEN CHANCE	LIKELY	CERTAIN
Rolling a 7 on a fair six-sided die	Picking blue from a bag with 1 blue and 3 red counters	Tossing heads on a fair coin	Picking red from a bag with 3 red and 1 blue counter	The day after Monday is Tuesday

ONE CHANCE, THREE FORMS



PROBABILITY REFERENCE

KEY WORDS

impossible = 0
unlikely = less than 1/2
even chance = 1/2
likely = more than 1/2
certain = 1

HOW TO CALCULATE

probability = favourable outcomes ÷ total equally likely outcomes

EXPECTED FREQUENCY

expected frequency = probability × number of trials

RELATIVE FREQUENCY

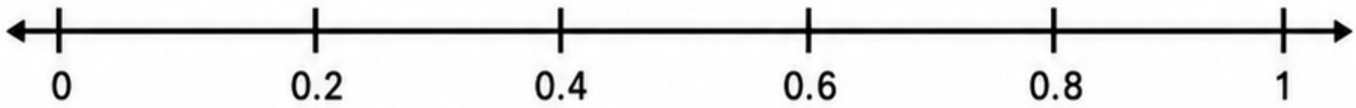
relative frequency = observed frequency ÷ number of trials

0	1/2	1
IMPOSSIBLE	EVEN CHANCE	CERTAIN

CHANCE CHECK-IN

Name: ______________________________

1. Mark 0.2, 0.5 and 0.9 on the probability scale. Label each unlikely, even chance or likely.



2. Convert $\frac{3}{5}$ to a decimal and a percentage.

   Decimal: ______________________

   Percentage: ______________________

3. How many heads are expected in 40 tosses of a fair coin? Show your calculation.

4. A fair coin lands heads [illegible] times in 40 tosses. Compare this result with the expected number of heads.

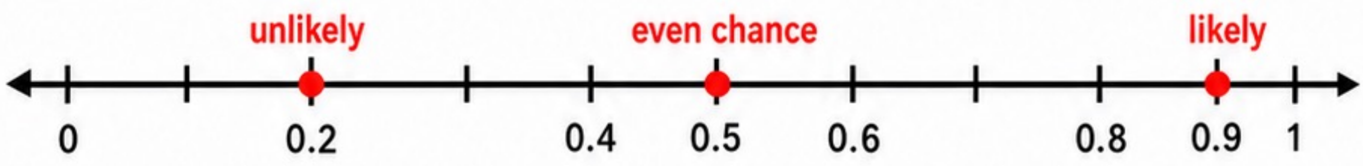
5. Why would 400 coin tosses usually give a more stable relative frequency than 20 tosses?

6. A fair coin has landed tails five times in a row. What is the probability of heads on the next toss? Explain.

CHANCE CHECK-IN

Name: ANSWERS

1. Mark 0.2, 0.5 and 0.9 on the probability scale. Label each unlikely, even chance or likely.



2. Convert $\frac{3}{5}$ to a decimal and a percentage.

Decimal: 0.6

Percentage: 60%

3. How many heads are expected in 40 tosses of a fair coin? Show your calculation.

$40 \times \frac{1}{2} = 20$ heads

4. A fair coin lands heads 13 times in 40 tosses. Compare this result with the expected number of heads.

13 heads is lower than the expected 20 heads.

5. Why would 400 coin tosses usually give a more stable relative frequency than 20 tosses?

With more trials, random variation has less effect on the overall proportion, so the relative frequency is usually more stable.

6. A fair coin has landed tails five times in a row. What is the probability of heads on the next toss? Explain.

$\frac{1}{2}$. Fair coin tosses are independent, so the earlier tails do not change the next toss.

PROBABILITY SCALE AND LANGUAGE

Name: ______________________________

Event		Chance word	Fraction	Decimal	Percentage
A	Roll above 4 on a fair six-sided die.				
B	Select a vowel from A, E, I, O, U.				
C	Select blue from a bag with 1 blue and 4 orange counters.				
D	The day after Monday is Tuesday.				
E	Roll a 9 on a f[illegible] six-sided [illegible]				
F	[illegible] re[illegible] a spinne[illegible] with [illegible]ed [illegible] blue equal s[illegible]ions.				

Write each event's exact probability.

A	B	C	D	E	F

Order A–F from least likely to most likely. Use = for equal probabilities.

____

PROBABILITY SCALE AND LANGUAGE

Name: ANSWERS

	Event	Chance word	Fraction	Decimal	Percentage
A	Roll above 4 on a fair six-sided die.	unlikely	$\frac{1}{3}$	0.333	33.3%
B	Select a vowel from A, E, I, O, U.	certain	1	1	100%
C	Select blue from a bag with 1 blue and 4 orange counters.	unlikely	$\frac{1}{5}$	0.2	20%
D	The day after Monday is Tuesday.	certain	1	1	100%
E	Roll a 9 on a fair six-sided die.	impossible	0	0	0%
F	Land on red on a spinner with 3 red and 1 blue equal sections.	likely	$\frac{3}{4}$	0.75	75%

Write each event's exact probability.

A	B	C	D	E	F
$\frac{1}{3}$	1	$\frac{1}{5}$	1	0	$\frac{3}{4}$

Order A–F from least likely to most likely. Use = for equal probabilities.

E < C < A < F < B = D

CONVERTING PROBABILITY FORMS — CORE

Name: ______________________________

fraction → decimal: divide numerator by denominator

decimal → percentage: multiply by 100

percentage → decimal: divide by 100

	Fraction	Decimal	Percentage
1.	$\frac{1}{2}$		
2.		0.2	
3.			75%
4.	$\frac{3}{10}$		
5.		0.625	
6.			40%
7.	$\frac{7}{8}$		
8.		0.05	
9.			90%
10.	$\frac{1}{6}$		

Round repeating decimals to three decimal places and percentages to one decimal place.

CONVERTING PROBABILITY FORMS — CORE

Name: ANSWERS

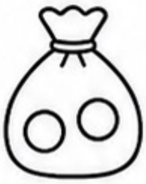
fraction → decimal: divide numerator by denominator
decimal → percentage: multiply by 100
percentage → decimal: divide by 100

	Fraction	Decimal	Percentage
1.	$\frac{1}{2}$	0.5	50%
2.	$\frac{1}{5}$	0.2	20%
3.	$\frac{3}{4}$	0.75	75%
4.	$\frac{3}{10}$	0.3	30%
5.	$\frac{5}{8}$	0.625	62.5%
6.	$\frac{2}{5}$	0.4	40%
7.	$\frac{7}{8}$	0.875	87.5%
8.	$\frac{1}{20}$	0.05	5%
9.	$\frac{9}{10}$	0.9	90%
10.	$\frac{1}{6}$	0.167	16.7%

Round repeating decimals to three decimal places and percentages to one decimal place.

CONVERTING PROBABILITY FORMS – REASONING

Name: ______________________________

1. 

A bag has 4 blue and 6 orange counters. What is P(blue)?

Fraction: _______ Decimal: _______ Percentage: _______

2. 

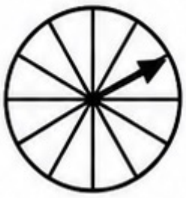
A fair eight-sided die is numbered 1–8. What is P(even)?

Fraction: _______ Decimal: _______ Percentage: _______

3. 

What is P(heart) when one card is drawn from a standard 52-card deck?

Fraction: _______ Decimal: _______ Percentage: _______

4. 

A spinner has 3 winning sectors out of [illegible] equal sectors. What is P(win)?

Fraction: _______ Decimal: _______ Percentage: _______

5. 

The probability of rain is [illegible]. What is P(no rain)?

Fraction: _______ Decimal: _______ Percentage: _______

6. 

What is P(rolling 2 or less on a fair six-sided die)?

Fraction: _______ Decimal: _______ Percentage: _______

7. Which is more likely: P(blue) in Question 1 or P(win) in Question 4? Explain.

____

____

8. Which is more likely: P(even) in Question 2 or P(no rain) in Question 5? Explain.

____

____

9. Create a different chance context. Give its probability in all three forms.

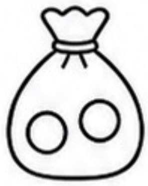
____

____

Fraction: _________ Decimal: _________ Percentage: _________

CONVERTING PROBABILITY FORMS – REASONING

Name: ANSWERS

1. 

A bag has 4 blue and 6 orange counters. What is P(blue)?

Fraction: 2/5 Decimal: 0.4 Percentage: 40%

2. 

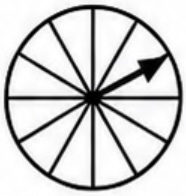
A fair eight-sided die is numbered 1–8. What is P(even)?

Fraction: 1/2 Decimal: 0.5 Percentage: 50%

3. 

What is P(heart) when one card is drawn from a stan[illegible] 52-[illegible]rd deck?

Fraction: 1/4 Decimal: 0.25 Perc[illegible]: 2[illegible]

4. 

A spinner has 3 winning secto[illegible]ut o[illegible]qual sectors. What is P(win)?

Fraction: 1/4 Deci[illegible]l: [illegible]5 Percentage: 25%

5. 

The prob[illegible]ity of rain is 3[illegible] [illegible]hat is P(no rain)?

[illegible]n: [illegible]20 [illegible]ecimal: 0.65 Percentage: 65%

6. 

[illegible]at is [illegible]lling 2 or less on a fair six-sided die)?

Fra[illegible]tion: 1/3 Decimal: 0.333 Percentage: 33.3%

7. Which [illegible]ore likely: P(blue) in Question 1 or P(win) in Question 4? Explain.

P(blue) is more likely: 0.4 > 0.25.

8. Which is more likely: P(even) in Question 2 or P(no rain) in Question 5? Explain.

P(no rain) is more likely: 0.65 > 0.5.

9. Create a different chance context. Give its probability in all three forms.

Example: heads on a fair coin

Fraction: 1/2 Decimal: 0.5 Percentage: 50%

EXPECTED FREQUENCY — FROM CHANCE TO COUNT

Name: ______________________________

expected frequency = probability × number of trials

1. Expected heads in 20 tosses of a fair coin.

Probability: _______________ × Number of trials: _______________ = ___________

Expected count: ______________________

2. Expected sixes in 60 rolls of a fair six-sided die.

Probability: _______________ × Number of trials: _______________ = ___________

Expected count: ______________________

3. A spinner has 3 red sections out of 4 equal sections. Expected reds in 80 spins.

Probability: _______________ × Number of trials: _______________ = ___________

Expected count: ______________________

4. A spinner has 2 blue sections out of 5 equal sections. Expected blues in 200 spins.

Probability: _______________ × Number of trials: _______________ = ___________

Expected count: ______________________

5. A bag has 3 green counters out of 10. Expected greens in 500 draws with replacement.

Probability: _______________ × Number of trials: _______________ = ___________

Expected count: ______________________

6. Expected hearts in 120 card draws with replacement from a standard deck.

Probability: _______________ × Number of trials: _______________ = ___________

Expected count: ______________________

7. Expected even numbers in 60 rolls of a fair six-sided die.

Probability: _______________ × Number of trials: _______________ = ___________

Expected count: ______________________

8. A bag has 7 orange counters out of 20. Expected oranges in 200 draws with replacement.

Probability: _______________ × Number of trials: _______________ = ___________

Expected count: ______________________

Show the probability, multiplication and expected count for each task.

EXPECTED FREQUENCY — FROM CHANCE TO COUNT

Name: ANSWERS

expected frequency = probability × number of trials

1. Expected heads in 20 tosses of a fair coin.

Probability: 1/2 × Number of trials: 20 = 10

Expected count: 10 heads

2. Expected sixes in 60 rolls of a fair six-sided die.

Probability: 1/6 × Number of trials: 60 = 10

Expected count: 10 sixes

3. A spinner has 3 red sections out of 4 equal sections. Expected reds in 80 spins.

Probability: 3/4 × Number of trials: 80 = 60

Expected count: 60 reds

4. A spinner has 2 blue sections out of 5 equal sections. Expected blues in 200 spins.

Probability: 2/5 × Number of trials: 200 = 80

Expected count: 80 blues

5. A bag has 3 green counters out of 10. Expected greens in 500 draws with replacement.

Probability: 3/10 × Number of trials: 500 = 150

Expected count: 150 greens

6. Expected hearts in 120 card draws with replacement from a standard deck.

Probability: 1/4 × Number of trials: 120 = 30

Expected count: 30 hearts

7. Expected even numbers in 60 rolls of a fair six-sided die.

Probability: 1/2 × Number of trials: 60 = 30

Expected count: 30 even numbers

8. A bag has 7 orange counters out of 20. Expected oranges in 200 draws with replacement.

Probability: 7/20 × Number of trials: 200 = 70

Expected count: 70 oranges

Show the probability, multiplication and expected count for each task.

SCALING EXPECTED OUTCOMES

Name: ______________________________

Use the sample proportion to estimate a larger expected count.

A. WILDLIFE SIGHTINGS

In a sample of 20 sightings, there were 8 rosellas, 7 magpies and 5 cockatoos.

	Sample count	Fraction of sample	Expected in 200
Rosellas	8		
Magpies	7		
Cockatoos	5		

Calculation: ______________________________

B. TOKEN BAG

A sample of 10 tokens contains 5 teal, 3 coral and 2 yellow tokens.

	Sample count	Fraction of sample	Expected in 100	Expected in 500
Teal	5			
Coral	3			
Yellow	2			

Why are these expected counts rather than guaranteed results?

____

____

____

SCALING EXPECTED OUTCOMES

Name: ANSWERS

Use the sample proportion to estimate a larger expected count.

A. WILDLIFE SIGHTINGS

In a sample of 20 sightings, there were 8 rosellas, 7 magpies and 5 cockatoos.

	Sample count	Fraction of sample	Expected in 200
Rosellas	8	8/20 = 2/5	[illegible]
Magpies	7	7/2[illegible]	[illegible]0
Cockatoos	5	5/2[illegible] = 1/[illegible]	50

Calculation: Scale 20 to 200 by multiplying each count by 10.

B. TOKEN BAG

A sample of 10 tokens contains 5 teal, 3 coral and 2 yellow tokens.

	Sample count	Fraction of sample	Expected in 100	Expected in 500
Teal	5	5/10 = 1/2	50	250
Coral	3	3/10	30	150
Yellow	2	2/10 = 1/5	20	100

Why are these expected counts rather than guaranteed results?

These are expectations, not guarantees,

because random chance can make observed results vary.

REPEATED TRIALS LAB — RECORD

Name: ______________________________

Materials: fair coin, paperclip, pencil, four-section spinner

1. FAIR COIN — 40 TOSSES

Toss the coin 40 times. Record each result.

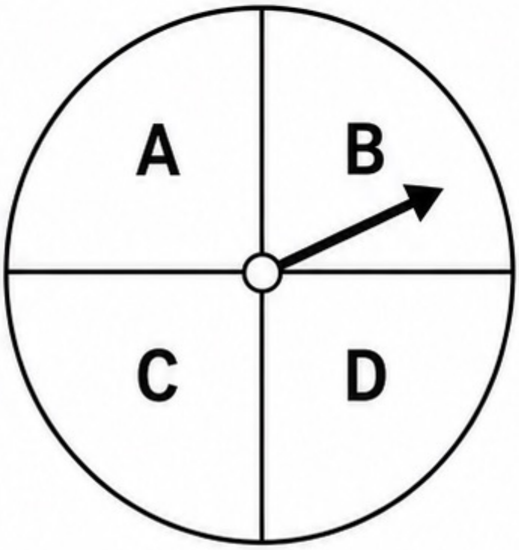
	Tally	Frequency	Relative frequency
Heads			
Tails			

Tosses 1–10	
11–20	
21–30	
31–40	

2. FOUR-EQUAL-SECTION SPINNER — 40 SPINS

Spin 40 times. Record A, B, C or D.

	Tally	Frequency	Relative frequency
A			
B			
C			
D			



Check: each frequency table must total 40.

REPEATED TRIALS LAB — ANALYSE

Name: ______________________________

Use your results from REPEATED TRIALS LAB — RECORD.

1. Calculate the relative frequencies of heads and tails. Do they total 1?

   Heads relative frequency = ______________________________

   Tails relative frequency = ______________________________

2. Compare your coin results with the theoretical probability of 1/2 for each outcome.

   ____
   ____
   ____
   ____

3. Calculate the relative frequency of A, B, C and D. Compare each with the theoretical probability of 1/4.

Outcome	Frequency	Relative frequency	Theoretical probability
A			
B			
C			
D			

4. Why might your observed results differ from the theoretical probabilities?

   ____
   ____
   ____
   ____

5. Predict what would usually happen to the relative frequencies if you completed 160 more trials, for 200 trials in total.

   ____
   ____
   ____
   ____

6. A fair coin has landed tails five times in a row. What is P(heads) on the next toss? Explain.

   ____
   ____
   ____
   ____

REPEATED TRIALS LAB — ANALYSE

Name: ANSWERS

Use your results from REPEATED TRIALS LAB – RECORD.

1. Calculate the relative frequencies of heads and tails. Do they total 1?

   Heads relative frequency = answers vary; heads frequency ÷ 40

   Tails relative frequency = answers vary; tails frequency ÷ 40; yes, the two relative frequencies total 1

2. Compare your coin results with the theoretical probability of 1/2 for each outcome.

   Answers vary. Compare each observed relative frequency with 1/2.

3. Calculate the relative frequency of A, B, C and D. Compare each with the theoretical probability of 1/4.

Outcome	Frequency	Relative frequency	Theoretical probability
A	answers vary	answers vary	1/4
B	answers vary	answers vary	1/4
C	answers vary	answers vary	1/4
D	answers vary	answers vary	1/4

4. Why might your observed results differ from the theoretical probabilities?

   Random chance creates variation, especially in a small number of trials.

5. Predict what would usually happen to the relative frequencies if you completed 160 more trials, for 200 trials in total.

   With 200 trials, the relative frequencies would usually be more stable and closer to the theoretical probabilities.

6. A fair coin has landed tails five times in a row. What is P(heads) on the next toss? Explain.

   1/2. Tosses are independent, so the previous tails do not change the next toss.

TWO-DICE SIMULATION — THEORETICAL MODEL

Name: ______________________________

Two fair six-sided dice create 36 equally likely ordered pairs.

Sum	Number of ordered pairs	Theoretical fraction	Percentage
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			

1. Which sum is most likely? Explain using ordered pairs.

____

____

2. Why are sums 2 and 12 less likely than sum 7?

____

____

3. Check: do all theoretical probabilities total 1 or 100%?

____

____

TWO-DICE SIMULATION — THEORETICAL MODEL

Name: ANSWERS

Two fair six-sided dice create 36 equally likely ordered pairs.

Sum	Number of ordered pairs	Theoretical fraction	Percentage
2	1	1/36	2.8%
3	2	2/36	[illegible]
4	3	3/36	[illegible]
5	4	4/36	[illegible]
6	5	[illegible]	[illegible]
7	6	[illegible]	16.7%
8	5	[illegible]	13.9%
9	4	4/36	11.1%
10	3	3/36	8.3%
11	[illegible]	2/36	5.6%
12	[illegible]	1/36	2.8%

1. [illegible] is most likely? Explain using ordered pairs.

Sum [illegible] it has 6 ordered pairs.

2. Why are sums 2 and 12 less likely than sum 7?

Sums 2 and 12 each have only 1 ordered pair.

3. Check: do all theoretical probabilities total 1 or 100%?

Yes. Exact fractions total 1; rounded percentages total approximately 100%.

TWO-DICE SIMULATION — 100 TRIALS

Name: ______________________________

Use a digital tool to roll two fair six-sided dice 100 times. Add the dice, then record each sum.

Sum	Occurrences	Relative frequency
Sum 2		
Sum 3		
Sum 4		
Sum 5		
Sum 6		
Sum 7		
Sum 8		
Sum 9		
Sum 10		
Sum 11		
Sum 12		

1. Which sum occurred most often?

____

2. Compare your results with the theoretical distribution from the previous page.

____

____

3. Why might your observed frequencies differ from the theoretical probabilities?

____

____

4. Predict how the relative frequencies would usually change after 500 trials.

____

____

Check: occurrences must total 100.

TWO-DICE SIMULATION — 100 TRIALS

Name: ANSWERS

Use a digital tool to roll two fair six-sided dice 100 times. Add the dice, then record each sum.

Sum	Occurrences	Relative frequency
Sum 2	results vary	results vary
Sum 3	results vary	results vary
Sum 4	results vary	results vary
Sum 5	results vary	results vary
Sum 6	results vary	results vary
Sum 7	results vary	results vary
Sum 8	results vary	results vary
Sum 9	results vary	results vary
Sum 10	results vary	results vary
Sum 11	results vary	results vary
Sum 12	results vary	results vary

1. Which sum occurred most often?
   Results vary; theory predicts that sum 7 is most likely.

2. Compare your results with the theoretical distribution from the previous page.
   Results should be broadly similar to the theoretical pattern, but not exact.

3. Why might your observed frequencies differ from the theoretical probabilities?
   Random chance causes variation in a finite number of trials.

4. Predict how the relative frequencies would usually change after 500 trials.
   After 500 trials, the relative frequencies would usually be more stable and closer to the theoretical probabilities.

Check: occurrences must total 100.

TWO-DICE SIMULATION — COMPARE TRIAL SIZES

Name: ______________________________

The theoretical probability of a sum of 7 is $\frac{1}{6} \approx 16.7\%$.

Number of trials	Occurrences of sum 7	Relative frequency	Distance from 16.7%
100	12		
500	78		
1,000	169		

1. Calculate each relative frequency as a percentage.

2. Calculate the absolute distance from 16.7% in percentage points.

3. Which result is closest to the theoretical probability? Does more trials guarantee an exact result?

4. Write a conclusion about trial size and relative-frequency stability.

TWO-DICE SIMULATION — COMPARE TRIAL SIZES

Name: ANSWERS

The theoretical probability of a sum of 7 is $\frac{1}{6} \approx 16.7\%$.

Number of trials	Occurrences of sum 7	Relative frequency	Distance from 16.7%
100	12	12%	4.7 percentage points
500	78	15.6%	1.1 percentage points
1,000	169	16.9%	0.[illegible]rcen[illegible]e points

1. Calculate each relative frequency as a percentage.

   12 ÷ 100 = 12%; 78 ÷ 500 = 15.6%; 169 ÷ 1,0[illegible] 16.9[illegible]

2. Calculate the absolute d[illegible]nce f[illegible] 16.7% in [illegible]rcentage points.

   Distances: 4.[illegible]nd [illegible] perc[illegible]age points.

3. Wh[illegible]sult is closest to the theoretical probability? Does more trials guarantee an exact result?

   The 1,[illegible]0-trial result is closest. More trials do not guarantee an exact result.

4. Write a conclusion about trial size and relative-frequency stability.

   As trial size increases, relative frequencies generally become more stable and closer to the theoretical probability.

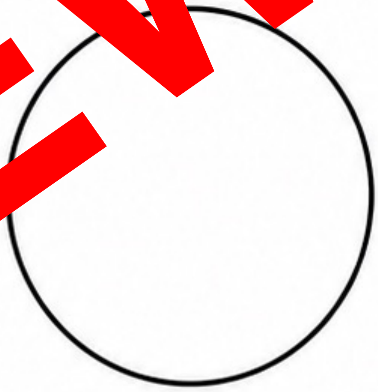
PROBABILITY REASONING CHALLENGE

Name: ______________________________

1. If P(red) = 0.32, find P(not red). Explain the complement rule.

2. Which is greater: $\frac{5}{8}$ or 0.6? Show both as decimals or percentages.

3. Design a spinner with an exact 45% chance of winning.
State the number of equal sectors and winning sectors.



4. A model gives three outcome probabilities: 0.25, 0.40 and 0.45.
Explain why the model is impossible.

5. A fair die has rolled six four times in a row.
A player says, 'Six cannot happen next.' Critique the claim.

6. A spinner designer claims P(red) = 0.30.
Plan a digital simulation that could test the claim.
Include a sensible trial count, what to record and how to compare results.

PROBABILITY REASONING CHALLENGE

Name: ANSWERS

1. If P(red) = 0.32, find P(not red). Explain the complement rule.

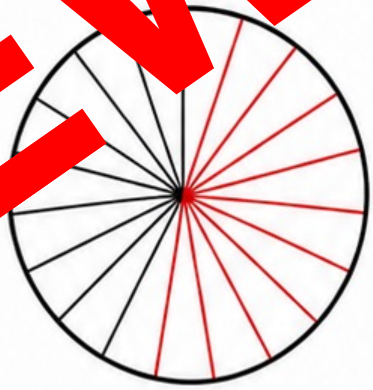
   P(not red) = 1 – 0.32 = 0.68. Complementary probabilities total 1.

2. Which is greater: $\frac{5}{8}$ or 0.6? Show both as decimals or percentages.

   $\frac{5}{8}$ = 0.625 = 62.5%, which is greater than 0.6 = 60%.

3. Design a spinner with an exact 45% chance of winning.
   State the number of equal sectors and winning sectors.

   Example: 20 equal sectors with 9 winning sectors; $\frac{9}{20}$ = 45%



4. A model gives three outcome probabilities: 0.25, 0.40 and 0.45.
   Explain why the model is impossible.

   0.25 + 0.40 + 0.45 = 1.10. A complete model must total 1.

5. A fair die has rolled six four times in a row.
   A player says, 'Six cannot happen next.' Critique the claim.

   The claim is false. Rolls are independent, so P(six) is still $\frac{1}{6}$.

6. A spinner designer claims P(red) = 0.30.
   Plan a digital simulation that could test the claim.
   Include a sensible trial count, what to record and how to compare results.

   Example: run 1,000 spins, record the number of reds, calculate red frequency ÷ 1,000, then compare the relative frequency with 0.30. Other valid plans accepted.

CHANCE MATCH

START

- **A** Roll 7 on a fair six-sided die
- **B** [illegible] sector[illegible] out of 10 [illegible]
- **C** 1 blue counter and 7 red counters
- **D** Roll a 6 on a fair six-sided die
- **E** 1 green counter and 4 orange counters
- **F** Draw a heart from a standard deck
- **G** 3 red sectors out of 10 equal sectors
- **H** Roll above 4 on a fair six-sided die
- **I** 2 blue counters and 3 red counters
- **J** 9 winning sectors out of 20 equal sectors
- **K** Toss heads on a fair coin
- **L** [illegible]nning w[illegible] 9 of 20 [illegible]rs
- **M** 3 blue counters and 2 red counters
- **N** Roll below 5 on a fair six-sided die
- **O** 7 red sectors and 3 yellow sectors
- **P** 3 red sectors and 1 blue sector
- **Q** 4 green counters and 1 orange counter
- **R** Do not roll a 6 on a fair die
- **S** 7 blue counters and 1 red counter
- **T** Roll a number from 1 to 6 on a fair die

1 $0 = 0\%$	**2** $\frac{1}{10} = 0.1 =$ 1[illegible]	[illegible] $\frac{1}{8} =$ [illegible]5 = 12.5%	**4** $\frac{1}{6} \approx 0.167 \approx 16.7\%$	**5** $\frac{1}{5} = 0.2 = 20\%$
6 $\frac{1}{4} = 0.25 = 25\%$	**7** $\frac{3}{10} = 0.3 = 30\%$	**8** $\frac{1}{3} \approx$ 0[illegible] ≈ 33.3%	**9** $\frac{2}{5} = 0.4 = 40\%$	**10** $\frac{9}{20} = 0.45 = 45\%$
11 $\frac{1}{2} = 0.5 = 50\%$	**12** $\frac{11}{20} = 0.55 = 55\%$	**1**[illegible] $\frac{3}{5} = 0.6 =$ 6[illegible]	**1**[illegible] $\frac{2}{3} \approx$ 0.[illegible]67 ≈ 66.7%	**15** $\frac{7}{10} = 0.7 = 70\%$
16 $\frac{3}{4} = 0.75 = 75\%$	**17** $\frac{4}{5} = 0.8 = 80\%$	**18** $\frac{5}{6} \approx 0.833 \approx$ 83[illegible]	[illegible] $\frac{7}{8} =$ [illegible]75 = 87.5[illegible]	**20** $1 = 100\%$

FINISH

CHANCE MATCH — CARDS & RULES

$0 = 0\%$	$\frac{1}{10} = 0.1 =$ [illegible]%	$\frac{1}{8} = 0.125 = 12.5\%$	$\frac{1}{6} \approx 0.167 \approx 16.7\%$	$\frac{1}{5} = 0.2 = 20\%$
$\frac{1}{4} = 0.25 = 25\%$	$\frac{3}{10} = 0.3 = 30$[illegible]	[illegible]$333 \approx 33.3\%$	$\frac{2}{5} = 0.4 = 40\%$	$\frac{9}{20} = 0.45 = 45\%$
$\frac{1}{2} = 0.5 = 50\%$	$\frac{11}{20} = 0.55 = 55\%$	[illegible]$= 0$[illegible]$= 60\%$	$\frac{2}{3} \approx 0.667 \approx 66.7\%$	$\frac{7}{10} = 0.7 = 70\%$
$\frac{3}{4} = 0.75 = 75\%$	$\frac{4}{5} = 0.8 = 80\%$	$\frac{5}{6} \approx 0.83$[illegible]83.3[illegible]	[illegible]$= 0.875 = 87.5\%$	$1 = 100\%$

2–4 players. Cut out and shuffle the cards. On your turn, draw o[illegible] card an[illegible]nd the matching event on the board. If correct, move to that event. First to [illegible]ISH[illegible]s.

TEACHER CHECK — CUT OFF BEFORE [illegible]

A–1, B–2, C–3, D–4, E–5, F–6, G–7, H–8, I–9, J–10, K–11, L–12, M–13, N–14, O–15, P–16, Q–17, R–18, S–19, T–20.

PROBABILITY INVESTIGATION STATIONS

1. Form a team and start at your assigned station.
2. Roll a fair die until you get 1–[illegible], then solve that numbered question card. Your teacher may assign a card instead.
3. Record one agreed answer on the score sheet.
4. Check with your teacher, then spin for your score.
5. Rotate when the signal sounds.

Materials:
station cards, score sheet, cards, dice, coins, counters, pencil and digital tool.

SCORE SPINNER

PROBABILITY STATIONS SCORE SHEET

Team: ____________________ Players: ________________________________

Record one agreed answer at each station. Ask your teacher to check it before spinning.

	Agreed answer	Teacher check	Spin score
Station 1			
Station 2			
Station 3			
Station 4			
Station 5			
TOTAL SCORE			

EXTENSION: Predict the most common and least common sums when two four-sided dice are rolled. Explain.

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STATION 1 — PLAYING CARDS

REFERENCE | STANDARD DECK: 52 cards • 4 suits • 13 cards per suit • 26 red • 26 black

♥ ♦ ♣ ♠

1 What is P(heart)?
Give a fraction, decimal and percentage.

2 What is P(black jack)?
Give a simplified fraction.

3 What is P(red card)?
Explain why it is an even chance.

4 How many queens are expected in 26 card draws with replacement?
Show the calculation.

Record one agreed answer on your score sheet.

STATION 2 – DICE DATA

A fair six-sided die was rolled 120 times.

Face	1	2	3	4	5	6
Frequency	18	24	[illegible]	20	22	20

✓ Total: 120

1. What frequency was expected for each face?

2. Which face was most over-represented? By how many?

3. Which face was most under-represented? By how many?

4. How many of each face are expected in 300 rolls?

Record one agreed answer on your score sheet.

STATION 3 – COIN TOSSES

HEADS

Equally likely

TAILS

Equally likely

A fair coin has two equally likely outcomes. Each new toss is independent.

1. Is a run of 10 heads possible? Explain.

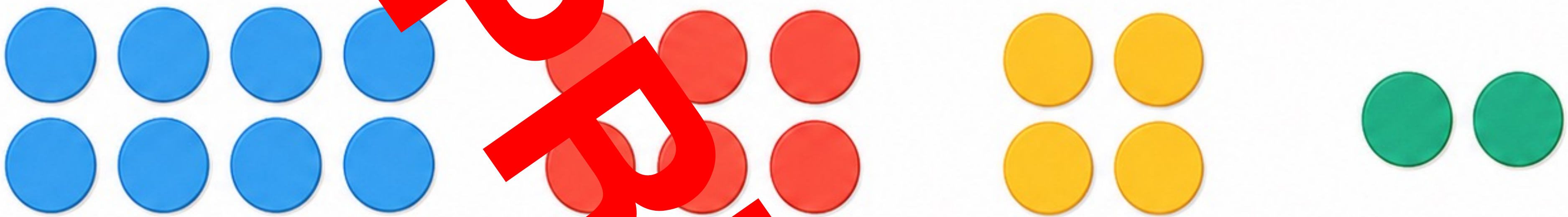
2. After one head, what is P(heads) on the next toss?

3. After three tails, what is P(heads) on the next toss? Explain.

4. How many tails are expected in 1,000 tosses?

Record one agreed answer on your score sheet.

STATION 4 — MYSTERY BAG



8 blue | 6 [illegible] | 4 yellow | 2 green

20 counters: 8 blu[illegible] • 6 [illegible]ed • 4 yellow • 2 green

1

What is P(blue)? Give a fraction, decimal and percentage.

2

Which is more likely: red or yellow? By how much?

3

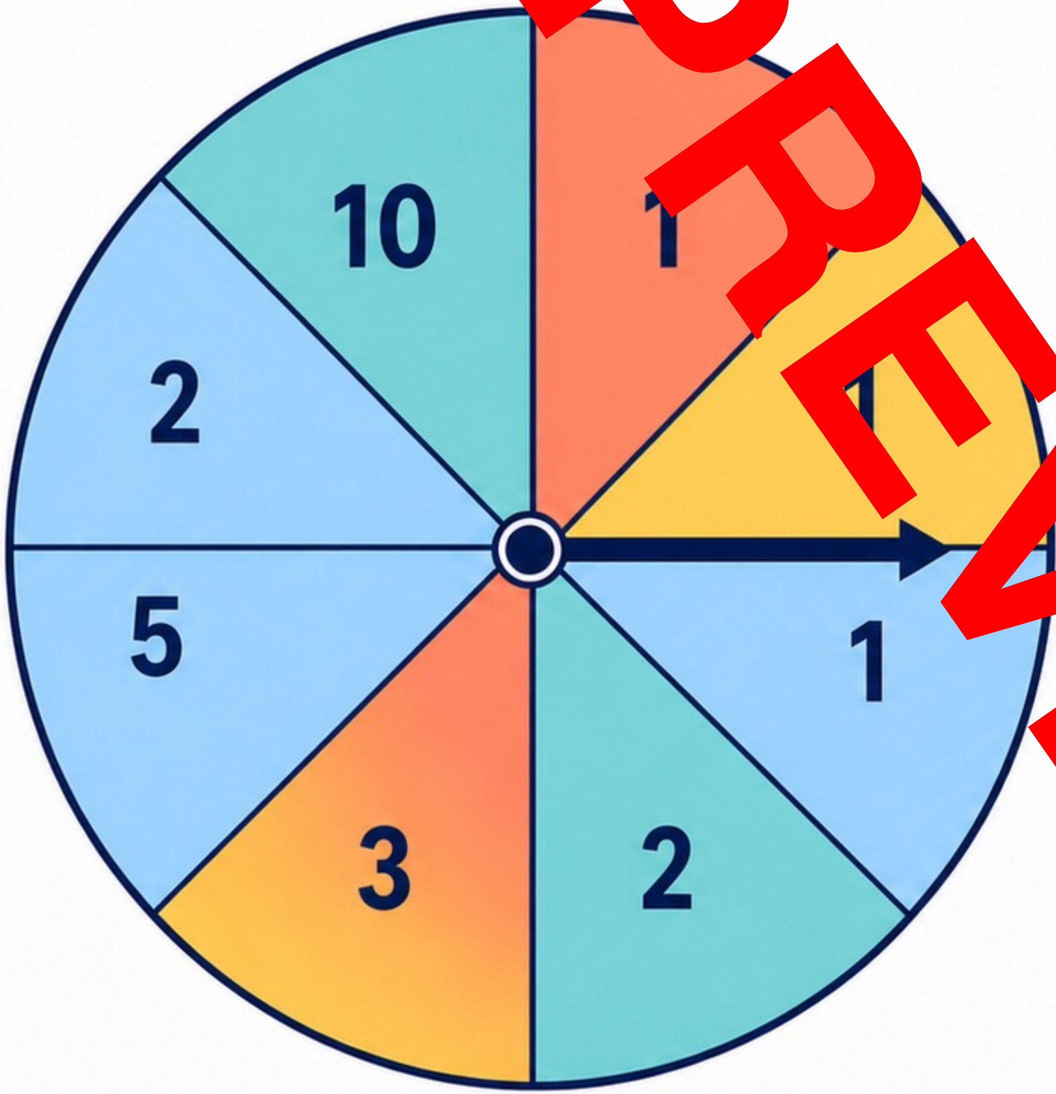
A[illegible] 6 re[illegible] [illegible]unters [illegible] removed[illegible] P(bl[illegible]

4

With replacement, how many greens are expected in 100 draws?

Record one agreed answer on your score sheet.

STATION 5 – WEIGHTED RANDOMISER



1. What is P(score 1)?
   Give a fraction and percentage.

2. What is P(score 5)?
   Is this unlikely, even chance or likely?

3. What is P(score 10)?
   Compare it with P(score 2).

4. In 10 spins, how often is each score expected? What is the maximum total for five turns?

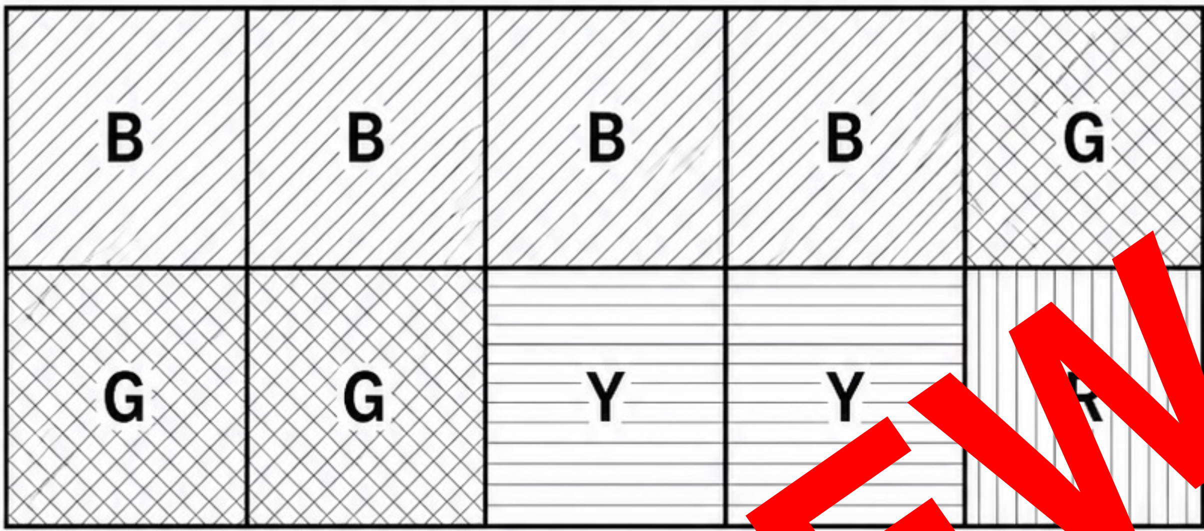
Record one agreed answer on your score sheet.

FAIRGROUND CHANCE ASSESSMENT — PART 1

Name: ______________________________

A prize wheel has 10 equal sectors: 4 blue, 3 green, 2 yellow and 1 red.

10 EQUAL PRIZE-WHEEL SECTORS



B = blue • G = green • Y = yellow • R = red

1. Complete the table.

	Fraction	Decimal	Percentage
Blue			
Green			
Yellow			
Red			

2. Order the four colours from least likely to most likely.

____

3. Calculate the expected number of each colour in 200 spins.

	Expected in 200
Blue	
Green	
Yellow	
Red	

Show your calculations.

____

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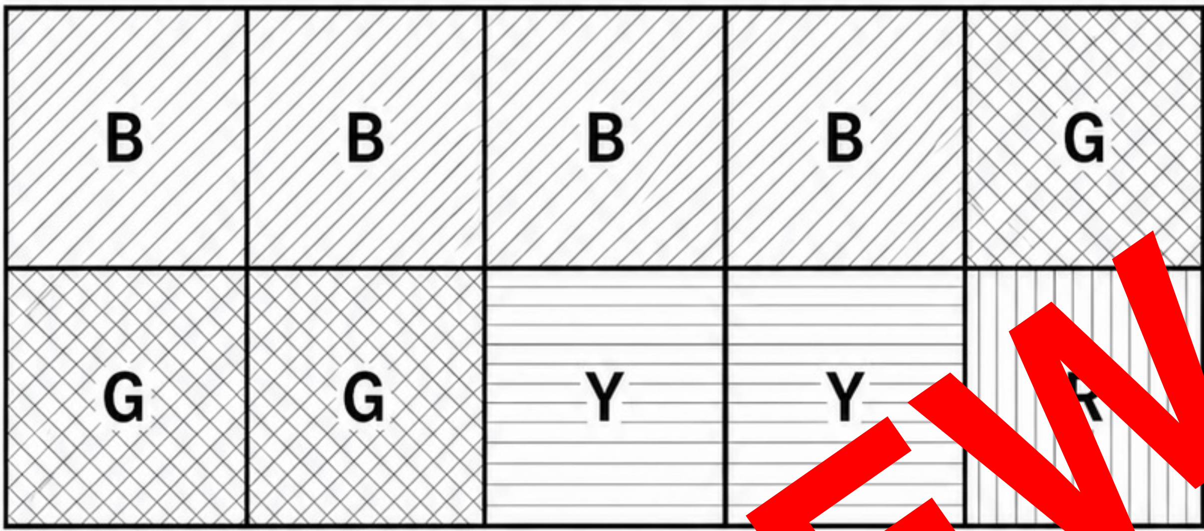
FAIRGROUND CHANCE ASSESSMENT — PART 1

Name: ANSWERS

A prize wheel has 10 equal sectors: 4 blue, 3 green, 2 yellow and 1 red.

10 EQUAL PRIZE-WHEEL SECTORS



B = blue • G = green • Y = yellow • R = red

1. Complete the table.

	Fraction	Decimal	Percentage
Blue	2/5	0.4	40%
Green	3/10	0.3	30%
Yellow	1/5	0.2	20%
Red	1/10	0.1	10%

2. Order the four colours from least likely to most likely.

Red, Yellow, Green, Blue.

3. Calculate the expected number of each colour in 200 spins.

	Expected in 200
Blue	80
Green	60
Yellow	40
Red	20

Show your calculations.

200 × 2/5 = 80

200 × 3/10 = 60

200 × 1/5 = 40

200 × 1/10 = 20

FAIRGROUND CHANCE ASSESSMENT – PART 2

Name: ______________________________

The theoretical probabilities are blue 40%, green 30%, yellow 20% and red 10%.

Colour	Observed in 50 spins	Relative frequency	Observed in 500 spins	Relative frequency
Blue	21		198	
Green	13		151	
Yellow	11		99	
Red	5		52	

1. Calculate every relative frequency as a percentage.

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2. Compare the 50-spin results with the theoretical probabilities.

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3. Compare the 500-spin results with the theoretical probabilities.

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4. Which trial size produced the more stable set of relative frequencies? Use evidence.

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FAIRGROUND CHANCE ASSESSMENT – PART 2

Name: ANSWERS

The theoretical probabilities are blue 40%, green 30%, yellow 20% and red 10%.

Colour	Observed in 50 spins	Relative frequency	Observed in 500 spins	Relative frequency
Blue	21	42%	198	39.6%
Green	13	26%	151	30.2%
Yellow	11	22%	99	[illegible]9.8%
Red	5	10%	52	[illegible]4%

1. Calculate every relative frequency as a percentage.

   50 spins: 42%, 26%, 22%, 10%. 500 spins: 39.6% [illegible].2%, [illegible]8%, 10[illegible]

2. Compare the 50-spin resu[illegible]th the theoretica[illegible]abilities.

   Compared with th[illegible] the [illegible]pin diff[illegible]ences are +2, −4, +2 and 0 percentage points.

3. Comp[illegible] the 500-spin results with the theoretical probabilities.

   The 500-spin differences are −0.4, +0.2, −0.2 and +0.4 percentage points.

4. Which trial size produced the more stable set of relative frequencies? Use evidence.

   The 500-spin set is more stable: every result is within 0.4 percentage points of theory, compared with up to 4 points for 50 spins.

FAIRGROUND CHANCE ASSESSMENT – PART 3

Name: ______________________________

Prize-wheel probabilities: blue 40%, green 30%, yellow 20%, red 10%.

1. Plan a 1,000-spin digital simulation of the prize wheel. State the tool, what data to record and how to calculate relative frequencies.

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2. A player says, 'After five reds in a row, blue is guaranteed next.' Evaluate the claim using probability and independence.

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3. Explain why increasing the number of spins usually makes relative frequencies more stable, but does not guarantee exact theoretical results.

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4. Write an evidence-based conclusion that compares theoretical probability, expected frequency and observed results for this prize wheel.

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FAIRGROUND CHANCE ASSESSMENT – PART 3

Name: ANSWERS

Prize-wheel probabilities: blue 40%, green 30%, yellow 20%, red 10%.

1. Plan a 1,000-spin digital simulation of the prize wheel. State the tool, what data to record and how to calculate relative frequencies.

Use a digital spinner with probabilities 40%, 30%, 20% and 10%. Run 1,000 spins; record each colour's count; calculate count ÷ 1,000; then compare each relative frequency with theory.

2. A player says, 'After five reds in a row, blue is guaranteed next.' Evaluate the claim using probability and independence.

The claim is false. Spins are independent. After any sequence, P(blue) remains 40%, so blue is likely but not guaranteed.

3. Explain why increasing the number of spins usually makes relative frequencies more stable, but does not guarantee exact theoretical results.

More spins reduce the influence of random variation on the overall proportion, so relative frequencies usually become more stable. Chance can still prevent an exact match.

4. Write an evidence-based conclusion that compares theoretical probability, expected frequency and observed results for this prize wheel.

Theory predicts 400 blue, 300 green, 200 yellow and 100 red in 1,000 spins. Observed counts may differ, but relative frequencies from many spins should usually be close to 40%, 30%, 20% and 10%.

PROBABILITY — YEAR 6 RUBRIC

Name: ________________ Class: __________ Date: __________

CRITERIA	BEGINNING	DEVELOPING	ACHIEVING	CONFIDENT	EXCEEDING
Represent probability	Identifies simple chance words.	Sh[illegible]ome [illegible]ctions [illegible] deci[illegible]ls.	Uses equivalent fractions, decimals and percentages.	Converts forms accurately and explains links.	Chooses efficient forms and justifies comparisons.
Calculate expected frequency	Needs support to connect chance and count.	Calcu[illegible]tes fa[illegible] example[illegible] guidance.	Calculates expected [illegible]equencies ac[illegible]urately.	Solves multi-step expected-frequency problems.	Generalises and verifies efficient calculations.
Conduct and record simulations	Records incomplete trial data.	Runs trials wi[illegible] some accurate recording.	[illegible]onducts fair trials and re[illegible]ds [illegible]urately.	Uses digital tools and relative frequencies accurately.	Designs robust simulations and checks data quality.
Compare observed with expected	States results without comparison.	Notices simple similarities or differences.	Co[illegible]es observed [illegible] expect[illegible] result[illegible]	Uses numerical evidence to compare results.	Evaluates patterns across different trial sizes.
Explain variation	Recognises results can differ.	Links differences to chance.	Expla[illegible] rand[illegible] variatio[illegible] finite trials.	Explains why larger samples are m[illegible]e stable.	Qualifies conclusions without claiming guarantees.
Explain independence	May rely on previous outcomes.	Recognises some events reset.	Explains that trials are independent.	[illegible]ejects gambler's-fal[illegible]asoning with probability.	Applies independence accurately in unfamiliar contexts.

Overall achievement: ________________ Teacher comment: ________________

Probability

What will we learn?

Represent probability as a fraction, decimal and percentage.

Calculate expected frequency.

Run repeated trials and record relative frequency.

Explain why observed and expected results can differ.

Probability measures likelihood

Probability measures range from 0 to 1.

0 = impossible = 0%

1 = certain = 100%

Every probability belongs somewhere between.

Chance language on the scale

0 — impossible

about 0.25 — unlikely

0.5 — even chance

about 0.75 — likely

1 — certain

One probability, three forms

1/4 = 0.25 = 25

3/5 = 0[illegible] = [illegible]0%

3/4 = 0.75 = 75%

he[illegible] c[illegible]ng[illegible], but the chance stays the same.

Build a sample space

Fair die: P(roll above 4)

Favourable outcomes: 5 and 6 → 2 outcomes

Total equally likely outcomes: 6

P = 2/6 = 1/3 ≈ 0.333 ≈ 33.3%

Complements make a whole

An event and its complement cover every outcome.

P(event) + P(no event) = 1

Example: P(rain) = 35%

P(no rain) = 65%

Expected frequency

expected frequency = probability × number of trials

It predicts a count before an experiment.

It is an expectation, not a guarantee.

120 fair die rolls

For any face of a fair die

p(face) = 1/6

120 × 1/6 = 20

We expect each face about 20 times, not exactly 20.

Relative frequency

relative frequency = observed frequency ÷ total trials

Example: 13 heads in 40 tosses

13 ÷ 40 = 0.325 = 32.5%

Expected and observed

Fair-coin theory: 50% heads

Observed: 13 heads in 40 tosses = 32.5%

Difference: 17.5 percentage points

Chance variation explains the gap.

Variation in small samples

Small samples can look uneven.

A fair process may still produce streaks or clusters.

Variation does not automatically mean the process is unfair.

More trials, more stability

As trials increase, random fluctuations have less influence on the overall proportion.

Relative frequency usually becomes more stable and tends to move closer to theory.

Independence and streaks

Five tails in a row does not make heads 'due'.

For a fair coin, each toss is independent.

p(heads on the next toss) = 1/2 = 50%.

Two-dice sums

Two dice have 36 ordered outcomes.

Sum 7: 6 combinations

Sum 2: 1 combination

Sum 12: 1 combination

Therefore, 7 is more likely than 2 or 12.

Digital simulations

A digital spinner or dice simulator can run hundreds of trials quickly.

Record every outcome count.

Divide by the total trials to find relative frequency.

Compare trial sizes

Suppose sum 7 occurs

12/1[illegible]0 = [illegible]2%

[illegible]/500 = [illegible]6%

[illegible]16[illegible],000 = 16.9%

The[illegible]ry [illegible]6.7%[illegible] the larger samples are more stable here.

Plan an experiment

1. Define the sample space.
2. Calculate theoretical probabilities.
3. Choose enough trials.
4. Record outcomes accurately.
5. Compare observed and expected results.

Review your reasoning

1. Convert 3/5 to a decimal and percentage.
2. Find expected sixes in 120 die rolls.
3. Why are 50 trials usually more stable than 20?
4. After five tails, what is P(heads next)?

Well Done!

Probability Quiz

Question 1

What is P(rolling a 3 on … fa… six…ded die)?

1/…

B. 1…

C. 1/2

D. 5/6

Answer 1

B. 1/6

There is one favourable face out of six equally likely faces.

Question 2

True or false?

0.75, 3/4 and 75% represent the same probability.

Answer 2

True.

0.75 = 3/4 = 75%.

Question 3

A bag has 3 blue and [illegible] yellow counters.

Give (blue) as a fraction, decimal and percentage.

Answer 3

3/5 = 0.6 = 60%

Question 4

If $P(\text{rain}) = 35\%$, what is $P(\text{no rain})$?

A. 35%

B. 50%

C. 65%

D. 75%

Answer 4

C. 65%

100% – 35% = 65%.

Question 5

True or false?

After four tails in a row, heads is more likely on the next fair toss.

Answer 5

False

The next fair toss remains independent, so P(heads) = 1/2.

Question 6

How many sixes are expected in 120 fair die rolls?

Answer 6

$120 \times 1/6 = 20$

We expect about 20 sixes.

Question 7

Which result is closest to [illegible] e[illegible]ect[illegible] 50:50 split?

A. 8[illegible]/2T [illegible] 10

B. 5[illegible]H/49[illegible] 1,000

C. [illegible]H/6T in 20

D. 75H/25T in 100

Answer 7

B. 506H/494T in 1,000

That is 50.6% heads and 49.4% tails.

Question 8

True or false?

The probabilities of all possible outcomes in a complete chance experiment add to 1.

Answer 8

True.

A complete set of outcomes represents 100% of the chance.

Question 9

Which total is most likely with two fair six-sided dice?

A. 2

B.

C. 7

D. 12

Answer 9

C 7

Six ordered pairs make 7, more than any other total.

Question 10

Why do larger numbers of trials usually produce more stable relative frequencies?

Answer 10

Random variation has less influence on the overall proportion, so results tend to move closer to theoretical probability.

Well Done!