2.1 Probability Experiments

Student Text Pages
60–67

Suggested Timing
70 min

Tools
- 10 coloured tiles: 5 red, 5 blue
- 15 coloured tiles: 7 yellow, 5 red, 3 blue
- opaque bag or box

Related Resources
BLM 2-3 Section 2.1 Probability Experiments

Link to Prerequisite Skills

Students should complete questions 1 to 4, 8, and 10 of the Prerequisite Skills before proceeding with this section.

Warm-Up

1. Evaluate.
a) 60% of 20 **b)** $1 - \frac{1}{3}$

2. Express $\frac{6}{15}$ as a decimal and as a percent.

3. Write $\frac{15}{20}$ in lowest terms.

Warm-Up Answers

1. a) 12 **b)** $\frac{2}{3}$

2. 0.40, 40%

3. $\frac{3}{4}$

Teaching Suggestions

Warm-Up

- Write the Warm-Up questions on the board or on an overhead. Have students complete the questions independently. Then, discuss the solutions as a class.

Section Opener

- Discuss the questions. Have a pre-made spinner to simulate a 20% chance of rain. Ask students if they would still go to the concert, then spin the spinner to see if it rains. Try it for 5 (10, 15…) students and see how many times it happens (twice, 3 times…).

Investigate

- In Investigate 1, students may need assistance in creating a tally chart. Discuss why this is better than writing down numbers 1, 2, 3… while doing an experiment or survey.
- This investigation should promote discussion because many students will *expect* the number of odd and even draws to be equal—that the probability of even is $\frac{1}{2}$ or 50%. However, the actual or theoretical probability of drawing even is $\frac{4}{9}$ or 44%. The reason, which would be more appropriate to address in section 2.2, is as follows: Draw 1 tile. Assume it is red. There are now 4 red and 5 blue tiles remaining. There is a $\frac{4}{9}$ chance of drawing a second red tile to obtain an even outcome. The same would be true if blue were first drawn.
- As an alternate activity, students can roll 1 or 2 dice and look for specific outcomes (even numbers, doubles etc.). Students would likely have more prior experience with this type of experiment and the results would match what they expect.

- In Investigate 2, question 5, discuss how a bar graph differs from a histogram. Students could use spreadsheet software to draw the bar graph.
- In question 7, students should see that experimental probability does not always match the actual or theoretical probability, but that more trials will lead to a more accurate result.
- Question 8 allows students to connect to real aspects of fishing: fish are not equally dispersed in a lake; the type of fish caught often depends on the type of bait or lure; and some fish are more difficult to catch than others.

Investigate Answers (pages 60-61)

Answers may vary. Sample answers:

Investigate 1

1. 10 odds; 10 evens

2.

Evens	Odds
𝍸 |	𝍸 𝍸 |

3. In the actual results there was a slightly greater number of odd results than even results.

4. Most students had a slightly greater number of odd results than even results.

5. The combined results from question 4. Using results from many trials will make the prediction more accurate.

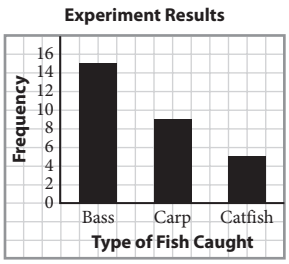
Investigate 2

3. bass $\frac{7}{15}$, carp $\frac{1}{3}$

4.

Bass	Carp	Catfish
𝍸 𝍸 |	𝍸 |	𝍸 |

5.



6. a) 15 : 9 : 5

b) It is very close to the ratio of tiles in the bag.

c) Yes, the results do give reasonable data about the ratio of tiles in the bag.

7. More trials will usually give more accurate results.

8. No. Some factors may affect the number of each type of fish caught, such as the location fisheing, the likeliness of a certain type of fish being caught, and the type of fish sought by anglers.

Examples

- As an alternate to Example 1, have students roll dice, generate their own graphs, and then use them to answer the questions. Part c) is their first introduction to the concept of the complement of an event and that probabilities add to 1. Part d) shows that experimental probability does not always agree with theoretical probability.
- For Example 2, alternate ways of generating a family of six include rolling 6 dice and counting the number of even/odd as female/male outcomes, and using the command **randInt(0,1,6)** on a graphing calculator.

Key Concepts

- Discuss why probability experiments would be used. It is possible that some probabilities are difficult or even impossible to calculate, making experimental probability the most logical way of predicting the likelihood of an event. In quality control, the probability of something not working can not be calculated, and the probability of failure can only be determined through experimental probability—in this case, testing of the products.
- Students will have prior knowledge of the formula for probability. How does this differ from what they already know? The formula for theoretical probability is similar, except for the word *trials* (experimental) instead of *outcomes* (theoretical).
- Reinforce the fact that probability is always between 0 (certain not to happen) and 1 (certain to happen). Mention the complement of an event; for example, the probability of rolling a 2 with a single die is $\frac{1}{6}$, of rolling anything but a 2 is $\frac{5}{6}$, and the sum of these is 1.

Discuss the Concepts

- Have students read the questions and record their solutions before starting a class discussion.

Discuss the Concepts Suggested Answers (page 65)

D1. No. For example, it is possible to roll a 1 six times in a row with one die, or to get heads 9 times in 10 coin tosses.

D2. One with 100 trials. The greater the number of trials, the more accurate the estimated probability.

D3. Yes, but it is not likely. It is more likely to obtain heads 5 times in 10 rolls.

Practise (A)

- Encourage students to refer to the Examples before asking for assistance.
- **In question 1, part b)**, students should recognize that there must be 35 unsuccessful trials out of 50. They can also subtract their answer to **part a)** from 1 to get $\frac{7}{10}$. This same concept is also covered in **question 3, part c)**.

Apply (B)

- **Question 5, part a)**, and **question 11** are Literacy Connects. You may wish to assign these questions as journal entries or to discuss the questions as a class. Literacy Connect questions offer the opportunity to explore literacy issues in the mathematics classroom and within the context of mathematics. In **question 5, part a)**, students should see that landing 2 heads or 2 tails is equally likely. This question is a nice lead-in to theoretical probability and drawing tree diagrams.
- **Question 7** should help students recognize that experimental probability provides an estimate of what will occur. A random sample may not reflect each batch.
- **Question 8** links to the Chapter Problem. Remind students to keep the solution to this question handy as the methods they used may help them with the Chapter Problem Wrap-Up.

Common Errors

- Some students may be inclined to rely on their prior knowledge of theoretical probability when answering questions.

R_x Remind students that experimental probability is the number of successful trials divided by the total number of trials.

Accommodations

Memory—provide a vocabulary sheet with definitions and diagrams where appropriate

Spatial—provide a handout with the charts needed for the Investigates

Perceptual—provide dice, coins, and tiles for students as they work through the exercises

Gifted and Enrichment—have students design a probability simulation using *Fathom*™ or other software

Extend (C)

- Assign the Extend questions to students who are not being challenged by the questions in Apply.
- **Question 10** should provide a more accurate estimate of the theoretical or actual probability of drawing evens. With technology, students can perform a very large number of trials with the results getting closer to 44%.

Mathematical Process Expectations

Process Expectation	Questions
Problem Solving	3, 7, 8, 10
Reasoning and Proving	5–7
Reflecting	5–7, 10, 11
Selecting Tools and Computational Strategies	1–7, 9, 10
Connecting	9
Representing	4
Communicating	3, 5–8, 11

Ongoing Assessment

- While students are working, circulate and see how well each person works. This may be an opportunity to continue observing and recording individual students' learning skills.

Extra Practice

- You may wish to use **BLM 2-3 Section 2.1 Probability Experiments** for remediation or extra practice.