

Investigation

1

Estimating With Fractions

Sometimes when you need to find an amount, you do not need an exact answer. In these situations, making a reasonable estimate of the answer is good enough. This investigation will help you develop strategies for estimating sums and differences. The sums and differences will involve fractions, as well as decimals.

1.1

Getting Close

Getting Close is a game that will sharpen your estimating skills. In *Bits and Pieces I*, you used *benchmarks* to estimate fractions and decimals. Look at this set of benchmarks.

$$0 \quad \frac{1}{4} \quad \frac{1}{2} \quad \frac{3}{4} \quad 1 \quad 1\frac{1}{4} \quad 1\frac{1}{2} \quad 1\frac{3}{4} \quad 2$$

Which benchmark is $\frac{3}{8}$ nearest? Three-eighths is less than $\frac{1}{2}$, because it is less than $\frac{4}{8}$. Three-eighths is greater than $\frac{1}{4}$, because it is greater than $\frac{2}{8}$. In fact, $\frac{3}{8}$ is exactly halfway between $\frac{1}{4}$ and $\frac{1}{2}$.

Which benchmark is 0.58 nearest? Since $\frac{1}{2}$ is equal to 0.50, 0.58 is greater than $\frac{1}{2}$. You also know that 0.58 is less than $\frac{3}{4}$ or 0.75. So 0.58 is between $\frac{1}{2}$ and $\frac{3}{4}$, but it is closer to $\frac{1}{2}$.

Getting Ready for Problem 1.1

How can you use benchmarks to help you estimate the sum of two fractions? Think about the example below.

$$\frac{1}{2} + \frac{5}{8}$$

- Is the sum between 0 and 1 or between 1 and 2?
- Is the sum closest to 0, to 1, or to 2?

When you play the Getting Close game, you will use benchmarks and other strategies to estimate the sum of two numbers.

Getting Close Rules

Two to four players can play Getting Close.

Materials

- Getting Close game cards (one set per group)
- A set of four number squares (0, 1, 2, and 3) for each player



Playing

1. All players hold their 0, 1, 2, and 3 number squares in their hand.
2. The cards are placed face-down in a pile in the center of the table.
3. One player turns over two game cards from the pile. Each player mentally estimates the sum of the numbers on the two game cards. Each player then selects from their set the number square (0, 1, 2, or 3) closest to their estimate and places it face-down on the table.
4. After each player has played a number square, the players turn their number squares over at the same time.
5. The player whose number square is closest to the actual sum gets the two game cards. If there is a tie, all players who tied get one game card. Players who have tied may take a game card from the deck if necessary.
6. Players take turns turning over the two game cards.
7. When all cards have been used, the player with the most cards wins.

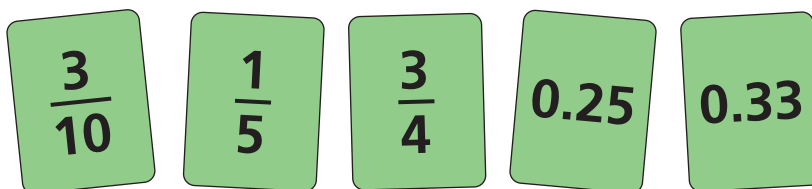
You may find benchmarks, fraction strips, number lines, diagrams, or changing a fraction to a decimal helpful in making estimates. You may discover other ways of thinking that help as well.



Problem 1.1 Using Benchmarks

Play Getting Close several times. Keep a record of the estimation strategies you find useful.

- A.**
1. Describe or illustrate one estimation strategy that you found useful in the game.
 2. For which pairs was it easy and for which pairs was it hard to estimate the sum? Why?
- B.** Suppose you played Getting Close with only these game cards:



1. What is the greatest sum possible with any two of the game cards shown?
2. What is the least sum possible with any two of the game cards shown?

ACE Homework starts on page 10.

1.2 Estimating Sums

In this problem, you will see several situations that use fractions and involve estimating sums. There are times when you should overestimate what is needed to make sure you have enough. Other times, you want to underestimate to make sure you do not take or assume too much.

Problem 1.2 Estimating Sums

- A. Elaine is making a model of a house that she designed. She wants to put wood molding around two rooms in the model. She measures and finds that she needs $3\frac{1}{4}$ feet of molding for one room and $2\frac{3}{8}$ feet of molding for the other room. She has $5\frac{1}{2}$ feet of molding.
1. Estimate whether she has enough molding.
 2. Describe your strategy for estimating the answer.
 3. Is your estimate an overestimate or an underestimate of the sum?



- B.** Elaine asks her granddaughter, Madison, to make curtains for the windows in the two model rooms. The pattern for the first room calls for a $\frac{7}{12}$ -yard strip of material. The pattern for the second room calls for a $\frac{5}{8}$ -yard strip.
1. Should Madison underestimate or overestimate the amount of material she needs? Why?
 2. She writes the following computation: $\frac{7}{12} + \frac{5}{8} = \frac{12}{20}$. Use estimation to check whether her computation is reasonable. Explain your thinking.
 3. Madison's friend, Jamar, says that he can write $\frac{7}{12} + \frac{5}{8}$ using the same denominator. He writes $\frac{14}{24} + \frac{15}{24}$ and says, "Now the answer is easy."
 - a. What do you think Jamar will give as the sum? Does his thinking make sense?
 - b. Is this an exact answer or an estimate?
- C.** Elaine makes the lace edging that is used to decorate the curtains in the model house. She needs 5 yards of lace for the curtains. She has these lengths of lace on hand:
- $1\frac{1}{3}$ yards $2\frac{5}{6}$ yards $\frac{7}{8}$ yard $\frac{5}{12}$ yard
1. Should Elaine underestimate or overestimate the amount of lace she has? Why?
 2. Use estimation to tell whether she has enough lace.
 3. Find equivalent fractions with the same denominator to represent the lengths of lace. How does this help you find the actual length of all the lace?
- D.** Estimate these sums and describe your thinking.
1. $\frac{2}{3} + \frac{1}{5}$
 2. $2\frac{1}{3} + 3\frac{2}{3}$
 3. $\frac{3}{4} + \frac{4}{3}$

ACE Homework starts on page 10.