LESSON 6.10

Improving Your Average

FREE THROWS

Alaberg High School has a girls' basketball team nicknamed "the Gals." Ms. Ball, the coach, is studying these statistics.

Mid-Season Free-Throw Data

	FT-A	Average
Bea	15-20	75%
Gale	3-18	____
Lara	____ -8	25%
Lea	5- ____	20%
Li Ann	16-24	____

FT-A means *free throws made - free throws attempted.* The average is shown as a percent, but it could be shown as a ratio or decimal. (For example, Bea's average is 15/20 or 0.75.)

1. Copy and complete the table. Who has the best record so far this season?

2. **Exploration** Bea wants to have a season record of 90%. She thinks she can make every free throw that she attempts for the rest of the season. Tell how many she would have to make in a row in order for her season average to be:

a. 80% b. 85% c. 90%
d. 95% e. 99% f. 100%

Discuss.

3. If Bea has had 20 free throw attempts and has made 15 of them, her average is 15/20. If she has x more attempts and makes all of them, her average is $\frac{15 + x}{20 + x}$.

a. What is the value of this ratio when $x = 40$? (That is, what is her average if she has 40 more attempts and makes all of them?)

b. What is her average if $x = 25$?

4. Suppose Li Ann had x free throw attempts during the rest of the season and *missed* every one.

a. What would her season average be, in terms of x? (Hint: The expression will be different from the one in problem 3.)

b. If she had a season average of 40%, how many more free throws after mid-season must she have attempted?

c. If she attempted ten more free throws, what would her season average be?

5. Suppose Li Ann *made* every attempted free throw.

a. What would her season average be, in terms of x?

b. What would her season average be if she attempted eight more free throws?

c. If she had a season average of 0.85, how many more free throws must she have attempted?

These problems are not very realistic. Usually people do not make all their attempted free throws, but they don't miss all of them either. Lea hopes that she will make about 40% of her attempted free throws for the rest of the season.

6. If Lea attempts x more free throws, and makes 40% of them, she knows that her average for the season would be

$$\frac{5 + 0.40x}{25 + x}.$$

a. Explain the meaning of the numerator and denominator of this expression, and how it was figured out.
b. How would the expression change if Lea made 60% of her remaining free throws?
c. How would the expression change if Lea made 20% of her remaining free throws?

7. Assume Lea makes 40% of her remaining free throws and wants to raise her season average to at least 30%. What is the minimum number of free throws she needs?

8. By the end of the season Gale had doubled both her attempts and her successes. What happened to her average?

9. Generalization Assume a student has made M out of T free throws. Assume she attempts x more shots and makes N of them. What will her season average be in terms of M, T, x, and N? Explain.

GRADES

Alaberg High School has a "no pass, no play" rule for all sports. Students must have an average of 65% in all their classes in order to qualify to play any sport the following quarter.

Some members of the boys' basketball team (the Bears) are worrying about their averages for algebra. (See the table.)

Their grades in algebra are based on 12 ten-point assignments per quarter. Students who have been absent because of illness (like Hal and Zal) can complete the assignments late.

Mid-Quarter Algebra Scores

	Possible points	Points earned	Average
Al	80	35	—
Hal	70	52	—
Cal	80	63	—
Zal	60	59	—
Sid	80	74	—

10. Copy and complete the table.

Use the table to answer the following questions. Assume that *passing* means having an average of 65% or better, and *failing* means having an average below 65%.

11. Who has the lowest average so far?

12. Answer the following questions for each student.
a. What is the worst conceivable average he could get by the end of the course?
b. What is the best conceivable average he could get?
c. What is the smallest number of points he needs to earn in the remaining assignments in order to pass?

REVIEW EQUATION SOLVING

Solve for the variable.

13. $\frac{y+5}{2} = \frac{19-y}{1}$

14. $\frac{y+5}{4} = \frac{19-y}{2}$

15. $2(y+5) = 19-y$

16. $4(y+5) = 2(19-y)$

17. $y+5 = 2(19-y)$

18. $\frac{-15+3x}{5+4x} = 7$

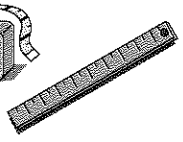
LESSON 6.11

Stuart Little and Alice

You will need:

rulers 

measuring tape 

and/or yardsticks 

STUART LITTLE

Here is the beginning of *Stuart Little,* a children's book by E.B. White.

> When Mrs. Frederick C. Little's second son arrived, everybody noticed that he was not much bigger than a mouse. The truth of the matter was, the baby looked very much like a mouse in every way. He was only about two inches high; and he had a mouse's sharp nose, a mouse's tail, a mouse's whiskers, and the pleasant, shy manner of a mouse. Before he was many days old he was not only looking like a mouse but acting like one, too — wearing a gray hat and carrying a small cane. Mr. and Mrs. Little named him Stuart, and Mr. Little made him a tiny bed out of four clothespins and a cigarette box.

1. Measure, in inches, the height of several boys in your class. To do the following exercises, choose someone whose height is near the average of the heights you measured.
2. Measure, in inches, the length and width of the average boy's
   a. pants; b. shirt or coat.
3. Measure, in inches, the length and width of:
   a. a book or binder;
   b. a chair or desk.
4. Calculate the size of each item in problems 2-3, if it were to be made for Stuart Little. Explain your work.
5. Draw each item in the size that you calculated in problem 4.

ALICE

Here is an excerpt from *Alice in Wonderland,* a book by the English mathematician Lewis Carroll.

> ...this bottle was not marked "poison," so Alice ventured to taste it, and finding it very nice, (it had, in fact, a sort of mixed flavour of cherry-tart, custard, pine-apple, roast turkey, toffy, and hot buttered toast), she very soon finished it off.
>
> * * * * *
> * * * * *
> * * * * *
>
> "What a curious feeling!" said Alice, "I must be shutting up like a telescope!"
>
> And so it was indeed: she was now only ten inches high, and her face brightened up at the thought that she was now the right size for going through the little door into that lovely garden.

6. Measure, in inches, the height of several girls in your class. To do the following exercises, choose someone whose height is near the average of the heights you measured.
7. Assuming that before she drank from the bottle, Alice was the size of the average girl in your class, how many times as tall was she after shrinking?
8. a. Measure a real pencil or pen.
   b. Calculate the correct size for a pencil or pen of the same kind for Alice. Explain.

c. Draw it in the size you calculated in part (b).

9. Measure a real door, and calculate the dimensions of "the little door into that lovely garden."

> "Curiouser and curiouser!" cried Alice (she was so much surprised, that for the moment she quite forgot how to speak good English). "Now I'm opening out like the largest telescope that ever was! Goodbye, feet!"...
>
> ...Just at this moment, her head struck against the roof of the hall: in fact she was now rather more than nine feet high...

10. How many times as tall as an average girl in your class is Alice now?

11. What would be the size of a pencil if it were the right size for giant Alice? Show your calculations.

THE BIG FRIENDLY GIANT

The following are quotations about the Big Friendly Giant, a character in Roald Dahl's book *The BFG*.

a. It was four times as tall as the tallest human.

b. It actually had to bend down to peer into the upstairs windows. That's how tall it was.

c. ...an arm as thick as a tree trunk...

d. The Giant was sprinting down the High Street... Each stride he took was as long as a tennis court.

e. In the middle of the floor there was a table twelve feet high...

f. He had truly enormous ears. Each one was as big as the wheel of a truck...

12. Project Estimate the height of the Giant using the information given in each quotation. Explain your work.

- What real-world numbers did you use?
- How did you find them?
- What calculations did you do?
- Did the results of your calculations agree with each other?
- Based on all the calculations, what is your final estimate of the Giant's height?

YOUR OWN STORY

13. Project

a. Write and illustrate a story for a young child featuring little people or giants. Make sure the dimensions of all objects are sized correctly.

b. On a separate piece of paper, explain your calculations.

OTHER STORIES

14. Project Ask a librarian or an elementary school teacher to suggest a book that involves little people or giants. Make up math problems based on the book. Use specific quotations from the book as much as possible. On a separate piece of paper, solve the problems you make up.

REVIEW *SOLVING EQUATIONS*

15. Solve the equation,

$$2.5x + 18 + 1.5x - 11 = 19.$$

16. If $x = 3$, calculate, $2.5x + 18 + 1.5x - 11$.

17. Explain how problems 15 and 16 are related.