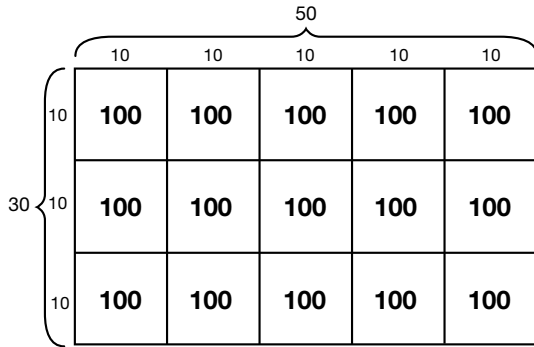


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Estimate Products (SG pp. 137–141)

Questions 1–17

- 1.* Tanya first wrote 20 as 2×10 and 30 as 3×10 . Then she wrote $20 \times 30 = 2 \times 3 \times 10 \times 10$. She changed the order of the 10 and the 3 so she could multiply more easily.
- 2.* Answers may vary. Possible response: Round 33 to 30 and 49 to 50. Using rectangle method:



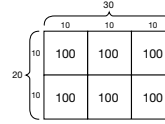
$$\begin{aligned} \text{Total} &= 5 \text{ hundreds per row} \times 3 \text{ rows} \\ &= 500 \times 3 \\ &= 1500 \end{aligned}$$

3. Answers will vary. Possible response: Round 71 to 70 and 58 to 60. $7 \times 10 \times 6 \times 10 = 4200$ or $7 \times 6 \times 10 \times 10 = 4200$
- 4.* Answers will vary. See the discussion in the Lesson.
5. A.* Answers will vary. $600 \times 30,000$ or $640 \times 30,000$ or $650 \times 30,000$
- B.* Answers will vary. $600 \times 40,000$ or $640 \times 40,000$ or $650 \times 40,000$
- C.* Between 18,000,000 and 24,000,000 dead skin cells are shed every minute if 600 is used as the convenient number for all students.

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Irma's method:

Irma drew a rectangle to show a way to multiply 20 classrooms \times 30 students.



$$\begin{aligned} \text{Total students} &= 3 \text{ hundreds in each row} \times 2 \text{ rows} \\ &= 300 \times 2 \\ &= 600 \end{aligned}$$

That means there are about 600 students in our school.

Nila and Tanya thought of two more strategies to multiply 30 students \times 20 classrooms.

Nila's method:

$$\begin{aligned} 20 \times 30 &= 20 \times 3 \text{ tens} \\ &= 60 \text{ tens} \\ &= 600 \end{aligned}$$

Tanya's method:

$$\begin{aligned} 20 \times 30 &= 2 \times 10 \times 3 \times 10 \\ &= 2 \times 3 \times 10 \times 10 \\ &= 6 \times 100 \\ &= 600 \end{aligned}$$

Tanya rewrote 20×30 into smaller factors. Then she changed the order of two factors. Mathematicians call this the **commutative property**.



1. Explain how Tanya used the commutative property. How did she change the order of the factors?
2. Use Irma's rectangle method to estimate the product of 33×49 .
3. Use any method to estimate the product of 71×58 .
4. What strategy is most efficient, Irma's, Nila's, Tanya's, or a different strategy? Explain your thinking.

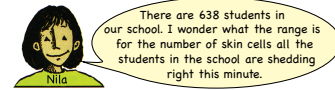
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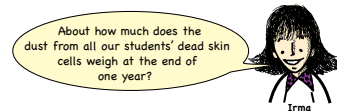
Estimating a Range of Answers

Nila, Irma, and Tanya were reading about gross things for their science project and learned that dust is made up of dead skin cells. Each person sheds about 30,000 to 40,000 dead skin cells a minute. This amount is expressed as a range. The low end of the range for the number of skin cells shed per minute is 30,000 and the high end of the range is 40,000. Any number between 30,000 and 40,000 is also a possible value for the number of dead skin cells shed in one minute.



5. A. What two convenient numbers should Nila multiply to find the low end of the range for the number of dead skin cells shed in a minute?
- B. What two convenient numbers should she multiply to find the high end of this range?
- C. What is the range for the number of dead skin cells that the students in Nila's school are shedding each minute?

Nila, Irma, and Tanya read that by the end of one year, the dust for one person weighs about 8 pounds.



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* Answers and/or discussion are included in the lesson.

Tanya estimated that the weight of the dust from the dead skin cells of all the students in one year was 5200 pounds.

6. What two convenient numbers did Tanya use to find her estimate?



5200 pounds is about the weight of a rhinoceros. Wow! That's a lot of dead skin cells!



- 7. The product 570×8450 is between _____ and _____.
- 8. The product $6250 \times 350,200$ is between _____ and _____.
- 9. There are 638 students at Bessie Coleman School and 48 schools in the district. Each school has about the same number of students. Use mental math to help Irma make a reasonable estimate for the range of dead skin cells shed every minute by all the students in their district. Write down the range.
- 10. A. Estimate how many pounds of dead skin cells all the district's students would shed in a year.
B. About how many rhinoceros would it take to equal the weight of dead skin cells for all the students in the district?

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6.* 650 and 8; Tanya used 650 for a convenient number for all students and multiplied $650 \times 8 = 5200$.

7.* Possible response: 570×8450 is between 4,000,000 and 4,800,000

8. Possible response: $6250 \times 350,200$ is between 1,800,000,000 and 2,400,000,000

9.* $600 \times 50 = 30,000$ students. $30,000 \times 30,000 = 900,000,000$ low end. $30,000 \times 40,000 = 1,200,000,000$ high end. The range is between 900,000,000 and 1,200,000,000.

10. A.* Possible response: 8 pounds \times 30,000 students = 240,000 pounds

B.* 48 rhinoceroses

11.* Possible response: Nick could use 25 as a convenient number for 26 and 5 as a convenient number for 7. $25 \times 5 = 125$ and then add 50 (2×25) for 175 liters of spit.

12.* Yes; $100 \times 20 = 2000$ will be a low estimate for 105×23 but close enough.

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Choosing Efficient Estimation Strategies

Mr. Moreno's students are doing science projects on gross things. Tanya and Nick went to the school store to buy posters and had \$40 to spend. Tanya chose a poster of stinky, smelly stuff and Nick chose a poster of slimy, gooey stuff. The posters were \$17.65 each.

They decided to estimate to see if they had enough money to buy two posters.

Nick chose \$18.00 as a convenient number. He thought, "\$18.00 is close to \$17.65 but is easier to use because I know if I double \$18.00 it is \$36. Since \$36.00 is less than \$40.00. We have enough."



I estimated that \$17.65 is about \$20.00. If I double \$20.00 it is \$40.00. Since I estimated high, the two posters are going to cost less than \$40.00.

Since Tanya and Nick had \$40 to spend, both estimates worked to predict that they had enough money to buy the posters.

Discuss



- 11. Nick's poster of slimy, gooey things shows that everyone makes 7 liters of spit per week. There are 26 students in Mr. Moreno's class. What convenient numbers can Nick use to make a reasonable estimate of how much spit the class makes in a week?
- 12. Tanya's poster of stinky, smelly stuff shows that each person burps about 105 times a week. There are 23 students in the library. Tanya estimated that these 23 students will burp about 2000 times this week. Is her estimate reasonable? Explain your thinking.

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* Answers and/or discussion are included in the lesson.

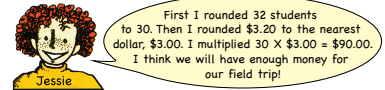
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- 13.* Nicholas is incorrect. The number should be between $3000 \times 400 = 1,200,000$ and $4000 \times 400 = 1,600,000$. 147,190 is too low.
- 14.* No, Peter needs to consider the cents, not just the dollars.
15. A. Jessie's estimate is lower than the actual cost because she rounded both the number of students and the cost of each admission down.
- B. No, Mr. Moreno's class will not have enough money. To the \$90, Jessie needs to add 2 more students which is \$6 more and 32 times 20 cents, which will amount to more than \$100.
16. 27×298 is less than 10,000 views because rounding up to convenient numbers of 30×300 is 9000.
17. A. $120 \text{ families} \times 3 \text{ bags of popcorn} = 360$ bags of popcorn
- B. $120 \text{ families} \times 6 \text{ bags of popcorn} = 720$ bags of popcorn

13. Nicholas used a calculator to solve 3590×411 and got 147,190. Without using a calculator or finding the exact answer, decide if his answer is reasonable. Explain how you decided.
14. Peter has \$20.00 to spend on some special science books. The four books he chose cost \$5.45, \$3.35, \$7.20, and \$4.25. He rounded each price to the nearest dollar and decided he would have enough money to buy all four books. Do you agree with Peter? Explain why or why not.

✓ Check-In: Questions 15-17

15. The students in Mr. Moreno's class want to take a field trip to a local science museum. They have \$100.00 to spend. The cost of admission for each person is \$3.20. There will be 32 people attending the trip. Jessie used rounding to decide if they had enough money for all 32 admissions.



- A. Is Jessie's estimate higher or lower than the actual cost for the admissions? Explain your reasoning.
- B. Will Mr. Moreno's class have enough money for all of the admissions? How did you decide?
16. Nila and Irma found that last year 298 students attended the Family Science Night and 27 students presented projects. They wondered how many total views of the science projects the students could have seen. Without finding an exact answer, decide if 27×298 is greater or less than 10,000 views. Explain your thinking.
17. Romesh wants to make sure there is enough popcorn at the Family Science Night popcorn stand. Last year 119 families attended Science Night and each family purchased between 3 and 6 bags of popcorn. He expects about the same number of families will attend this year.
- A. What is the lowest estimate for the number of bags of popcorn he will need? Explain how you estimated.
- B. What is the highest estimate for the number of bags of popcorn he will need? Explain how you estimated.

Use the *Frank's Weight in Gold* pages in the *Student Activity Book* to continue to practice multiplying by multiples of ten.

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Homework

Choose convenient numbers to help you make quick estimates for Questions 1–11. Do not use a calculator.

Planetarium Field Trip

- Mr. Moreno's class is taking a field trip to the planetarium. The cost of admission is \$4.35 per student. If 26 students attend, about how much money is needed for admission? Explain how you estimated.
- The planetarium is celebrating its 9th anniversary. The planetarium is open 357 days a year. About how many days has the planetarium been open?
- Between 2165 and 2698 people visit the planetarium every day. About how many people visit the planetarium every year? Give your answer as a range between two numbers.
- Estimate the products. Show the convenient numbers you chose.
 - $229,476 \times 27 = \underline{\hspace{2cm}}$
 - $1,029,576,123 \times 4329 = \underline{\hspace{2cm}}$
 - $11,111 \times 1111 = \underline{\hspace{2cm}}$
 - $343,217 \times 999 = \underline{\hspace{2cm}}$

Estimation with Big Numbers

- Ming says there are about 2,000,000 seconds in a week. Jackie says it is more like 600,000. Jacob says there are about 10,000 seconds. Whose estimate is the most reasonable? Show or tell how you know.
- Find two numbers whose product lies between 120,000 and 130,000.
- Find a number to multiply by 322 that will give a product between 6000 and 7000. Show or tell how you know.
- It costs \$11,234 per year to educate one student at Glen Oaks High School. There are 2743 students currently enrolled. About how much does it cost a year to educate all the high school students?

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Air Travel

- One type of large jet airplane can travel at 534 miles per hour. It can carry enough fuel for about eight hours of flight. The airplane uses 3361 gallons of fuel per hour.
 - About how many miles can the airplane travel without refueling?
 - It costs about \$7098 an hour to operate the airplane. It takes about 12 hours to fly from Los Angeles to Beijing, China. About how much does the trip cost?
 - It takes about 19 hours to fly from New York to Melbourne, Australia. About how far is it from New York to Melbourne?
 - About how much fuel does the airplane use on the 19-hour flight from New York to Melbourne?
- A large airline had a total of 85,955,000 passengers one year. If the number of passengers per year stays the same, about how many people will this airline serve in 5 years?
- Find the value of n that makes each number sentence true.
 - $n \times 40,000 = 200,000$
 - $7,400,000,000 \times n = 1,000,000,000 \times 7 + 400,000,000$
 - $225 \times 500 = 10 \times 10,000 + n$

9-11

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Estimate Products (SG pp. 142–143)

Homework Questions 1–11

Estimates will vary. One reasonable estimate is given for each.

- $\$5.00 \times 30 = \150
- $357 \times 10 = 3570$ days
- $2000 \times 350 = 700,000$ people
 $2500 \times 400 = 1,000,000$ people
- A. $200,000 \times 30 = 6,000,000$
B. $1 \text{ billion} \times 4300 = 4,300,000,000,000$
C. $10,000 \times 1000 = 10,000,000$
D. $300,000 \times 1000 = 300,000,000$
- To estimate $7 \text{ days} \times 24 \text{ hrs./day} \times 60 \text{ min/hr.} \times 60 \text{ sec/min}$: $60 \times 60 = 3600$ or about 4000. $4000 \times 25 = 100,000$. $100,000 \times 7 = 700,000$. Jackie is closest to my estimate.
- Responses will vary. Possible response: $620 \times 200 = 124,000$
- Responses will vary. Possible responses: 20; $322 \times 2 = 644$, so 322×20 is 6440.
- Possible response: $2700 \text{ students} \times \$10,000 = \$27,000,000$ for an under estimate or $3000 \text{ students} \times \$11,000 = \$33,000,000$ for an overestimate.
- A. $8 \times 500 = 4000$ miles
B. $\$7100 \times 10 = \$71,000$
C. $20 \times 500 = 10,000$ miles
D. $20 \times 3000 = 60,000$ gallons
- $90 \text{ million} \times 5 = 450 \text{ million passengers}$
- A. 5
B. 1
C. 12,500

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Student Activity Book

Frank's Weight in Gold (SAB pp. 131–132)
Questions 1–3

- 1.* Possible response: $43 \times 40,000 = \$1,720,000$ and $45 \times 40,000 = \$1,800,000$
2. A.* Frank's weight in \$10 bills is worth \$400,000.
B.* Frank's weight in gold is worth more than his weight in \$10 bills. Possible response: \$400,000 is less the \$1,720,000 which is the low range estimate for his weight in gold.
3. Possible response: Professor Peabody weighs about 90 kilograms ($90 \times 2 = 180$ lbs.). 90 kilograms is 90,000 grams; $90,000 \times \$30 = \$2,700,000$ and $90,000 \times \$40 = \$3,600,000$; the range for the worth of his weight in gold is \$ 2,700,000 to \$3,600,000.

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Name _____ Date _____

Frank's Weight in Gold

Frank helped his father clean out the garage to earn money to pay for his science experiment. When they were finished his father said, "Great job, Frank. You are worth your weight in gold!"

"That sounds like a lot of gold," said Frank. "I wonder how much that is worth," he thought aloud.

"Well, it is really just a saying," replied his father, "but we can find out."

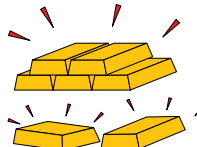
Together they looked up the current price of gold on a financial website and learned that the price of gold changes every fifteen minutes. At the beginning of the day, the price was \$42.65 per gram and by the end of the day it was \$45.40 per gram.

"The price is not exact; it is a range. We will have to estimate your worth in gold for the day," said his father.

Frank thought, "If I round the price of gold to convenient numbers that would be a range of about \$43 to \$45 dollars per gram for today. I weigh 88 pounds. I know that is like 40 kilograms, but how many grams is that?"

"There are exactly 1000 grams in one kilogram," his father replied.

"So how much is my weight in gold worth?" asked Frank.



Explore

1. Help Frank estimate the range of what his weight in gold is worth for the day. Show or tell how you solved the problem.

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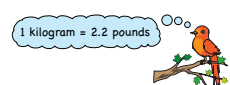
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Name _____ Date _____

2. Frank wondered if it would be a better compliment to say he is worth his weight in \$10 bills. A \$10 bill weighs approximately one gram.
 - A. What is Frank's weight in \$10 bills worth?
 - B. What is worth more: Frank's weight in gold or his weight in \$10 bills? Show or explain how you know.

✓ **Check-In: Question 3**

3. Professor Peabody weighs 180 pounds. He wants to know how much he would be worth in gold. He checked the price of gold and found that in the morning it was worth \$35.25 per gram and in the afternoon it was worth \$37.80 per gram. Use estimation to find the range for how much Professor Peabody is worth in gold. Show or tell how you found your answer.



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Name _____ Date _____

Frank's Weight in Gold Check-In: Question 3 Feedback Box Use strategies to estimate quantities (e.g., rounding, using benchmarks). Estimate products.	Expec- tation	E3	E8	Yes, but ...	No, but ...
	Check In			Yes, but ...	No, but ...
	Comments				
MP.2. Find a strategy. I choose good tools and an efficient strategy for solving the problem.					
MP.6. Show my work. I show my work and checked my answer so someone else can understand my thinking.					

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* Answers and/or discussion are included in the lesson.