

10.3.2.3: Estimation with Decimals

Learning Objectives

- Estimate the answer to a decimal problem.

Introduction

Being able to **estimate** your answer is a very useful skill. Not only will it help you decide if your answer is reasonable when doing homework problems or answering test questions, it can prove to be very helpful in everyday life. When shopping, you can estimate how much money you have spent, the tip for a restaurant bill, or the price of an item on sale. By **rounding** and then doing a quick calculation, you will at least know if you are close to the exact answer.

Estimating with Decimals

Consider this problem. Stewart wanted to buy a DVD home theater system that cost \$345.23. He also wanted a universal remote priced at \$32.90. He used a calculator to add the costs and the sum that he got was \$674.23. He was surprised!

Whether Stewart can afford to spend \$674.23 or not is not really the problem here. Rather, the problem is whether the system and remote would total \$674.23. Round both item costs to the tens place: \$345.23 is about \$350, and \$32.90 is about \$30. Is $\$350 + \30 close to \$ 674.23? Of course not!

Estimating an answer is a good skill to have. Even when using a calculator, you can get an incorrect answer by accidentally pressing a wrong button. When decimals are involved, it's very easy to put the decimal point in the wrong place, and then your numbers can be drastically wrong.

✓ Example

Hakim wrote checks for \$64.20, \$47.89, and \$95.80. Estimate the total of all three checks.

Solution

	To estimate the total, first round each of the check values. You want to round to the nearest \$10 in this example.
64.20 → 60	Since 4 < 5, round 64.20 to 60.
47.89 → 50	Since 7 > 5, round 47.89 up to 50. Since 5 = 5, round 95.80 up to 100.
95.80 → 100	
60 + 50 + 100 = 210	Add the estimates to find the estimated total.

The total estimate for the three checks is \$210.

You can use estimation to see if you have enough money for a purchase. In this case, it is best to round all the numbers up to make sure that you have enough money.

✓ Example

Sherry has \$50 and wants to buy CDs that cost \$11.50 each. About how many CDs can she buy?

Solution

11.50 → 12.00	Round \$11.50 to the nearest whole number. Since you want to make sure that Sherry has enough money, round up to 12.00 or 12.
50 ÷ 12 = 4R2	Divide 50 by 12. The amount of the remainder is not important.

Sherry can buy about 4 CDs with \$50.

You will generally estimate when you compute the amount of tip to leave when you eat at a restaurant. Recall that an easy way to compute the tip is to double the tax. You can probably do this in your head, if you estimate this product by rounding to the nearest \$1. You can round up if the service is good or round down if not.

✓ Example

After a delicious meal at a restaurant, the bill for two is \$45.36, which includes tax of \$3.74. The service was very good. How much tip would you leave if you follow the rule to double the amount of tax?

Solution

$3.74 \rightarrow 4.00$	Round up to \$4.00, or \$4, as the service was good.
$4 \cdot 2 = 8$	Multiply the rounded number by 2 to double this number.

The tip for good service would be \$8.

When using rounding in addition and subtraction problems, you usually round all numbers to the same place value—this makes adding or subtracting a bit easier. However, when you use rounding to help you multiply or divide numbers, it's usually better to round the numbers so they each have only one or two digits that are not 0. This is shown in the example below.

✓ Example

Jin is building a model ship based on a real one. Each length of the model is 0.017 times the actual length of the ship. The real ship is 132 feet long. Estimate the length of the model, then use a calculator to find the actual length of the model.

Solution

$0.017 \rightarrow 0.02$	The scale of the model is 0.017. It wouldn't make sense to round this value to a whole number or even tenths, but you can round it to hundredths. Since $7 > 5$, round up to 0.020 or just 0.02.
$132 \rightarrow 130$	You will round 132 to the tens to make it easier to work with. Since $2 < 5$, round to 130.
$130 \cdot 0.02$ $130 \cdot 2 = 260$ $130 \cdot 0.02 = 2.60$	Multiply $130 \cdot 2 = 260$. Then place the decimal point to get 2.60. Use a calculator to find the exact length. The estimate is fairly accurate!

The model length is about 2.6ft, or exactly 2.244ft.

? Exercise

Evelyn is purchasing 287 ceramic tiles for her new kitchen. Each one costs \$0.21. Which of the following is the most accurate estimate for the cost of purchasing the tiles for her kitchen?

- A. \$90
- B. \$60
- C. \$50
- D. \$40

Answer

- A. Incorrect. You may have rounded 287 to 300 and then 0.21 to 0.30, to arrive at $300 \cdot 0.30 = 90$, or \$90. This is too high; 0.21 rounds down to 0.20, not up to 0.30. The correct answer is \$60.
- B. Correct. 287 rounds to 300, and 0.21 rounds to 0.20, to arrive at $300 \cdot 0.20 = 60$ or \$60.

- C. Incorrect. You may have rounded 287 to 250 and then 0.21 to 0.20, to arrive at $250 \cdot 0.20 = 50$ or \$50. This is too low; to the tens place, 287 rounds up to 290, not down to 250. Then $290 \cdot 0.20 = \$58$ the closest answer to this is the \$60. The correct answer is \$60.
- D. Incorrect. You may have rounded 287 to 200 and then 0.21 to 0.20, to arrive at $200 \cdot 0.20 = 40$ or \$40. This is too low; to the hundreds place, 287 rounds up to 300, not down to 200. The correct answer is \$60.

Summary

Estimation is useful when you don't need an exact answer. It also lets you check to be sure an exact answer is close to being correct. Estimating with decimals works just the same as estimating with whole numbers. When rounding the values to be added, subtracted, multiplied, or divided, it helps to round to numbers that are easy to work with.

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