
High or low? Problem

1. Craig wanted to buy 3 compact discs which cost \$14.49 each. He said the total would be about \$45; his sister Janine said the total would be about \$42. Ignore taxes.
 - (a) How do you think Craig found his estimate? Is his estimate too high or too low?
 - (b) How do you think Janine found her estimate? Is her estimate too high or too low?
 - (c) Try to find a better estimate than Craig's or Janine's.
2. Donita, Jim, and Annette were thinking about the product of 218 and 93. Answer the following without calculating the actual product.
 - (a) Donita estimated by multiplying 200 by 90. Compare these numbers to the one in the actual product. Is Donita's estimate too high or too low?
 - (b) Jim estimated by multiplying 220 by 100. Is his estimate too high or too low?
 - (c) Annette first multiplied 200 by 100. She subtracted from one number and added to the other.
 - i. Which will change the product more, the addition or the subtraction?
 - ii. Is this estimate too high or too low?
 - (d) "I can't make up my mind," Annette said, so she multiplied 220 by 90. Is this new estimate too high or too low?
 - (e) Which of the four estimates is closest to the actual total? Explain your reasoning.

Hints

Hint to problem 1c: How far from the original numbers were the numbers they used for their estimates?

Hint to problem 2a: How did Donita choose the number she multiplied?

Hint to problem 2b: How did Jim choose the numbers he multiplied?

Hint to problem 2c: Consider how much the added or subtracted number would have been multiplied by, not just how much was added or subtracted.

Hint to problem 2e: Find the values for the estimates. If two estimates are low, which one is closer to the actual product?

Answers

1. (a) He multiplied 3 by \$15. His estimate is too high.
(b) She multiplied 3 by \$14. Her estimate is too low.
(c) Possible answer: \$43.50
2. (a) Too low
(b) Too high
(c) i. The subtraction
ii. Too low
(d) Too low
(e) 20,000. See the solutions for the reasoning.

Solutions

1. (a) Craig probably multiplied 3 by a number close to 14.49. Since $45 \div 3 = 15$, he probably rounded 14.49 up to 15, giving an estimate that's too high.
- (b) Since $42 \div 3 = 14$, Janine probably rounded 14.49 down to 14, giving an estimate that's too low.
- (c) The actual price, \$14.49, is about halfway between the two numbers used for estimating, 14 and 15. So the actual total is probably about halfway between their estimates, around \$43.50.

2. (a) Donita rounded both numbers down to get her factors, so her estimate will be less than the actual product.
- (b) Jim rounded both numbers up, so his estimate will be greater than the actual product.
- (c) Annette subtracted 18 from the 218 and added 7 to the 93. The subtracted 18, when multiplied by 93, is taking off close to 1,800 from the actual total. The added 7, when multiplied by the 218, would add more than 1,400 to the actual total. Annette is subtracting more than she's adding, and so her estimate is too low.
- (d) Annette added 2 to the 218 and subtracted 3 from the 93. The added 2 would add between 180 and 200 to the actual total. The subtracted 3 would take off close to 660 from the actual total. Since Annette is subtracting more than she's adding, her estimate is too low.
- (e) Jim's estimate of 22,000 was the only one that was too high, and Annette's first estimate of 20,000 was the highest of the underestimates. The closest estimate must be one of these two. To decide between them, estimate the "error" of the estimates.

By adding 2 to the 218, Jim overestimated by about 200. (The real increase is 2×93 , but 200 is close enough.) By adding 7 to the 93, he again overestimated, this time by 1,400. This makes his estimate about 1,600 too high.

Annette rounded 218 down to 200, underestimating by about 1,800. However, she also added 7 to the 93, *overestimating* by about 1,400. Overall, she missed by only about 400, so her estimate is closer.

If you have several estimates, the actual value must be between the lowest of the overestimates and the highest of the underestimates.

The actual product is 20,274, so Annette is off by less than 300. Annette got closer by rounding to the nearest 100 than she did by rounding to the nearest 10.