THE HARDEST MATH PROBLEM STUDENT CONTEST

CHALLENGE 2 ANSWER KEY

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GRADE 6

Answer: 7 minutes and 30 seconds or 7.5 minutes

Step 1: First, I want to find out how much the cookbook version of the recipe weighs so I'll add up the ingredients, converting kilograms to grams: 500 grams spinach + 250 grams apricots + 200 grams jalapeno toaster pastry + 100 grams pine nuts = 1,050 grams of delicious spinach apricot goodness.

Step 2: Now that I know the weight in grams for the recipe, I have to figure out how much will be needed to feed the studio audience. 1,050 grams feeds 6 people, but there are 63 members of the studio audience. Using proportional reasoning, I can set up the following: 1,050 grams is to 6 people as x grams is to 63 people or $1,050/6 = x/63$.
x = 11,025 grams.

Step 3: The directions indicate that 1,050 grams of ingredients will fit in a medium loaf pan but Carlita only has 175-gram pans available. 11,025 grams of ingredients divided by 175 grams per pan means Carlita needs 63 loaf pans.

Step 4: Cooking time is proportional to the amount of mixture in the dish. If 1,050 grams takes 45 minutes to cook then I can use proportional reasoning again to find how long the 175-gram loaf pans will take to cook. $175/1,050 = x/45$, so x = 7.5 minutes or 7 minutes and 30 seconds.

Step 5: If I have 63 pans and the oven holds 9, then, since 63/9 = 7, I'll need to prepare the audience samples in 7 batches. If I need 7 batches and each batch takes 7.5 minutes, then total cooking time = 7 × 7.5 = 52.5 minutes. Since the show is 60 minutes long, Carlita will finish cooking with 60 – 52.5 = 7.5 minutes to spare!

Grade 7

Answer: $69,750

Step 1: I know that Profit = Sales – Expenses, so Expenses = Sales – Profit. If 225,000 copies are each sold to retailers for $26.40, then total sales = 225,000 × $26.40 or $5,940,000. Since I know total profit will be $4,092,100, then total expenses will be sales minus profit or $5,940,000 – $4,092,100 = $1,847,900.

Step 2: I know all of the publisher's expenses except for the cost of the kelp, so I must calculate the total of the other anticipated expenses. Some of the costs depend on the number of copies sold and are variable but some are fixed, that is, they won't change no matter how many copies are sold. First, I find the variable cost of printing. Printing cost = 225,000 books × $3.75 per copy = $843,750.

Step 3: Then, I must also determine the variable cost of Carlita's author fee. To do this, I first find the rate per copy. Rate per copy sold = $48 × 6.5% = $3.12. Then, I determine the variable cost of Carlita's royalty payment, which is $3.12 × 225,000 copies sold = $702,000 (not bad!).

Step 4: Then, I add up all of the variable and fixed costs to find Total Expenses without the cost of the bookmarks = $843,750 (printing cost) + $702,000 (Carlita's royalty cost) + $27,500 (editing + design cost) + $135,150 (publicity/advertising/administrative cost) = $1,708,400.

Step 5: But I still need to figure out how much the kelp bookmarks will cost. I find the publisher's share of the cost by subtracting the costs I already know about from total costs. Cost of the kelp sheets = $1,847,900 – $1,708,400 = $139,500.

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(Grade 7 continued)

Step 6: However, $139,500 is the publisher's share of the cost of the kelp. Carlita has agreed to pay ⅓ the cost of the kelp and the publisher's ⅔ share equals $139,500. If Carlita is paying ⅓ and the publisher ⅔, then Carlita's cost is half the publisher's cost since ⅓ ÷ ⅔ = ½. Carlita's cost is ½ of the publisher's cost of $139,500 which equals $69,750 for the kelp bookmarks.

Grade 8

Answer: $52,885.70

Step 1: I know that the total cost of the book tour will equal the RV rental cost + the cooking demonstration cost + the cost of the book signing materials. So I'll start by determining the cost of the RV rental. The cost of the RV for one week is equal to the per mile charge times the number of miles, plus the weekly rental fee. I recognize that this could be graphed as a straight line and so I can use the slope/intercept formula: $y = mx + b$, where y is the total cost of the RV for the week, m is the per mile charge, x is the mileage total, and b is the weekly rental fee. I have two points to work with (880, 1310.55) and (540, 1188.15).

Step 2: To determine the slope of the line, I'll calculate the change in y values and divide by the change in x values from the two invoices in the problem. Cost for a 540 mile trip was $1,188.15 and cost for an 880 mile trip was $1,310.55. Change in y = $1,310.55 – $1,188.15 = $122.40. Change in x = 880 – 540 = 340. The slope of the line equals the change in y over the change in x = $122.40/340 = 0.36. So, the slope of the line and the mileage charge equal $0.36.

Step 3: Since $y = mx + b$ and I know that m = 0.36, I can use the coordinates of one of the points to determine the value of b, the y-intercept. If a one-week trip of 880 miles costs $1,310.55 and the mileage charge is $0.36/mile, then the total charge for mileage = $316.80. So the weekly rental charge must equal the total charge of $1,310.55 – $316.80 = $993.75.

Step 4: Now that I know the weekly charge and the mileage charge, I can calculate the cost for the rental. Carlita will have the RV for two weeks, so that part of the charge is 2 × $993.75 = $1,987.50. Then I want to determine the number of miles for the trip. Carlita will drive an average of 240 miles each trip. There will be 13 trips because she's picking up the RV in the first city and doesn't have to drive to get there. So total miles = 13 × 240 = 3,120 and total mileage charges equals 3,120 × $0.36 = $1,123.20. Total RV rental fees = $1,987.50 + $1,123.20 = $3,110.70.

Step 5: In addition to the RV rental cost of $3,110.70, there is the cost of book signing materials ($1,475) and cooking demonstrations (14 demonstrations x $3,450 = $48,300). So total costs for the tour = $3,110.70 + $1,475 + $48,300 = $52,885.70.