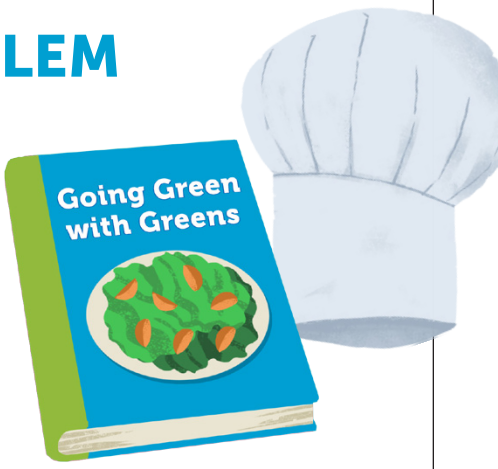
SCHOLASTIC

THE HARDEST MATH PROBLEM
STUDENT CONTEST



Celebrity chef Carlita Kahn's new environmentally responsible cookbook, *Going Green With Greens,* is expected to be a runaway best seller! Solve these problems and help Carlita and her publisher figure out some of the book launch logistics!

Helpful Hints:
Profit = Sales – Expenses
Slope/Intercept Formula: $y = mx + b$

GRADE 6

On the popular cooking show *Cookbook Crunch*, the host picks a random recipe from a cookbook and the author has to feed the 63-member studio audience in one hour! The host selects this recipe for Carlita:

Spicy Spinach and Apricots (Feeds 6)

Ingredients:
- 1/2 kilogram spinach
- 1/4 kilogram apricots
- 1/5 kilogram jalapeno pastry
- 1/10 kilogram pine nuts
- Salt, pepper, and hot sauce

Bake at 350° in a medium loaf pan for 45 minutes.

Carlita only finds a hundred small, 175-gram loaf pans. If cooking time is proportional to the amount of mixture and if the oven holds 9 of these pans at once, **how much time will be left in the show when Carlita pulls the last batch out of the oven?** (Assume the time to mix ingredients, remove a batch from the oven, and put in the next one is insignificant.)

GRADE 7

The publisher will sell Carlita's book to bookstores for $26.40 per copy. The retail price for customers to pay will be $48. Carlita expects to sell 225,000 copies. The publisher's expenses will be:

- Printing: **$3.75 per copy**
- Editing/Design: **$27,500**
- Publicity/Advertising/ Administrative: **$135,150**
- Carlita's Author Fee: **6.5%** of the suggested retail price of every book sold

Carlita suddenly announces that she wants to insert a kelp bookmark in each copy. The publisher thinks this will guarantee sales, but Carlita must agree to pay for 1/3 of the cost of the kelp. If the publisher expects the total profit on the book with the added expense to be $4,092,100, **how much should Carlita expect to pay for her share of the kelp?**

GRADE 8

Carlita will visit 14 cities in 14 days. She will have a book signing and cooking demonstration in each city, then travel overnight to the next city. The distance between each city averages 240 miles.

The publisher will rent a solar powered RV camper, with a weekly rental fee plus a per-mile charge. The rental company hasn't prepared the final estimate, but showed the publisher two recent invoices for one-week rentals. One was $1,188.15 for a 540 mile trip. The other was $1,310.55 for an 880 mile trip. Carlita will pick up the camper in the first city on the tour and leave it in the last.

The other tour costs are:
- Cooking demonstration production: **$3,450 each**
- Book signing materials: **$1,475 total**

How much should the publisher budget for total tour expenses?

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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.

(Continued on next page)

(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.