THE BIG BAKING THEORY

Making Bread

You are a purchasing agent for Bobby's Bread Bakery. You must buy the raw materials needed to make one of their biggest sellers, loaves of Bobby's Bread, which are distributed to grocery stores nationwide. You must find the best price, the right quantity, and the correct delivery date for the raw materials.

One of the most important ingredients in Bobby's Bread is flour. The bakers go through a lot of flour to meet the demand for bread. Your first assignment is to identify the best vendor, from whom to purchase the flour.

1. Bakery Wholesale sells a 50-pound bag of flour for $14.54. They have a flat shipping rate of $19.99 for standard shipping. The shipping rate is the same no matter how much flour you buy.

Write an expression to determine the price of 50-pound bags of flour and shipping costs from Bakery Wholesale. Define your variable and explain your expression.

$14.54x + 19.99$
x = number of 50-pound bags of flour

In order to get the total price, you need to multiply the number of bags, x, by the cost of one bag, $14.54, and then add the cost of shipping, $19.99. You only add $19.99 once because it is a flat shipping rate.

2. Flour World also sells 50-pound bags of flour. The company posts this expression on their website to help buyers find the cost of their order.

$$13.29x + 4.75x$$

In a sentence, describe what you think the expression means in terms of dollars, bags of flour, and shipping.

Flour World appears to charge $13.29 per bag of flour, and then $4.75 for shipping per each bag of flour.

3. Can Flour World's expression be simplified? Explain why or why not.

Yes, Flour World's expression could be $18.04x$. 18.04 is the cost of the bag and the shipping, which needs to be multiplied by the number of bags, x.

4. Flour World sells many different grades of flour, based on weight. Flour World uses the following expression to determine the grade.

$x^3 + 2$, where x is the weight in ounces of one cup of flour

One cup of flour weighs 4 ounces. What is the grade of this flour? Show your work.

$4^3 + 2$
$64 + 2$
66

Bobby has five different bakeries across the country so he can ensure his bread is delivered while it is fresh. Right now, he needs flour at all five of his bakeries.

5. One of the companies that you are considering buying flour from, Bakery Wholesale, ships from one warehouse. To show that they can deliver the flour to your bakeries in a timely manner, Bakery Wholesale provides this expression.

$$\frac{x}{300 \text{ miles/day}} + 4 \text{ days}$$

What does x represent in the expression?

In this expression, x would equal the number of miles between the bakery where the flour needs to be delivered and Bakery Wholesale's warehouse.

After you find enough flour for the bakeries, you need to make sure each bakery has enough eggs. Three providers give expressions about the cost to purchase and ship their eggs. In each expression, x represents the quantity of eggs, in dozens.

Provider	Cost to Purchase and Ship
Eggcellent Eggs	$1.5(1.50x + 1)$
Everyone's Eggs	$1.5(x + 1.50x)$
Eggs-R-Us	$1.5x + 1.5x$

6. Simplify the expressions from providers. Explain which mathematical property you used to simplify each expression.

Eggcellent Eggs: $2.25x + 1.5$, distributive property

Everyone's Eggs: $1.5x + 2.25x = 3.75x$, distributive property and properties of operations (addition of like terms)

Eggs-R-Us: $3x$, properties of operations

7. Are any of the expressions equivalent?

No, none of the expressions are equivalent.

8. A fourth company, Egg Masters, offers eggs at the rate of $2(x + 0.5x)$. Which vendor offers the same rate as Egg Masters? Use mathematical terms to explain how you found the answer.

$2x + 1x = 3x$; use the distributive property and the properties of operations (addition of like terms), and this is the same rate as Eggs-R-Us.

Price is important. But, it is equally important to make sure the egg provider can keep up with the demand at the bakery. You ask each vendor how many eggs, on average, their chickens produce. The vendors provide the following expressions, where x equals the number of days. The expressions also include the number of chickens the vendor will dedicate to Bobby's bakery.

Provider	Egg Production (x = number of days)
Eggcellent Eggs	$12(3x)$
Everyone's Eggs	$10(2.5x) + 6(x)$
Eggs-R-Us	$7(5x)$

9. Describe what each expression means in terms of days, eggs, and number of chickens.

At Eggcellent Eggs, there are 12 chickens, each of which lays an average of 3 eggs per day.

At Everyone's Eggs, there are 10 chickens, each of which lays an average of 2.5 eggs per day and 6 chickens, each of which lays an average of 1 egg per day.

At Eggs-R-Us, there are 7 chickens, each of which lays an average of 5 eggs per day.

10. You expect the provider to ship the eggs every 5 days, to guarantee freshness. Using only the chickens dedicated to Bobby's bakery, how many eggs will each provider have after 5 days? Show or explain how you found the answer.

Eggcellent Eggs: $12(3(5)) = 12(15) = 180$ eggs

Everyone's Eggs: $10(2.5(5)) + 6(5) = 125 + 30 = 155$ eggs

Eggs-R-Us: $7(5(5)) = 175$ eggs

You ask each provider to estimate of the number of eggs they can deliver over a 100-day period. Their answers are shown in the table.

Provider	Number Eggs in 100 Days
Eggcellent Eggs	3600
Everyone's Eggs	3000
Eggs-R-Us	3500

11. Based on the expressions provided in question 9, are the estimates correct? Explain why or why not.

Eggcellent Eggs: 12(3(100)) = 3600 eggs = correct

Everyone's Eggs: 10(2.5(100)) + 6(100) = 2500 + 600 = 3100 eggs = incorrect

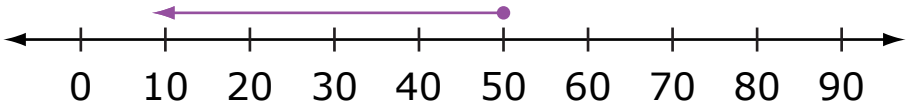
Eggs-R-Us: 7(5(100)) = 3500 eggs = correct

You finished your research, but Bobby (your boss) has some additional requirements to save money and time.

12. One company charges $7 per 25-pound bag of flour and $15 for shipping for the total purchase. Bobby wants the total bill to be less than or equal to $365. Write an inequality to represent this requirement, where x represents the number of bags of flour.

$365 \geq 7x + 15$

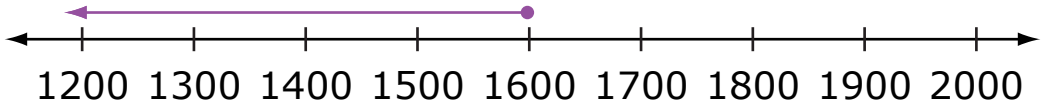
13. On the number line, show the number of bags you can purchase and meet Bobby's cost requirement.



14. Bobby wants the eggs to be extremely fresh when they arrive at the bakery. One egg company can ship the eggs 400 miles a day, plus an extra day for packing and handling. You want the eggs in less than five days. Write an inequality to show the number of miles that will meet the delivery requirements, where *x* equals the number of miles from the egg company to the bakery.

$5 > \frac{x}{400} + 1$

15. On the number line, show the number of miles over which the eggs can be delivered in fewer than five days.



16. The manager of another egg company says it takes five days to package the eggs and shipping will take *x*, based on miles traveled. When the eggs arrive at the bakery, it will take *y* days to use all of the eggs. Write an expression to show the number of days from start of packaging to the use of the last egg.

$5 + x + y$

17. It took 10 days from the start of packaging the eggs to the use of the last egg. The shipment took 3 days. How many days, *y*, were the eggs at the bakery? Write and solve an equation. Show or explain how you found the answer.

$5 + 3 + y = 10$
$8 + y = 10$
$y = 2$ days

18. You decide to use Eggcellent Eggs as the egg vendor. You were able to negotiate a new price. You will pay $2 for each dozen eggs and $5 for shipping.

a. Write an expression to show the new price, where x is dozens of eggs.

$2x + 5$

b. You purchase 50 dozen eggs for your first shipment. Evaluate the expression when $x = 50$.

New Deal: $2x + 5 = 2(50) + 5 = \$105$

19. You decide to order flour from Bakery Wholesale. The original price was $14.54 for each 50-pound bag of flour and $19.99 flat shipping per order.

Use the expression you wrote in question 1 to find the cost to purchase 30 bags of flour. Show or explain how you found the answer.

$14.54x + 19.99$
x = number of 50-pound bags of flour
$14.54(30) + 19.99$
$456.19

20. The manager at Bakery Wholesale is willing to waive the shipping charges if you pay $15.50 for each bag of flour.

a. Write an expression to show the new price, where x represents the number of bags of flour.

$15.50x$

b. You order 30 bags of flour. Evaluate the expression, when $x = 30$.

$15.50(30) = \$465$

c. Which deal costs less?

Original Deal is less expensive.

21. Bakery Wholesale's delivery truck travels 300 miles per day and it takes 4 days to process the order and pack the flour to be ready for shipment.

a. Write an equation to show this relationship. Let y equal the total number of days from the day the order is placed to the day it arrives at the bakery. Let x equal the total number of miles between Bakery Wholesale and Bobby's Bakery.

$$\frac{x}{300 \text{ miles/day}} + 4 \text{ days} = y$$

b. It takes 6 days to receive the order for flour at Bobby's Bakery. How far is Bobby's Bakery from Bakery Wholesale?

$$\frac{x}{300 \text{ miles/day}} + 4 \text{ days} = 6 \text{ days}$$

$$\frac{x}{300 \text{ miles/day}} = 2 \text{ days}$$

$x = 600$ miles maximum

22. One of Bobby's best sellers is walnut bread. One of your retailers wants to know how many walnuts are in each slice of bread.

The bread can be sliced to different thicknesses, measured in centimeters. The number of walnuts is 4 more than the thickness (in centimeters) of the slice of bread multiplied by 2.

a. Write an equation to show the number of walnuts in a slice of bread. Define your variables, making y the dependent variable and x the independent variable.

$y = 2x + 4$

x = the thickness of the bread in centimeters (independent)

y = the number of walnuts per slice (dependent)

b. Complete the table to show the number of walnuts in 5 different thicknesses of bread.

Thickness (centimeters)	Number of Walnuts
1	6
2	8
3	10
4	12
5	14

c. Graph the information from your table.