Lesson 1: Planning a Pizza Party

- Let's write expressions to estimate the cost of a pizza party.

1.1: A Main Dish and Some Side Dishes

Here are some letters and what they represent. All costs are in dollars.

- m represents the cost of a main dish.
- n represents the number of side dishes.
- s represents the cost of a side dish.
- t represents the total cost of a meal.

1. Discuss with a partner: What does each equation mean in this situation?
   a. $m = 7.50$

   b. $m = s + 4.50$

   c. $ns = 6$

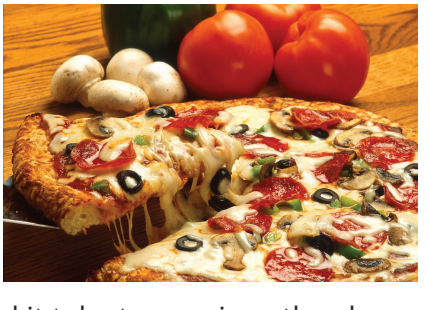
   d. $m + ns = t$

2. Write a new equation that could be true in this situation.

1.2: How Much Will It Cost?

Imagine your class is having a pizza party.

Work with your group to plan what to order and to estimate what the party would cost.



1. Record your group's plan and cost estimate. What would it take to convince the class to go with your group's plan? Be prepared to explain your reasoning.

2. Write down one or more expressions that show how your group's cost estimate was calculated.

3. a. In your expression(s), are there quantities that might change on the day of the party? Which ones?

   b. Rewrite your expression(s), replacing the quantities that might change with letters. Be sure to specify what the letters represent.

Are you ready for more?

Find a pizza place near you and ask about the diameter and cost of at least two sizes of pizza. Compare the cost per square inch of the sizes.

1.3: What are the Constraints?

A **constraint** is something that limits what is possible or reasonable in a situation.

For example, one constraint in a pizza party might be the number of slices of pizza each person could have, s. We can write $s < 4$ to say that each person gets fewer than 4 slices.

1. Look at the expressions you wrote when planning the pizza party earlier.
   a. Choose an expression that uses one or more letters.

   b. For each letter, determine what values would be reasonable. (For instance, could the value be a non-whole number? A number greater than 50? A negative number? Exactly 2?)

2. Write equations or inequalities that represent some constraints in your pizza party plan. If a quantity must be an exact value, use the $=$ symbol. If it must be greater or less than a certain value to be reasonable, use the $<$ or $>$ symbol.

Lesson 1 Summary

Expressions, equations, and inequalities are mathematical **models**. They are mathematical representations used to describe quantities and their relationships in a real-life situation. Often, what we want to describe are constraints. A **constraint** is something that limits what is possible or what is reasonable in a situation.

For example, when planning a birthday party, we might be dealing with these quantities and constraints:

quantities	constraints
• the number of guests	• 20 people maximum
• the cost of food and drinks	• \$5.50 per person
• the cost of birthday cake	• \$40 for a large cake
• the cost of entertainment	• \$15 for music and \$27 for games
• the total cost	• no more than \$180 total cost

We can use both numbers and letters to represent the quantities. For example, we can write 42 to represent the cost of entertainment, but we might use the letter n to represent the number of people at the party and the letter C for the total cost in dollars.

We can also write expressions using these numbers and letters. For instance, the expression $5.50n$ is a concise way to express the overall cost of food if it costs \$5.50 per guest and there are n guests.

Sometimes a constraint is an exact value. For instance, the cost of music is \$15. Other times, a constraint is a boundary or a limit. For instance, the total cost must be no more than \$180. Symbols such as <, >, and = can help us express these constraints.

quantities

- the number of guests
- the cost of food and drinks
- the cost of birthday cake
- the cost of entertainment
- the total cost

constraints

- $n \leq 20$
- $5.50n$
- 40
- $15 + 27$
- $C \leq 180$

Equations can show the relationship between different quantities and constraints. For example, the total cost of the party is the sum of the costs of food, cake, entertainment. We can represent this relationship with:

$$C = 5.50n + 40 + 15 + 27 \qquad \text{or} \qquad C = 5.50n + 82$$

Deciding how to use numbers and letters to represent quantities, relationships, and constraints is an important part of mathematical modeling. Making assumptions—about the cost of food per person, for example—is also important in modeling.

A model such as $C = 5.50n + 82$ can be an efficient way to make estimates or predictions. When a quantity or a constraint changes, or when we want to know something else, we can adjust the model and perform a simple calculation, instead of repeating a series of calculations.