Lesson 2-2
Equations with Variables on Both Sides

**Learning Targets:**
- Write and solve an equation to model a real-world situation.
- Interpret parts of an expression in terms of its context.

**Suggested Learning Strategies:** Close Reading, KWL Chart, Create Representations, Discussion Groups, Construct an Argument

The Future Engineers of America Club (FEA) wants to raise money for a field trip to the science museum. The club members will hold an engineering contest to raise money. They are deciding between two different contests, the Straw Bridge contest and the Card Tower contest.

The Straw Bridge contest will cost the club $5.50 per competitor plus $34.60 in extra expenses. The Card Tower contest will cost $4.25 per competitor plus $64.60 in extra expenses.

To help decide which contest to host, club members want to determine how many competitors they would need for the costs of the two contests to be the same.

1. Write an equation that sets the costs of the two contests equal:
   \[5.50c + 34.60 = 4.25c + 64.60\]

2. Solve the equation from Item 1 by using the algebraic method, showing each step. List a property of equality or provide an explanation for each step.

<table>
<thead>
<tr>
<th>Equations</th>
<th>Properties/Explanations</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.50c + 34.60 = 4.25c + 64.60</td>
<td>Original equation</td>
</tr>
<tr>
<td>5.50c + 34.60 - 4.25c = 64.60</td>
<td>Multiplication Property of Equality: Multiply each side by 100.</td>
</tr>
<tr>
<td>-34.60 = 1.25c + 30.00</td>
<td>Subs of equality (34.60)</td>
</tr>
<tr>
<td>5.50c = 4.25c + 30.00</td>
<td>Subtract equality (4.25c)</td>
</tr>
<tr>
<td>1.25c = 30.00</td>
<td>Div of equality</td>
</tr>
<tr>
<td>1.25c / 1.25 = 30.00 / 1.25</td>
<td>Solution</td>
</tr>
<tr>
<td>c = 24</td>
<td></td>
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</tbody>
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3. Model with mathematics. Interpret the meaning of the value of $x$ in the context of the problem.

$c = 24$ competitors in the contest

4. The FEA club estimates they will have more than 30 competitors in their contest. Make a recommendation to the club explaining which contest would be the better choice and why.

$SB = 5.50c + 34.60$
$CT = 4.25c + 64.60$

$= 5.50(31) + 34.60$ = 4.25(31) + 64.60

$SB = \$205.10$  $CT = \$196.35$

5. The FEA club will charge each competitor $10 to enter the engineering contest. Write an expression for the club’s revenue if $x$ competitors enter the contest.

$10c$

6. a. Write an equation to find the break-even point for the fundraiser using the context you recommended to the FEA club.

$10c = 4.25c + 64.60$

b. Solve the equation. State a property of equality or provide an explanation for each step. How many competitors does the club need to break even?

$10c = 4.25c + 64.60$

$-4.25c$ $-4.25c$

$5.75c = 64.60$

$5.75$

$c = 11.23$

at least 12 competitors to break even

7. How much profit will the FEA club earn from 32 competitors if they use the contest you recommended?

$P = R - C$

$\$200.60 - \$119.40$

$= 10c - (4.25c + 64.60)$

$\$213.35$

$= -10c - 4.25c - 64.60$

$P = -10(32) - 4.25(32) - 64.60$

$P = \$119.40$
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8. The Future Engineers of America Club treasurer was going back through the fundraising records. On Monday, the club made revenue of $140 selling contest tickets at $10 each. One person sold 8 tickets, but the other person selling that day forgot to write down how many she sold. Write and solve an equation to determine the number of tickets the other person sold.

\[10x = 4.25c + 64.60\]
\[-4.25c\]
\[5.75c = 51.05\]
\[c = 9\] tickets

Check Your Understanding

9. How can you use the Multiplication Property of Equality to rewrite the equation \[x = 4.25 \cdot 7.2\] so that the numbers in the problem are integers and not decimals?

10. When writing an expression or equation to represent a real-world situation, why is it important to be able to describe what each part of the expression or equation represents?

LESSON 2-2 PRACTICE

On-the-Go Phone Company has two monthly plans for their customers. The EZ Pay Plan costs $0.15 per minute. The 40 to Go Plan costs $40 per month plus $0.05 per minute.

11. Write an expression that represents the monthly bill for \(x\) minutes on the EZ Pay Plan.
\[0.15x\]

12. Write an expression that represents the monthly bill for \(x\) minutes on the 40 to Go Plan.
\[40+0.05x\]

13. Write an equation to represent the point at which the monthly bills for the two plans are equal.
\[0.15x = 40+0.05x\]

14. Interpret the solution of the equation within the context of the problem.

15. Construct viable arguments. Which plan should you choose if you want only 200 minutes per month? Justify your response.