TEACHER NOTES

# 10 The Great Yo-Yo Festival

**Objective**

Students will study the standard form of a linear equation, $y = mx + b$.

**Materials**

Transparency Master 10: The Great Yo-Yo Festival
Worksheet 10: The Great Yo-Yo Festival (1 page)
Homework 10: The Great Yo-Yo Festival (2 pages)
Graph paper (optional)

**Time Required**

1 class period

**Journal Prompts**

- One year at the yo-yo festival, there were 98 yo-yos. The box of spares held 14 yo-yos. How many experts might there have been, and how many main yo-yos might they have brought?
- One year there were 59 total yo-yos, 8 experts, and 15 yo-yos in the box of spares. The judge wants to investigate a potential problem. What did the judge notice?

**Assessment**

Check student graphs, T-tables, and formulas for accuracy.

**Homework**

Homework 10: The Great Yo-Yo Festival

## Extensions

The first journal prompt, and others like it, can be used as an investigation. Students could be shown how to use a T-table to find possible solutions:

| $y$ | = | $m$ | · | $x$ | + | $b$ |
|---|---|---|---|---|---|---|
| 98 | | 84 | · | 1 | + | 14 |
| 98 | | 42 | · | 2 | + | 14 |
| 98 | | 28 | · | 3 | + | 14 |
| 98 | | ? | · | 4 | + | 14 |
| 98 | | ? | · | ? | + | 14 |

## Suggested Teaching Procedure

1. Students can work individually or in groups. Display Transparency Master 10: The Great Yo-Yo Festival. Use a sheet of paper to hide the transparency. Pass out Worksheet 10 to the students.
2. Display only the first problem on the transparency and ask students to solve it. Most students will have little difficulty, and many will have become accustomed to doing multiplication before addition by this time: $y = 5 \cdot 27 + 34 = 169$. (Be aware that some students may need to be introduced to the multiplication dot symbol.)
3. Ask students what the $y$ represents in this first problem. They should see that it represents the number of "yo-yos."
4. Display the second problem. Here students will be solving for the intercept. Some will use a guess-and-check method. Ask them what guesses they took and why they chose that number. For example, if they discovered that 10 gave the result of 142, ask why they didn't try 5 next. Some will answer that they knew they needed a larger number. On the other hand, several students may choose to use a more formal approach and work backward. Let these students explain this approach to the class. It is much faster than the guess-and-check method and the class will appreciate and retain the approach better if it comes from the discovery of a peer. You should use this opportunity to translate working backward into the formal algebraic solution as follows:

**Working Backward**

| | | | |
|---|---|---|---|
| 154 | = | $6 \cdot 22 + b$ | |
| 154 | = | $132 + b$ | Find the number of yo-yos with experts. |
| – 132 | | – 132 | Take away from the total the number of yo-yos with experts. |
| 22 | = | $b$ | The number of yo-yos in the box. |

**5.** Ask students what the $b$ stands for. They should see that it represents the yo-yos in the "box." It should be stated that $b$ is the intercept or starting value. This can be made more apparent if students write the formula $y = 6x + 22$ and graph it. However, you may want to reserve graphing until after students have completed their worksheets.

**6.** Display the third problem. Again, most students will use a guess-and-check method, and in this problem, they may need to make more guesses than they did in the second problem. Students should share their strategies with the class. Be sure to include the explanations of students who used more formal strategies. Show how working backward translates into the algebraic solution:

**Working Backward**

$$\begin{aligned} 182 &= m \cdot 31 + 58 && \\ -58 &\quad\quad -58 && \text{Take away the number of yo-yos in the box.} \\ \frac{124}{31} &= \frac{m \cdot 31}{31} && \text{You know 124 yo-yos came with experts.} \\ & && \text{Divide by the number of experts.} \\ 4 &= m && \text{The number of yo-yos with each expert.} \end{aligned}$$

**7.** Ask the students what the $m$ represents. They should say it stands for "main yo-yos." It should be stated that $m$ is the slope or the number added with each expert. Again, writing the formula $y = 4x + 58$ and graphing it can help illustrate that $m$ is the slope.

**8.** Next, ask students to solve the fourth problem. Here they solve for $x$, which they should see stands for the number of "experts." Most will still use guess-and-check, but you may find that more of the students are willing to try the formal algebraic approach:

$$\begin{aligned} 214 &= 7 \cdot x + 46 && \\ -46 &\quad\quad -46 && \text{Take away the number of yo-yos in the box.} \\ \frac{168}{7} &= \frac{7 \cdot x}{7} && \text{Divide by the number of main yo-yos.} \\ 24 &= x && \text{The number of experts.} \end{aligned}$$

(This is a good time to show students why the symbol $\times$ is not used to show multiplication in algebra: $214 = 7 \times x + 46$.)

**9.** Ask students what the $x$ represents. They should say it represents the number of "experts," and they will probably ask why not use an "$e$." You can tell them either the authors couldn't spell well or that it really doesn't matter what letter you use in algebra to solve a problem. We prefer the latter explanation!

**10.** Now direct your students' attention to the fifth problem. Ask them if they can answer it. Most students will say there is not enough information, although some may realize that there is enough to construct a T-table,

graph, and formula. If students do not see this, ask them how many yo-yos there will be if only one expert comes. That is 40. What if two experts come? That would be 48. Continue in this manner until students see the pattern, then ask them to find the formula. Some students will see it without a T-table or graph, but you may ask them to construct either one or both. This is strongly suggested since the fifth problem is similar to the homework.

**11.** Lastly, ask students to translate this function into words:

$$y = m \cdot x + b$$

Let them share their responses with the class. Students should write something similar to this: "The number of total yo-yos is equal to the number of main yo-yos times the number of experts plus the spare yo-yos in the box." With algebra students, it is wise to define $y = mx + b$ as the generic slope-intercept form of a linear equation.

**12.** Assign Homework 10: The Great Yo-Yo Festival.

## Answer Key

### Homework 10: The Great Yo-Yo Festival

Questions 1–7 are based on the formula $y = 4x + 12$.

1. 40
2. 52
3. 72
4. 120
5. 8
6. 1
7. 18

Questions 8–16 are based on the formula $y = 9x + 20$.

8. 119
9. 92
10. 164
11. 1316
12. 2
13. 0
14. 10
15. 2324
16. about 109

At the annual yo-yo festival, all the yo-yo experts bring their favorite models. The festival also provides a box of spare yo-yos.

**1.** Last year, there were 34 yo-yos in the box of spares. There were 27 experts, and each one brought 5 yo-yos. How many yo-yos were there altogether?

$$y = 5 \cdot 27 + 34$$

**2.** This year, each expert brought 6 yo-yos. The number of experts attending was 22. In all, there were 154 yo-yos. How many spare yo-yos were in the box?

$$154 = 6 \cdot 22 + b$$

**3.** Two years ago, there were 182 yo-yos altogether, and 58 were in the box of spares. How many main yo-yos did each of the 31 experts bring?

$$182 = m \cdot 31 + 58$$

**4.** Three years ago, there were 214 yo-yos altogether. The box contained 46 spares. Each expert was told to bring 7 main yo-yos. How many experts attended?

$$214 = 7 \cdot x + 46$$

**5.** In the future, all experts are to bring 8 main yo-yos. The box of spares will have 32 yo-yos. How many yo-yos will there be altogether?

$$y = \_\_\_ \cdot \_\_\_ + \_\_\_$$

WORKSHEET **10**

**Name** _____

# The Great Yo-Yo Festival

At the annual yo-yo festival, all the yo-yo experts bring their favorite models. The festival also provides a box of spare yo-yos.

**1.** Last year, there were 34 yo-yos in the box of spares. There were 27 experts, and each one brought 5 yo-yos. How many yo-yos were there altogether?

$$y = 5 \cdot 27 + 34$$

**2.** This year, each expert brought 6 yo-yos. The number of experts attending was 22. In all, there were 154 yo-yos. How many spare yo-yos were in the box?

$$154 = 6 \cdot 22 + b$$

**3.** Two years ago, there were 182 yo-yos altogether, and 58 were in the box of spares. How many main yo-yos did each of the 31 experts bring?

$$182 = m \cdot 31 + 58$$

**4.** Three years ago, there were 214 yo-yos altogether. The box contained 46 spares. Each expert was told to bring 7 main yo-yos. How many experts attended?

$$214 = 7 \cdot x + 46$$

**5.** In the future, all experts are to bring 8 main yo-yos. The box of spares will have 32 yo-yos. How many yo-yos will there be altogether?

$$y = \_\_\_ \cdot \_\_\_ + \_\_\_$$

HOMEWORK **10**

**Name** _____

# The Great Yo-Yo Festival

At this year's yo-yo festival, every expert must bring 4 yo-yos. There will be 12 yo-yos in the box of spares. First complete the T-table and graph to show how many yo-yos there will be for different numbers of experts. Write a function in the form $y = mx + b$. Then use the graph and the function to answer the questions.

**1.** If 7 experts arrive, how many yo-yos will there be at the festival? _____

**2.** If 10 experts arrive, how many yo-yos will there be at the festival? _____

**3.** If 15 experts arrive, how many yo-yos will there be at the festival? _____

**4.** If 27 experts arrive, how many yo-yos will there be at the festival? _____

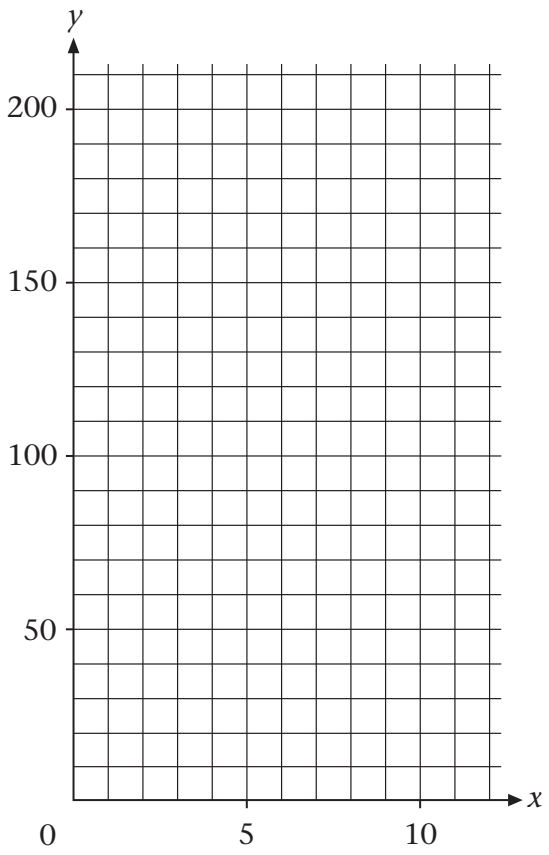
**5.** If there are 44 yo-yos at the festival, how many experts are attending? _____

**6.** If there are 16 yo-yos at the festival, how many experts are attending? _____

**7.** If there are 84 yo-yos at the festival, how many experts are attending? _____

| $x$ | $y$ |
|---|---|
| 0 | |
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| ⋮ | |
| 17 | |

Function: _____




 *The Pattern and Function Connection*

At this year's yo-yo festival, every expert must bring 9 yo-yos. There will be 20 yo-yos in the box of spares. First complete the T-table and graph, and write a function in the form $y = mx + b$. Then use the graph and function to answer the following questions.

**8.** If 11 experts arrive, how many yo-yos will there be at the festival? _____

**9.** If 8 experts arrive, how many yo-yos will there be at the festival? _____

**10.** If 16 experts arrive, how many yo-yos will there be at the festival? _____

**11.** If 144 experts arrive, how many yo-yos will there be at the festival? _____

**12.** If there are 38 yo-yos at the festival, how many experts are attending? _____

**13.** If there are 20 yo-yos at the festival, how many experts are attending? _____

**14.** If there are 110 yo-yos at the festival, how many experts are attending? _____

**15.** If 256 experts arrive, how many yo-yos will there be at the festival? _____

**16.** If there are about 1000 yo-yos at the festival, how many experts are attending? _____

| $x$ | $y$ |
|---|---|
| 0 | |
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| ⋮ | |
| 17 | |

Function: _____