



JOHN W. MAUS

# Every Story Tells a Picture

ONE OF THE MOST WONDERFUL THINGS about mathematics is that no matter how long you have been teaching, it continues to reveal itself in surprising ways and in unexpected places. One particular revelation occurred to me while reading a book by one of my favorite authors, Kurt Vonnegut, who connected mathematics to literature in a way that I had not thought of before.

Kurt Vonnegut has long been a critical voice in American literature. His ability to cause us to laugh, sometimes uncomfortably, at our own human con-

dition makes him an invaluable conscience for American culture and an esteemed writer in the American pantheon. His foray into mathematical thinking, although perhaps unintentional, inspired me to rethink my approach to introducing the art of graphing to my students.

In his autobiographical work *Palm Sunday*, Vonnegut describes a long-lost master's thesis in anthropology that was rejected "because it was so playful and looked like too much fun." This immediately appealed to me because "playful" and "fun" are important and often underused components of mathematics lessons. He goes on to describe the thesis: "stories have shapes that can be drawn on graph paper, and that the shapes of a given society's stories is at least as interesting as the shape of its pots or spearheads" (Vonnegut 1984, p. 312).

The graphs that Vonnegut describes are simple first and fourth quadrant graphs in which the  $x$ -axis is

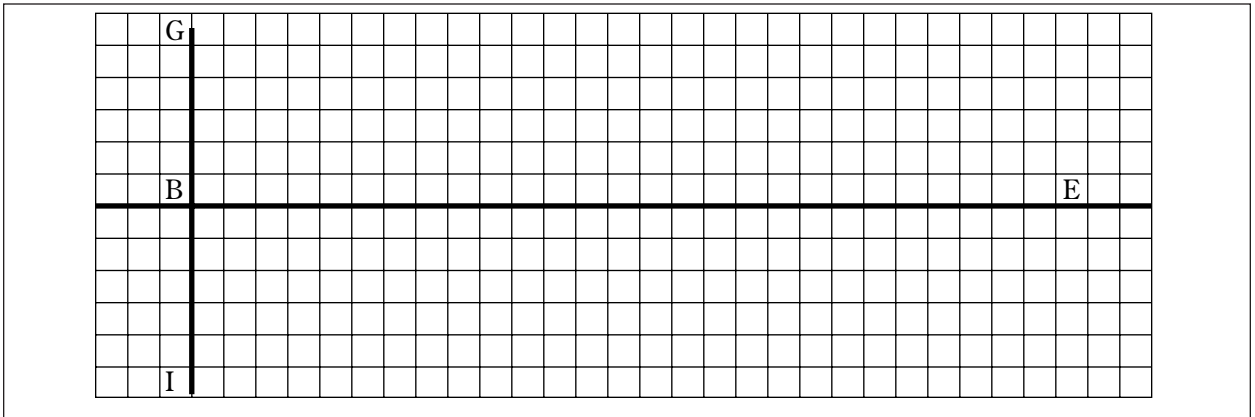


JOHN MAUS, [John\\_Maus@northshore.k12.ny.us](mailto:John_Maus@northshore.k12.ny.us), teaches seventh-grade mathematics at North Shore Middle School in Glen Head, NY 11545. He is interested in helping students bridge the gap from arithmetic to algebra through contexts that are relevant to their lives.

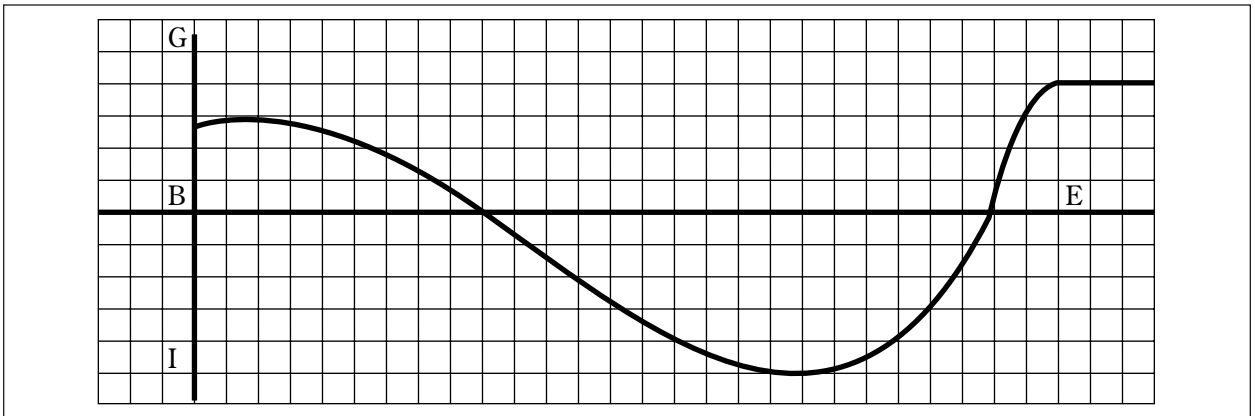
the time from the beginning (B) to the end (E) of the story, and the  $y$ -axis describes the good (G) or ill (I) fortune of a character in the story as the tale progresses. (See **fig. 1** for an illustration of such a graph.)

Vonnegut also describes an archetypal story in American literature that is “about a person who is leading a bearable life, who experiences misfortune, who overcomes misfortune, and who is happier afterward for having demonstrated resourcefulness and strength” (p. 313). (**Fig. 2** shows a graph of a life’s journey.)

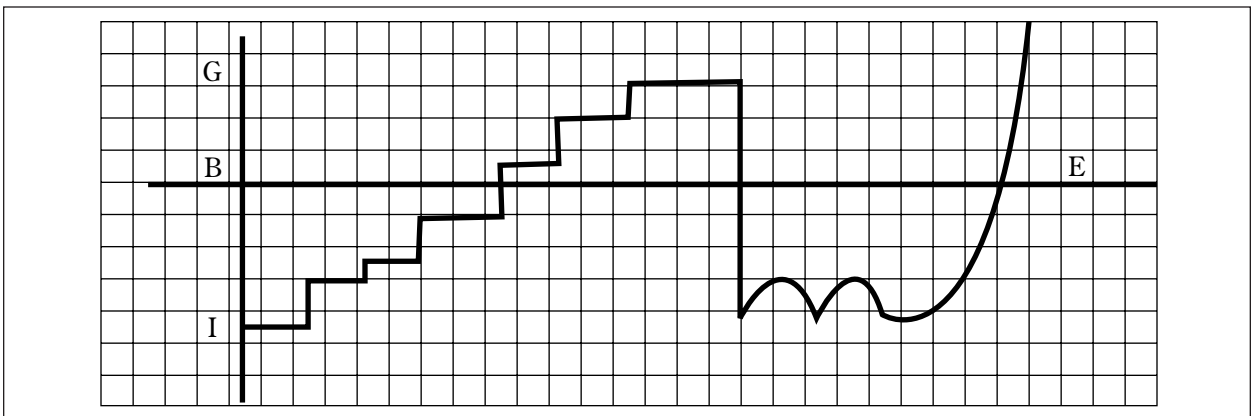
A graph tracking the life of “Cinderella” is shown in **figure 3**. The graph represents the accumulation of gifts from Cinderella’s fairy godmother that elevates her from her subservient life to the heights of glory at the ball. The vertical line occurs at 12:00 midnight in the context of the story and represents the instantaneous loss of all she had gained, and poor Cinderella is back where she started. “But then the prince finds her and marries her, and she is infinitely happy ever after. She gets all the stuff back, and then some” (p. 315).



**Fig. 1** From beginning to end, good and ill are graphed to illustrate a life that has no ups or downs.



**Fig. 2** Here a life is shown with ups and downs.



**Fig. 3** Cinderella’s tumultuous life ends on a high note.

## Every Story Tells a Picture

In an excerpt from his autobiographical work *Palm Sunday*, Kurt Vonnegut describes a process by which a story can be graphed on coordinate axes. Consider a familiar story and plot a “Good Fortune/Ill Fortune” graph for a particular character in that story.

Some points to consider:

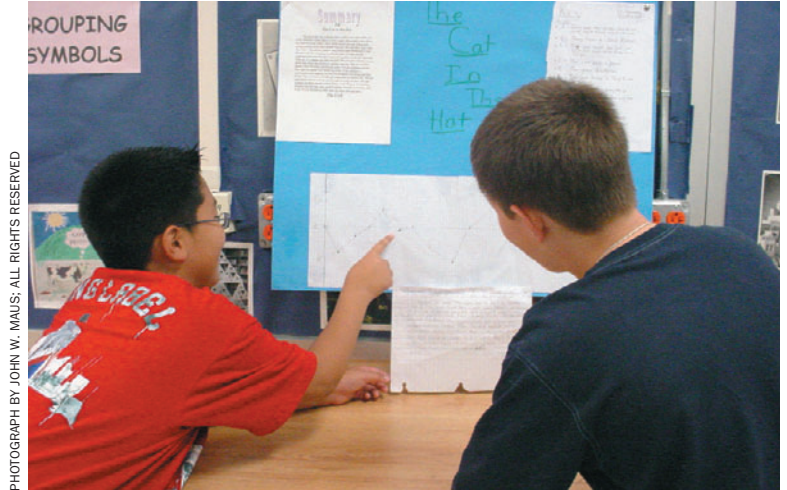
- Give the name and author if you can.
- Give a brief summary of the story.
- Clearly indicate the beginning and the end of the story on your graph.
- Clearly label the critical points of your graph, and explain why your graph changes as it does.
- What new insights into the story did this analysis of the story give you? Explain.
- Present your work in a way that clearly communicates your ideas and provides easy access to your graph.

**Fig. 4** The students’ graphing assignment

I have found that these excerpts from *Palm Sunday*, as an introduction to graphing, provide an opportunity for students to experience mathematics as an expression of Vonnegut’s social satire. The graphs in the context of the piece provide many levels of entry for a variety of students. Some students may take the graphs literally and develop a concrete understanding of their relationship to the stories they represent. Others will grasp the subtleties of the connections that Vonnegut makes and will find the humor of the graphs, given their context. In any case, the classroom discussion that ensues provides an informal assessment of where the students are in their understanding of graphing.

Part of the discussion involves an analysis of each graph in the piece. The students grapple with reasons for the starting point of the story on the  $y$ -axis, why the graph changes as it does, why it goes up or down quickly or slowly, why it goes up in steps, what does an almost vertical drop really mean, what does it mean when a graph levels off, and other aspects of graphing. Students start to encounter the concept of pacing and its connections with the slope of the graphs. Does the slope represent a drastic change or a slow change over time?

Although the graphs are not formal line graphs, the lack of a labeled scale on the axes led to some discussion about whether the  $x$ -axis represents time as measured in the usual sense using minutes, hours, or days, or time measured in lines or pages in the story. Many students felt that the lack of a scale was not problematic for stories they were familiar with; how-



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ever, when students encountered a graph to a story that they did not know, the need for a clear uniform scale became apparent. Some students questioned whether the graphs of some stories could even have a scale because they “jump through time.”

One interesting discussion involved the interpretation of a horizontal line on the graph of a story. When the students were asked to think about this interpretation, the conversation quickly turned toward a criticism of the “story”:

*Student 1:* It means the story is boring?

*Teacher:* Why?

*Student 1:* Nothing happens. If the line is high the guy is happy and stays that way, and nothing changes.

*Student 2:* Yeah. And if it’s low and flat things are bad and stay that way for the whole story. There are no ups and downs.

*Teacher:* Can you think of any stories that are flat?

*Student 3:* The beginning of *The Lord of the Rings* is like that before the party in the Shire starts. I almost gave up. It was so boring.

*Student 2:* Most stories aren’t like that, or no one would read them.

After discussing the graphs from the Vonnegut excerpt, I ask the students to write a brief description of their day, then read this account to a partner who draws a graph of the story. The students then swap roles and later discuss each other’s analyses of their days. After the student-pairs have been given an opportunity to come to an agreement and fine-tune their graphs, they are chosen to share their graphs based on their potential for generating disagreement and further discussion for the class as a whole.

After reading and discussing the piece in class, I give the students the opportunity to apply what they just experienced to familiar stories from their childhood. They are given the assignment shown in **figure 4**. I suggest to the students that they pick simple sto-

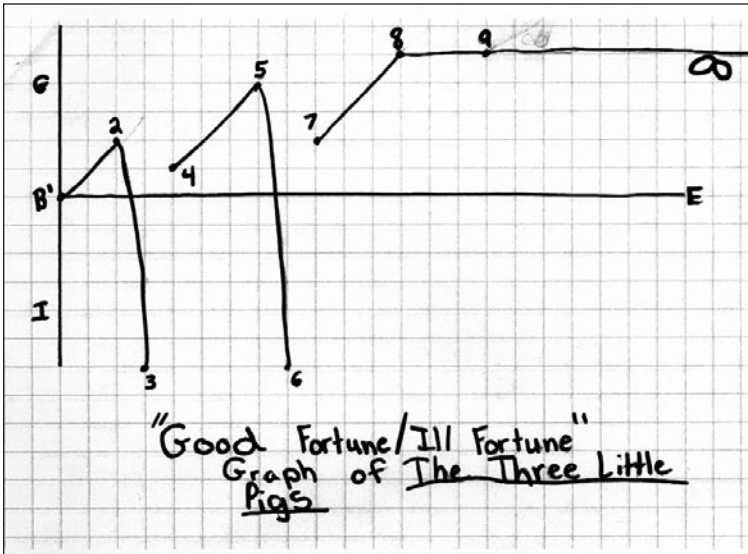


Fig. 5 The “The Three Little Pigs” story gets complicated when graphed.

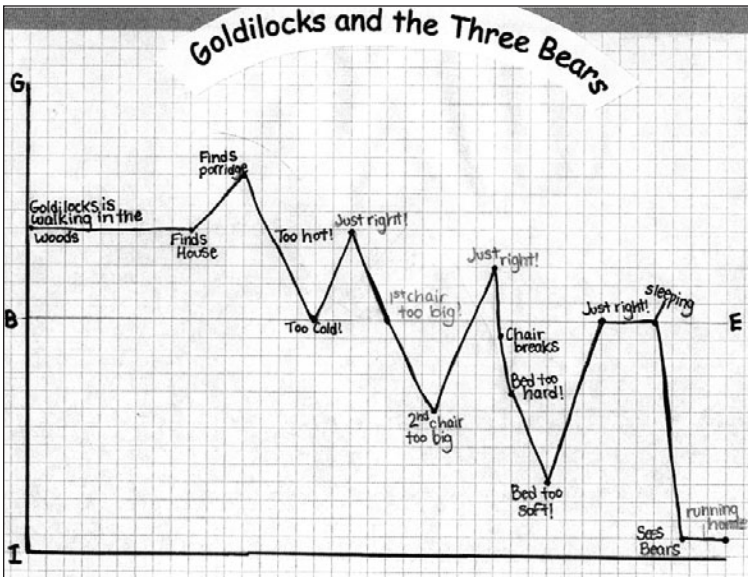


Fig. 6 The perception of relative highs and lows was a topic of discussion with this “Goldilocks and the Three Bears” graph.

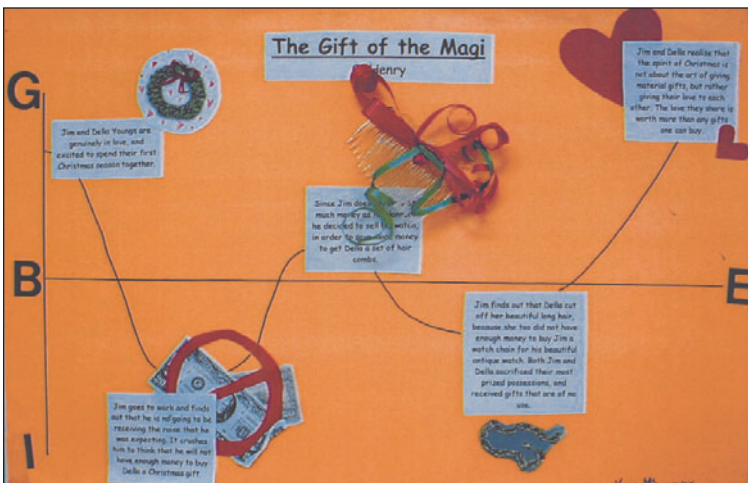


Fig. 7 “The Gift of the Magi” is graphed and described.



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ries such as those they might have read in elementary school. Fairy tales and children’s literature are perfect sources for this project and present opportunities for the students to find common interests with their fellow students. In addition, the students are advised to focus on one particular character in the story that they choose.

However, one student chose to graph “The Three Little Pigs” (see fig. 5), which certainly focused on more than one character. After providing a brief synopsis of the plot, this student wrote this analysis of his graph:

Point 1: The first pig built his house of straw. Thinking that this would be the strongest made the line go up.

Point 2: The wolf came and blew his house down. This caused the line to slope down.

Point 3: The wolf ate the pig. This pig’s line ends.

Point 4: The second pig built his house out of wood. Since the wood is stronger this made the line go higher than the first pig’s.

Point 5: The wolf came and blew his house down. This caused the line to slope down.

Point 6: The wolf ate the second pig. This pig’s line ends too.

Point 7: This point starts higher than point 4 because this pig thinks his house will be the strongest. It slopes up because he knows it is stronger than his brothers’ houses.

Point 8: The wolf comes to blow the house down, but can’t. This causes the line to stay.

Point 9: The wolf comes back to go through the chimney to get to the pig, but the pig has a fire

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under him and kills the wolf. This causes the line to stay at the same spot forever.

This student has certainly grasped some aspects of the graph-story connection. He has connected a rise in the fortunes of each pig with a corresponding upward slope of the graph and a decline in fortunes with the sudden dip of the lines. He has also found a reason to include discontinuities in his graph. However, his representation of “happily ever after” seems to confer a sense of immortality for the third little pig.

One student’s graphical representation of “Goldilocks and the Three Bears” (see **fig. 6**) gives insight to her overall perception of the relative highs and lows of her particular graph. When we discussed her graph in class, she paused and said that she “suddenly realized that some of the points ended up too low” when she compared them with other points in the graph.

One student who graphed the O. Henry story, “The Gift of the Magi” (see **fig. 7**), wrote, “My graph changes because the story is like a pattern of good news followed by bad news. This keeps the story interesting especially when it ends at a high point. A good story has its ups and downs to keep the reader interested. O. Henry is known for his surprise endings and on the graph it is easy to see that his stories are never flat and dull, but full of twists and turns.”

The seventh-grade students who completed this project were enthusiastic and animated during discussions of their work. Their determination to defend their interpretations of the stories in their graphs led to fruitful arguments that laid the groundwork for our work with linear functions and beyond.

The NCTM’s *Principles and Standards for School Mathematics* (2000) encourages teachers to help students discover the relevance of mathematics to their own lives and to enable them to bring their past mathematical experiences to bear on new situations that increase their knowledge. This project

inspired my students to discover the mathematics beneath the surface of familiar children’s stories, as well as enthusiastically communicate their ideas in classroom discussions and in written work. Their need for clarification and precision brought the Communication Standard of *Principles and Standards* to life each day in our classroom and helped students develop skills that will serve them well in years to come.

## Bibliography

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