

Teacher Supplement to Operation Comics, Issue #3

The purpose of this supplement is to provide content support for the mathematics embedded into the third issue of Operation Comics, and to show how the mathematics addresses the content standards provided by the National Council of Teachers of Mathematics (NCTM) for grades 3–5 and 6–8. The mathematics all takes place in the one problem posed by Wonderguy to Claire and Dillon, although different aspects of the problem address different parts of the standards. The problem in its entirety addresses both the NCTM standard for problem solving and the NCTM standard for reasoning and proof, for both grade ranges, in addition to the standards addressed below.

Finding the Center of a Set of Points

In the story, when Wonderguy has tired of being outmaneuvered by the Cheetah, he brings a map of the town to Claire and Dillon, with the locations of the crimes marked, perhaps with the hope that they could spot some pattern to where the robberies were taking place. Dillon, however, takes a more scientific tact, reasoning that if the culprit really has the same abilities as a cheetah, he might have the same weaknesses – namely, that he would have to rest for an extended period after running at his top speed for a few minutes. The most likely place for him to rest would be at his “lair”, centrally located somewhere in the midst of all of the robberies.

Claire decided to calculate the center of the set of points by taking the mean of all of the x -coordinates to get the x -coordinate of the center point, and taking the mean of all of the y -coordinates to get the y -coordinate of the center point. This calculation is a natural extension of the standard rule for the midpoint of a line segment with endpoints (x_1, y_1) and (x_2, y_2) ,

$$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right),$$

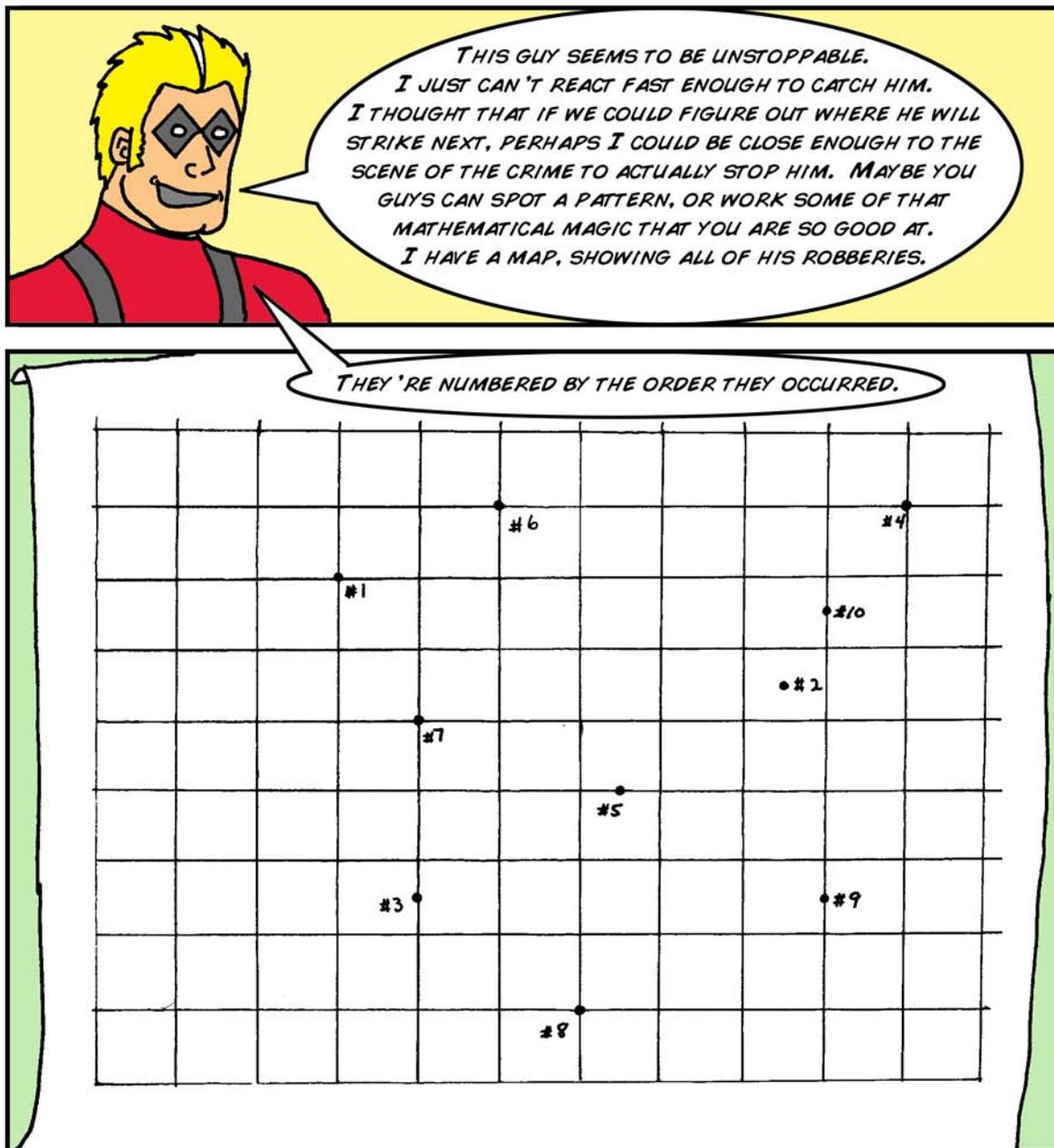
that ties together the concepts of the statistical mean and the geometric center of a set of points.

Finding the Center of Points with Claire and Dillon, #1

The first student supplement that accompanies this issue has the students finding the center of a set of points that lie on a horizontal line. Solutions are given below.

(6, 4)

Super-Tricky! The points are on a line, and the center point is also on this line. The center point is on a perpendicular line of reflection for the set of points, and is a point of 180° rotational symmetry for the set of points.

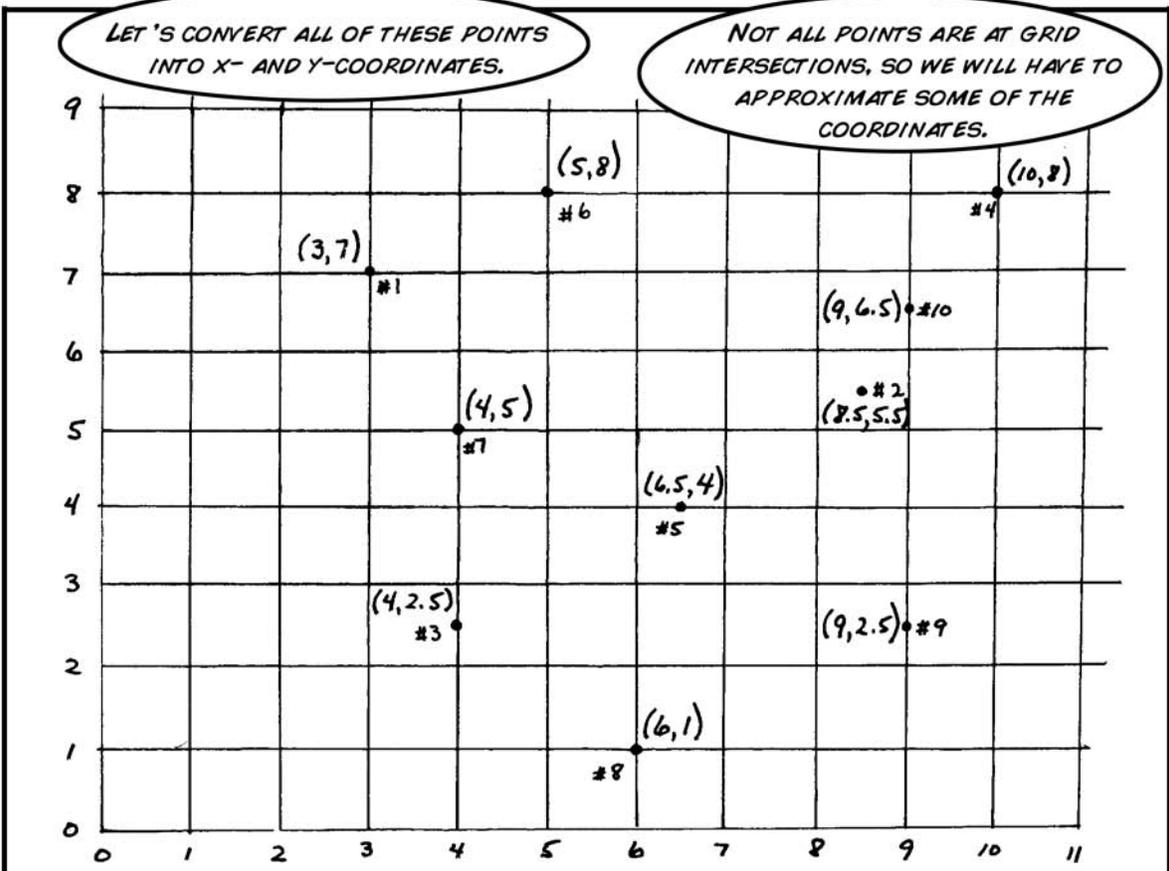


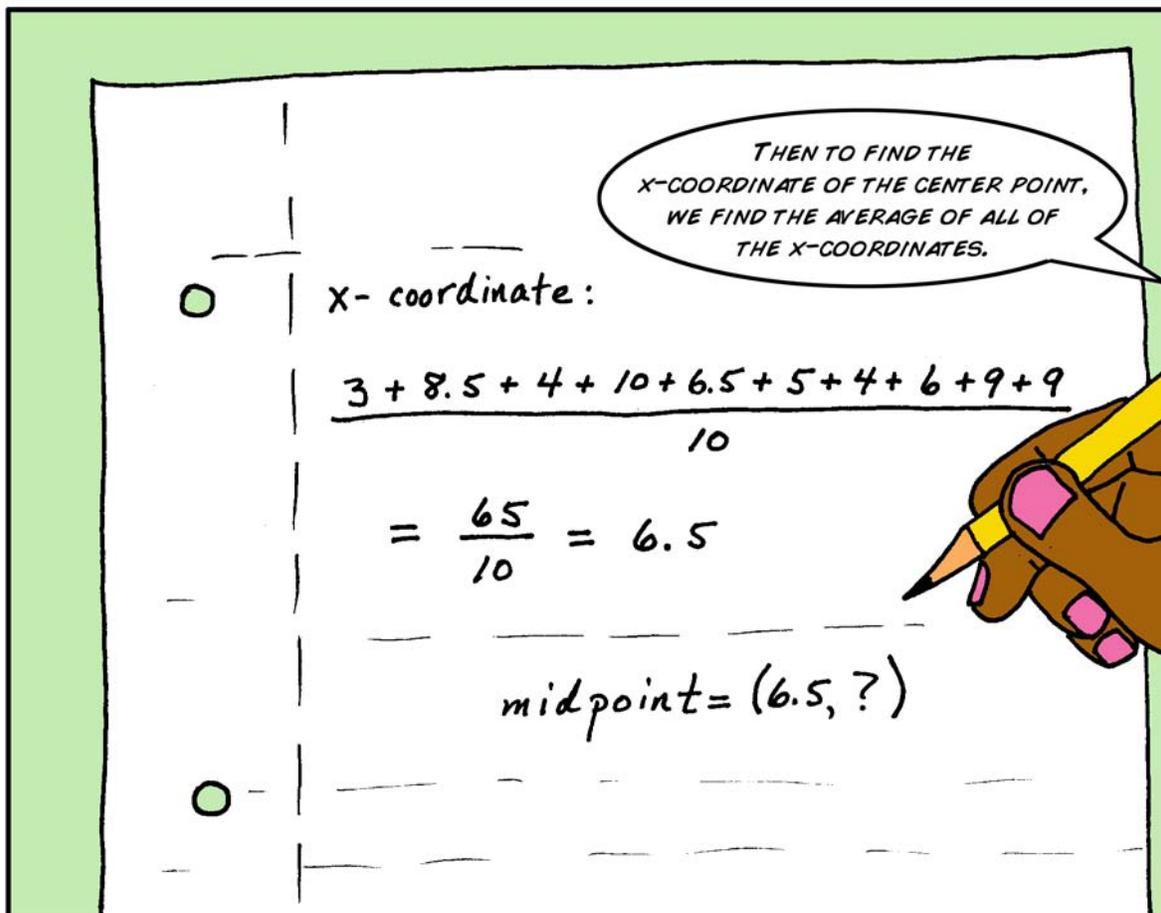
Finding the Center of Points with Claire and Dillon, #2

The second student supplement that accompanies this issue has the students finding the center of a set of points that lie on a diagonal line. Solutions are given below.

(6, 5.5)

Super-Tricky! The points are on a line, and the center point is also on this line. The center point is on a perpendicular line of reflection for the set of points, and is a point of 180° rotational symmetry for the set of points.





Finding the Center of Points with Claire and Dillon, #3

The third student supplement that accompanies this issue has the students finding the center of a set of points where all but one point lies on a vertical line. Solutions are given below.

(9,5)

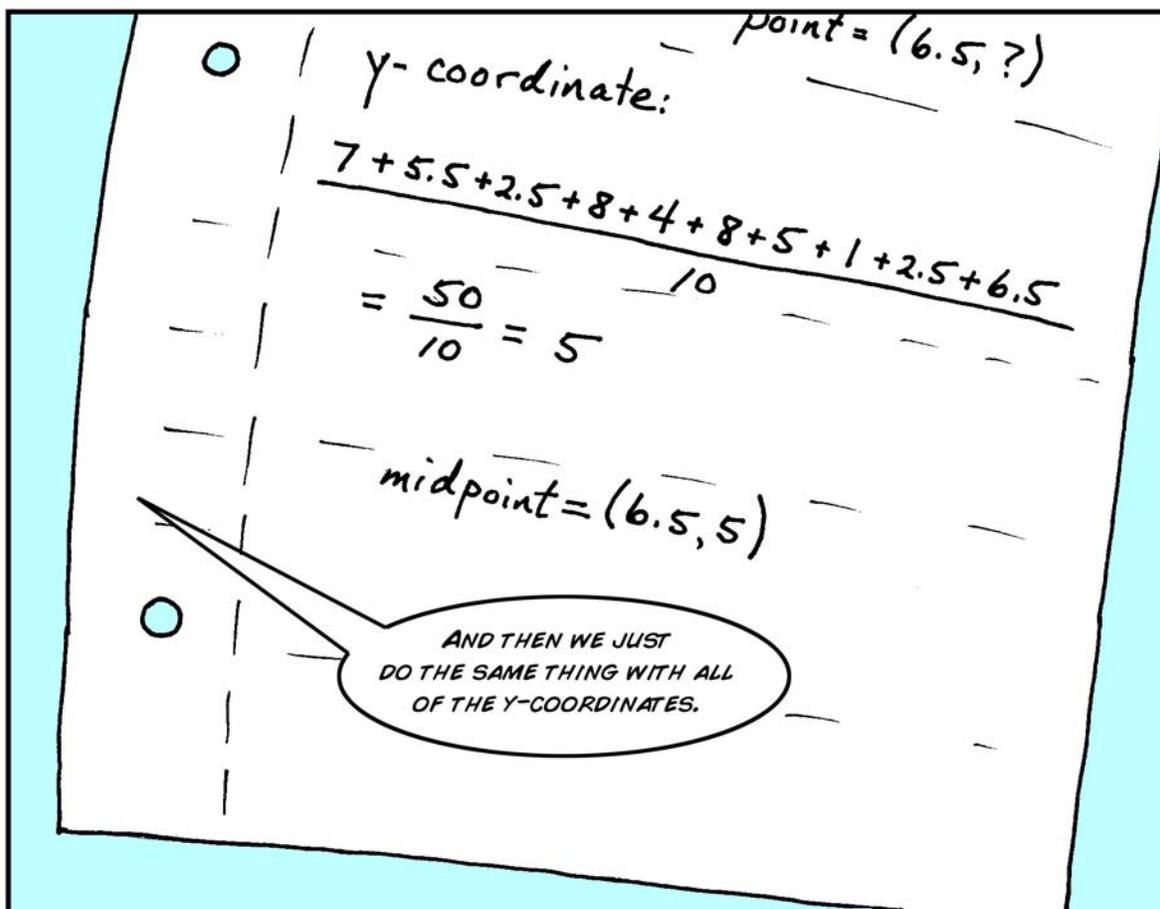
Super-Tricky! In order for the center point to be at (8,5), the sum of the x -coordinates must be $8 * 8 = 64$, so the point would need to be at (-6,5), 8 units to the left of the current point. In order for the center to be at (8,6), the sum of the y -coordinates must be $8 * 6 = 48$, so the point would need to be at (-6,13), 8 units above the last point we found.

Finding the Center of Points with Claire and Dillon, #4

The fourth student supplement that accompanies this issue has the students finding the center of a set of points that all lie on a circle of radius 5. Solutions are given below.

(6,5)

Super-Tricky! The points are on a circle of radius 5, and the center point is not on the circle. The center point is on four distinct lines of reflection for the set of points, and is a point of 90° rotational symmetry for the set of points.



Finding the Center of Points with Claire and Dillon, #5

The fifth student supplement that accompanies this issue has the students finding the center of a set of randomly distributed points. Solutions are given below.

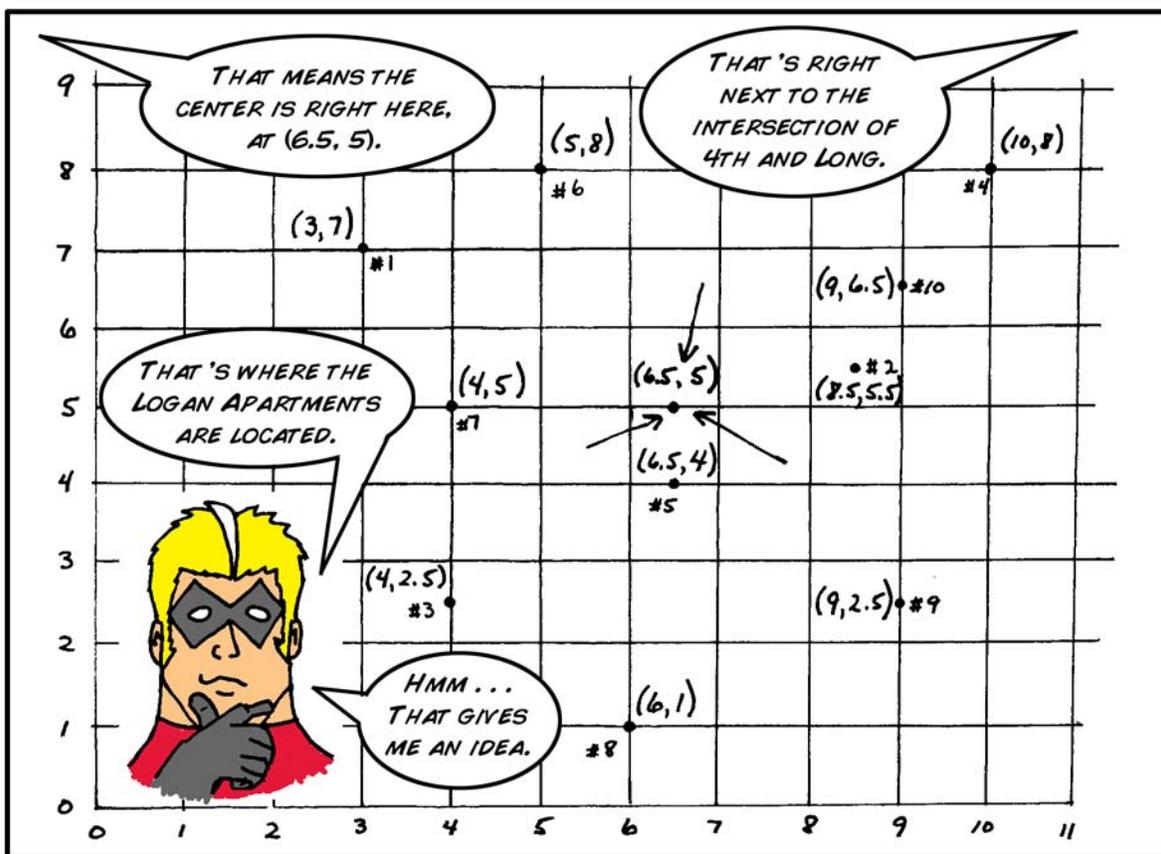
(6, 5)

Super-Tricky! Several solutions exist. One possible solution would be to move the point at (8, 3) to (10, 3), and the point at (9, 9) to (10, 9.5).

NCTM Standards

The introduction of the coordinate system in the problem addresses the NCTM standard for geometry for grades 3–5, which says that “in grades 3–5, all students should make and use coordinate systems to specify locations and to describe paths” and the worksheets “identify and describe line and rotational symmetry in two- and three-dimensional shapes and designs.” The worksheets with different shape data sets address the NCTM standard for data analysis and probability for grades 3–5, which says that “in grades 3–5, all students should compare different representations of the same data and evaluate how well each representation shows important aspects of the data.”

The problem also addresses the NCTM standard for geometry for grades 6–8, which says that “in grades 6–8, all students should examine the congruence, similarity, and line or rotational symmetry of objects using transformations” and “recognize and apply geometric ideas and



relationships in areas outside the mathematics classroom, such as art, science, and everyday life”, and the NCTM standard for data analysis and probability for grades 6–8, which says that “in grades 6–8, all students should find, use, and interpret measures of center and spread, including mean and interquartile range” and “select, create, and use appropriate graphical representations of data, including histograms, box plots, and scatterplots.”

One last note . . .

While my purpose here is to produce a comic book with embedded mathematical content, and mathematics is my background, I did endeavor to write a good story, and hopefully, the comics can be used for their literary elements as well. The following are a few examples of subtle things at work in the story.

- There are some catch-phrases that are becoming commonplace for Wonderguy to use – “Have a Wonder-ful day!” and “Great googly-moogly!”. One could ask students about the advantages and disadvantages of a superhero-type having regularly-used catch-phrases. One disadvantage that comes to mind is that it could jeopardize his secret identity if he continued to use the phrases when not in costume.
- There are some subtle clues in the story as to the origin of Wonderguy. Note that the government scientists refer to a “super-soldier” program that once was conducted at the government research facility. Wonderguy would be too young to have been a part of the program, but his parents would have been the correct age.
- In the story, Dr. Emata is not really that evil a character – he just wants to show that he can help the government create a better soldier. He uses this desire to do a greater good

to justify committing small crimes as the Cheetah. A discussion could ensue with students as to whether his crimes were really justified. Is it really okay to “break some eggs to make an omelet.”

- There is some foreshadowing in the story, when the government scientist makes the comment “You ride around on a motorcycle? We should work on that.” I have an idea for a future episode where the scientist develops an alternate, more efficient, form of transportation for Wonderguy. One could ask the students to come up with their own ideas for this new mode of transportation.

This document, as with the student supplements, is a work in progress. Please contact me with corrections or suggestions, and I will make the needed changes. Thanks for inviting Wonderguy into your classrooms, and please encourage your students to contact me with their comments and suggestions for future episodes.