

Background content: Prior to doing this activity, students should have working knowledge of the following:

- Graphing polynomial functions
- Evaluating functions with variable inputs
- Finding slope between two points

Philosophy behind this activity:

This activity reinforces graphing polynomials and provides students with a graphical understanding of the difference quotient. The difference quotient is an important topic for students pursuing calculus, and the concept of the tangent line is presented in this activity.

Learning Goals:

1. Create a graph for a polynomial function.
2. Practice evaluating functions with variable inputs, in particular, the difference quotient

$$\frac{f(x+h)-f(x)}{h}.$$

3. Understand how to graph a difference quotient and how it relates to secant/tangent lines.

Implementation Notes:

1. To ensure that students are comfortable with the difference quotient, do not move on after they have completed question 1. Discuss any issues with evaluation as a class – typically, students have an issue with distributing the negative sign to $f(x)$. This discussion may take up to 10 minutes.
2. Question 2 is more difficult than question 1, and therefore, will take more time for students to complete. The hint on the sheet should help most students since it reduces the function, but some students will need assistance with factoring as it is not reviewed prior to this topic. Once students have completed the question, review and discuss it together. If you feel that students could benefit from additional graphing practice, this may be a good function to discuss and complete, as it is a rational function with a hole at -2 .
3. Students can then begin working on question 3, 4, 5, and 6. It is worth stopping after question 6 and discussing how they found slope.
4. Question 8 has been challenging for most students as they have to create a function that is the difference between two points.
5. Questions 10, 11, and 12 bring up the concept of tangent. Following the completion of these problems, we completed a mini lesson on tangent lines.