# 2.5 Solving Inequalities Using Technology

**Student Text Pages**
123 to 131

**Suggested Timing**
40–60 min

**Tools**
- grid paper
- graphing calculator
- computer algebra system

**Related Resources**
- G–1 Grid Paper
- T–4 The Computer Algebra System (CAS) on the TI-89 Calculator
- BLM 2–7 Section 2.5 Practice

## Teaching Suggestions

- In this section, non-factorable polynomial inequalities are solved using technology. The next section focuses on factorable polynomial inequalities, which are solved algebraically.
- Have students work in pairs or small groups to complete the **Investigate**. The purpose of the **Investigate** is to help students make the connection between an inequality and $y$-values of the graph. In particular, the part above the $x$-axis corresponds to $>$ and the part below the $x$-axis corresponds to $<$. The $x$-axis divides the graph into two parts; one part is above the $x$-axis, and the other is below. Thus, the $x$-intercepts define the intervals where a graph may change from positive to negative or vice versa.
- Refer to **Prerequisite Skills** question 9 for this lesson.
- Discuss with students the concepts presented on page 125 before presenting the examples. It is important to define the intervals from left to right along the $x$-axis. The $x$-intercepts of the graph are required to determine the intervals. These are found by solving the equation that corresponds to the inequality.
- **Example 1** demonstrates how to use a graphing calculator to determine the $x$-intercepts needed to solve a non-factorable inequality. The graph can then be used to "see" which part lies above or below the $x$-axis.
- **Example 2** demonstrates how to use a CAS and test values to solve an inequality, without graphing first. If needed, use **T–4 The Computer Algebra System (CAS) on the TI-89 Calculator** to support this activity.
- **Example 3** provides two methods for determining the $x$-intercept. These methods were indicated in Section 2.3, Example 4.
- **Example 3** requires students to select tools when reflecting on the wording of the question to show how best to solve the problem of determining when the yearly sales will be $100 million or more. They will have to reason through which method they prefer to use and use their connecting skills to use the graphing calculator in the most appropriate way to solve the problem.
- As students consider the **Communicate Your Understanding** questions, draw out that in order to solve an inequality it is necessary first to determine the $x$-intercepts of the corresponding graph. The intervals that are possible solutions to the inequality are based on the values of the $x$-intercepts. The solutions can easily be found by looking at the parts of the graph that are below or above the $x$-axis.
- The graphs in **question 6** have integer valued $x$-intercepts.
- Any method can be used to solve **question 9**.
- The purpose of **questions 11** and **12** is for students to set up an inequality, similar to **Example 3**.
- **Question 13** gives students the opportunity to reflect, reason, and problem solve when trying to create the three cubic polynomial inequalities required. They will then have to select appropriate tools and use connecting skills to solve the inequalities.
- Use **BLM 2–7 Section 2.5 Practice** for remediation or extra practice.

### Differentiated Instruction

Use **Think-Pair-Share** to help students consolidate their knowledge of this section.

### Common Errors

- Students point the inequality symbols in the wrong direction.

$R_x$ Emphasize that the symbols always point to the smallest value and in the same direction, so $3 < x < 7$ is correct but $3 < x > 7$ is incorrect. Refer to a number line to emphasize these points.

- Students have difficulty identifying the intervals for the solution.

$R_x$ Point out that the $x$-axis divides the graph in half and they need only look for the intervals along the $x$-axis that correspond to the parts of the curve that are either above or below the $x$-axis and possibly include the $x$-intercepts (depending on the inequality being solved).

**Investigate Answers (pages 123–124)**

**1. a)** $x \leq 3$

**b)** $x > -1$

**c)** $-5 < x \leq 7$

**2. a)** above $x$-axis for $x < -5$ or $x > 3$; positive

**b)** same

**c)** below $x$-axis for $x < -4$ or $x > 5$; negative

**d)** same

**3.** The $x$-intercepts divide the $x$-axis into intervals that correspond to the solution to the inequality.

**4. a)** $-3 \leq x \leq 1$ or $x \geq 4$

**b)** $x < -3$ or $1 < x < 4$

**c) i)** The solution to this inequality is the set of $x$-values that correspond to the part of the graph that lies above the $x$-axis and includes the $x$-intercepts.

**ii)** The solution to this inequality is the set of $x$-values that correspond to the part of the graph that lies below the $x$-axis, not including the $x$-intercepts.

**Communicate Your Understanding Responses (page 129)**

**C1.** Examples may vary. A polynomial equation is solved by finding the roots. The number of roots, real and non-real, corresponds to the degree of the function. A polynomial inequality is solved by finding the intervals where the curve (or $y$-values), lies above or below the $x$-axis (and may or may not include the $x$-intercepts).

**C2.** The solution to an inequality depends on the intervals determined by the $x$-intercepts.

**C3.** The real roots of the polynomial equation are the $x$-intercepts of the graph.

**C4.** First, graph the function. Then, determine the $x$-intercepts. Write the intervals that correspond to the parts of the graph that lie below the $x$-axis, including the $x$-intercepts.

## Mathematical Process Expectations

| Process Expectation | Selected Questions |
|---|---|
| Problem Solving | 13–15, 17 |
| Reasoning and Proving | 3, 4, 5, 10–17 |
| Reflecting | 13–15 |
| Selecting Tools and Computational Strategies | 1–12, 16, 17 |
| Connecting | 5–17 |
| Representing | 3, 6 |
| Communicating | 4 |