Use Technology

Student Text Page
33

Suggested Timing
15–20 min

Tools
- TI-Nspire™ CAS graphing calculator

Use a TI-Nspire™ CAS Graphing Calculator to Find the Maximum or Minimum and the Zeros of a Quadratic Function

Teaching Suggestions

- It may be beneficial to pair struggling students with students who are more familiar with the operation of the TI-Nspire™ CAS graphing calculator.
- The "plot a point and drag" approach has been chosen to parallel *The Geometer's Sketchpad®* solutions presented in the chapter. You can also simply press (menu) and select the **Trace** operation, followed by **Graph Trace**. The cursor keys will move the tracing point along the graph. Whenever it reaches a maximum, minimum, or zero, an appropriate box will appear.

1.4 Skills You Need: Working With Radicals

Student Text Pages
34 to 40

Suggested Timing
75–90 min

Tools
- scientific calculator (optional)

Related Resources
- BLM 1–5 Section 1.4 Practice

Teaching Suggestions

- Allow 15 to 20 min for the **Investigate**. Once students have completed the investigation, have them share their responses to step 4.
- In **Example 1**, stress to students that the greatest perfect square factor must be removed from under the radical sign to put a radical in simplest form. For example, in part **c**), some students may use 9×20 for 180 and simplify the radical to $3\sqrt{20}$. Since 20 can be written as 4×5 and 4 is still a perfect square factor, $3\sqrt{20}$ is not in simplest form.
- Before students work through **Example 2**, parallel the addition and subtraction of radicals to simplifying like terms in a polynomial expression such as $3x + 2x$, where the coefficients 3 and 2 are added to become the coefficient of x.
- In **Example 2**, remind students to simplify all radicals to mixed radicals of the same radicand before adding and subtracting.
- In **Example 3**, remind students that once the radicands have been multiplied, the radical must be changed to its simplest form. For parts **d**) and **e**), parallel the simplification of expressions with radicals to simplifying an expression such as $(3x + 2)(2x - 5)$.
- In **Example 4**, remind students of the formula for the volume of a square-based pyramid if needed.
- Be sure to review the **Key Concepts** with the class to ensure that students understand all the concepts.
- Work through the **Communicate Your Understanding** questions with students. Ask for the correct answer to question C1 to see if students are comfortable enough with the material taught to simplify the expression mentally.

Differentiated Instruction

- Once students have practised using radicals, provide a list of questions with incorrect solutions. Have students work in pairs to find and correct errors. This process will help alert students to common errors and avoid them.
- Have student generate their own questions and incorrect solutions and trade with a partner to find and correct the errors.
- Post the questions with incorrect solutions and corrected solutions on chart paper in the classroom as a reminder of the common errors to avoid when manipulating radicals.

Common Errors

- Students forget that in question 12, each square has a side length of 2 cm, which will lead to an answer that is four times the correct answer.

R_x Have students reread that question to see if they can pick up on the fact that the side length of the game board obtained using Pythagorean theorem has to be divided by 2 to find the number of squares along the side of the board.

- Students incorrectly think that $(1 + \sqrt{3})^2 = 1 + 3$ in question 15.

R_x Have students work on question 13 before question 15.

Investigate Answers (page 34)

1.

A	B
$\sqrt{4} \times \sqrt{4} = 4$	$\sqrt{4 \times 4} = 4$
$\sqrt{81} \times \sqrt{81} = 81$	$\sqrt{81 \times 81} = 81$
$\sqrt{225} \times \sqrt{225} = 225$	$\sqrt{225 \times 225} = 225$
$\sqrt{5} \times \sqrt{5} = 5$	$\sqrt{5 \times 5} = 5$
$\sqrt{31} \times \sqrt{31} = 31$	$\sqrt{31 \times 31} = 31$
$\sqrt{12} \times \sqrt{9} = \sqrt{108} = 6\sqrt{3}$	$\sqrt{12 \times 9} = \sqrt{108} = 6\sqrt{3}$
$\sqrt{23} \times \sqrt{121} = 11\sqrt{23}$	$\sqrt{23 \times 121} = 11\sqrt{23}$

2. The results are the same in each row.

3. Answers may vary. Sample answer: Finding the product of two radicals in column A is the same as taking the square root of the product of the two radicands in column B.

4. a) In general, $\sqrt{a} \times \sqrt{b} = \sqrt{a \times b}$.

b) Answers may vary. Sample answer: No. This will not be true for $a < 0$ and $b < 0$. For example, $\sqrt{-3}$ and $\sqrt{-27}$ are not real numbers. Since $\sqrt{(-3) \times (-27)} = \sqrt{81} = 9$, $\sqrt{-3} \times \sqrt{-27} \neq \sqrt{(-3) \times (-27)}$.

Communicate Your Understanding Responses (page 39)

C1 Answers may vary. Sample answer: Marc is not correct. The expression can be simplified as follows.

$\sqrt{3} - \sqrt{75} = \sqrt{3} - \sqrt{25 \times 3} = \sqrt{3} - 5\sqrt{3} = -4\sqrt{3}$

C2 Answers may vary. Sample answer:

Use the distributive property, multiply the radicands, simplify the perfect square under the radical sign, and multiply the like terms.

$\sqrt{3}\,(2\sqrt{3} - 4\sqrt{2}) = 2\sqrt{3 \times 3} - 4\sqrt{3 \times 2} = 2\sqrt{9} - 4\sqrt{6} = 2 \times 3 - 4\sqrt{6}$

$= 6 - 4\sqrt{6}$

C3 Answers may vary. Sample answer:

Using Ann's method,

$\sqrt{108} = \sqrt{2 \times 2 \times 3 \times 3 \times 3} = \sqrt{4 \times 9 \times 3} = (\sqrt{4})(\sqrt{9})(\sqrt{3})$

$= (2 \times 3)(\sqrt{3}) = 6\sqrt{3}$

Using Rayanne's method,

$\sqrt{108} = \sqrt{36 \times 3} = (\sqrt{36})(\sqrt{3}) = 6\sqrt{3}$

Both techniques result in the same solution.

Practise, Connect and Apply, Extend

- In **question 8**, remind students that fractional coefficients do not change how the expressions are simplified, and that common denominators are needed to combine radicals.
- **Question 9** allows students to use their reasoning skills and connecting skills with previous learning to select tools to find the area of each shape.
- For **question 10**, have one student explain the result, and ask if anyone else has a different solution. If so, have students explain why the two solutions are in fact the same.
- **Question 15** gives students an algebraic problem to solve by reasoning through, reflecting on, and connecting knowledge from their previous mathematical education. They will have to select tools in order to solve this problem and communicate their findings.

- Remind students that in **question 16**, they must first factor out the common factor in the numerator or write each term in the numerator with the given denominator.
- Use **BLM 1–5 Section 1.4 Practice** for remediation or extra practice.

Mathematical Process Expectations

The table shows questions that provide good opportunities for students to use the mathematical processes.

Process Expectation	Selected Questions
Problem Solving	15–18
Reasoning and Proving	9, 11, 12, 14–18
Reflecting	15–18
Selecting Tools and Computational Strategies	9–13, 15–18
Connecting	1–18
Representing	
Communicating	10, 14, 15

Use Technology

Student Text Pages
41 to 42

Suggested Timing
20–40 min

Tools
- TI-Nspire™ CAS graphing calculator

Use a TI-Nspire™ CAS Graphing Calculator to Explore Operations With Radicals

Teaching Suggestions

- It may be beneficial to pair struggling students with students who are more familiar with the operation of the TI-Nspire™ CAS graphing calculator.
- The "Lists & Spreadsheet" approach is not actually required to multiply radicals. However, it provides a handy way to check a question with multiple parts. Alternatively, use a calculator page and enter each expression separately.
- If you have a number of radicals to be changed into mixed radicals, set up a Lists & Spreadsheet page and enter a formula in the formula cell. Then, you can simply enter numbers.
- Alternatively, you can define a function to perform the operation.
- Encourage students to "challenge" the CAS with messy operations involving radicals.
- Remind students that they can force an approximate answer at any time by pressing ctrl before pressing ≈ enter.