Application of Completing the Square

TIMATH.COM: ALGEBRA 2

TEACHER NOTES

Math Objectives

- Students will recognize the characteristics of a perfect square quadratic.
- Students will use the characteristics of a perfect square quadratic to complete the square.
- Students will apply knowledge of perfect square quadratics to solve real-world problems.

Vocabulary

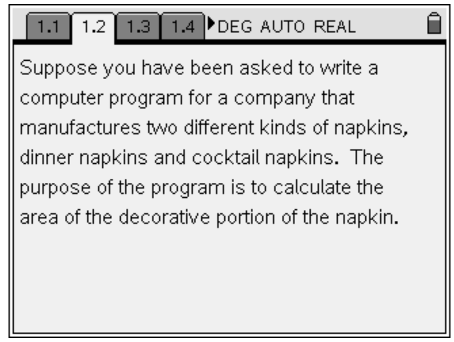
- perfect square quadratic
- coefficient
- constant term
- polynomial

About the Lesson

- This lesson is a follow-up lesson to the activity *Completing the Square*.
- This lesson involves students calculating a square area that involves perfect square quadratics.

Related Lessons

- Prior to this lesson: Completing the Square
- After this lesson: More Systems of Inequalities



TI-Nspire™ Technology Skills:

- Download TI-Nspire document
- Open a document
- Move between pages
- Use a slider
- Find area of a polygon

Tech Tips:

- *Make sure the **font size** on your TI-Nspire handhelds is set to Medium.*

Lesson Materials:

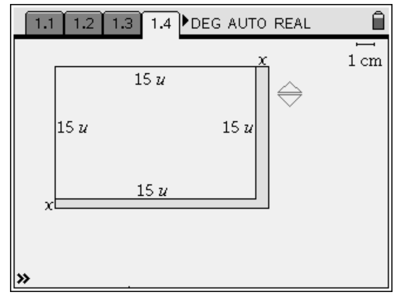
Student Activity

Application_of_Completing_the_Square_Student.PDF

Application_of_Completing_the Square_Student.DOC

TI-Nspire document

Application_of_Completing_the_Square.tns



Discussion Points and Possible Answers:

TI-Nspire Problem/Pages 1.4 and 2.2

Tech Tip: *Press (esc) to hide the entry line if students accidentally click the chevron.*

1. What will be the shape of the dinner napkin after the border is added? Explain.	**The shape of the napkin including the border will be a square, since the same value, *x*, is added to both sides of the square.**
2. Find the area of the white part of the napkin (without the border). What formula did you use?	**Use the area of a square formula.** $\mathbf{A = s^2}$ $\mathbf{A = 15^2}$ $\mathbf{A = 225\ cm^2}$
3. Write a general formula in the form of $A = s^2$ to find the area of the entire napkin (including border). Use the labels from the picture on page 1.4.	$\mathbf{A = (15 + x)^2}$
4. Expand your formula from Question 3. Show your work below.	$\mathbf{A = (15 + x)^2}$ $\mathbf{A = (15 + x)(15 + x)}$ $\mathbf{A = 225 + 30x + x^2}$ **or** $\mathbf{A = x^2 + 30x + 225}$
5. Question 4 resulted in what type of polynomial? Explain.	**Question 4 resulted in a perfect square quadratic, since half of the coefficient of the *x*-term squared equals 225.** $\mathbf{\frac{1}{2} \cdot 30 = 15}$ $\mathbf{15^2 = 225}$

6. Use your formula to calculate the total area for each dinner napkin using the x-values in the table. Show your work in the table below.

x	Substitute x in formula	Area
1	$(15 + 1)^2$	256 cm^2
2	$(15 + 2)^2$	289 cm^2
3	$(15 + 3)^2$	324 cm^2
4	$(15 + 4)^2$	361 cm^2
5	$(15 + 4)^2$	400 cm^2

Teacher Tip: *Students can also use the expanded formula to calculate the area.*

7. On page 1.4, use the **Measurement** tool **(MENU > Measurement > Area)** to find the area of the napkin for each value of x listed in the table. How did your results from Question 6 compare?

Answers may vary and are dependent on student responses to Question 6.

8. Using the areas from Questions 2 and 6, how can you determine the area of the decorative border? Explain.

Take the area of the entire napkin (from Question 6) and subtract the area of the white square (from Question 2).

9. Write a general formula in the form of $A = s^2$ to find the area of the decorative portion of the napkin (not including border). Use the labels from the picture on page 2.2.

$\boldsymbol{A = (15 - x)^2}$

10. Expand your formula from Question 9. How does this formula differ from the formula from Question 4 regarding the dinner napkin?

$\boldsymbol{A = (15 - x)^2}$

$\boldsymbol{A = (15 - x)(15 - x)}$

$\boldsymbol{A = 225 - 30x + x^2}$ **or** $\boldsymbol{A = x^2 - 30x + 225}$

The only difference between the two formulas is that the sign of the coefficient of the *x* is negative instead of positive.

11. Use your formula to calculate the area of the decorative portion of five cocktail napkins using the x-values in the table. Show your work in the table below.

x	Substitute x in formula	Area
1	$(15 - 1)^2$	196 cm^2
2	$(15 - 2)^2$	169 cm^2
3	$(15 - 3)^2$	144 cm^2
4	$(15 - 4)^2$	121 cm^2
5	$(15 - 5)^2$	100 cm^2

12. On page 2.2, use the **Measurement** tool **(MENU > Measurement > Area)** to find the areas for each value of *x* listed in the table. How did your results from Question 11 compare?	**Answers may vary and are dependent on student responses to Question 11.**
13. How can you determine the coefficient of the *x*-term and the constant term of the quadratic without going through the process of expanding the new formula? Explain.	**The new formula will become $A = (13 - x)^2$, so the constant will be 13 · 13 or 169. Therefore, the coefficient of the *x*-term will be 26, since half of 26 is 13.**

Wrap Up:

Upon completion of the discussion, the teacher should ensure that students are able to:

- Recognize the characteristics of a perfect square quadratic.
- Understand how to use the characteristics of a perfect square quadratic to complete the square.
- Understand how perfect square quadratics can be used to solve real-world problems.