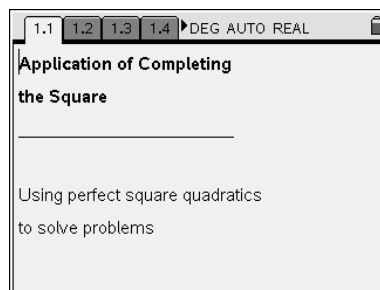# Application of Completing the Square

In this activity, perfect square quadratics are used to solve an application involving the area of a square. Students will apply their existing knowledge of perfect square quadratics and completing the square to solve problems.

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1.1  1.2  1.3  1.4 ▶DEG AUTO REAL      🔋
Application of Completing
the Square
_____

Using perfect square quadratics
to solve problems
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> **Open the TI-Nspire document *Application_of_Completing_the_Square*.**
> **Press ( ctrl ) ► to move to page 1.2 and begin the activity.**

Suppose you have been asked to write a computer program for a company that manufactures two different kinds of napkins: dinner napkins and cocktail napkins. The purpose of the program is to calculate the area of the decorative portion of the napkin.

> **Move to page 1.4.**

The dinner napkins have a decorative border around two sides like the picture on page 1.4. Use the up and down arrows to see the border change size. The size of the border is dependent on the design that is chosen for the decoration. The dinner napkin includes a white square with side lengths of 15 cm surrounded on two sides by the border. The length and width of the border are represented with the variable *x*.

1.   What will be the shape of the dinner napkin after the border is added? Explain.

_____

_____

2.   Find the area of the white part of the napkin (without the border). What formula did you use?

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.

4.   Expand your formula from Question 3. Show your work below.

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5. Question 4 resulted in what type of polynomial? Explain.

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   _____

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   |                           |      |
| 2   |                           |      |
| 3   |                           |      |
| 4   |                           |      |
| 5   |                           |      |

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?

   _____

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

   _____

   _____

➢ **Move to page 2.2.**

The cocktail napkin is square with side lengths of 15 cm. This napkin includes a square decorative portion surrounded on two sides by a white border. The length and width of the border are represented with the variable *x*. Use the up and down arrows on page 2.2 to see the border change.

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.

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

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 | | |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |

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?

_____

To cut back on costs, suppose the side lengths of the cocktail napkin were changed from 15 cm to 13 cm.

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.

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