Herbert's Patio

Concepts

- Number relationships
- Preview skills needed for factoring

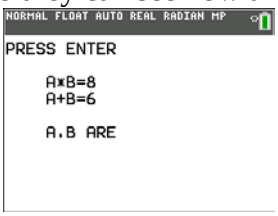
Materials

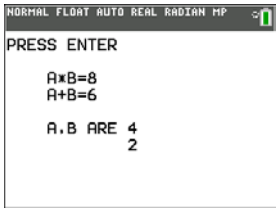
- Herbert's Patio student sheet
- Optional: graphing calculator program NUMPAIRS

Introduction

When factoring trinomials, one must find a pair of numbers whose sum and product are given. Early in the curriculum, preview this skill with the *Herbert's Patio* activity (with no mention of the fact that this has anything to do with factoring.)
The program NUMPAIRS provides students opportunities to practice this skill, which can be spaced throughout the year.

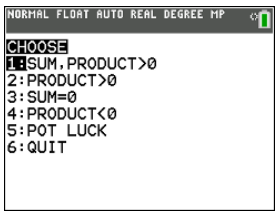
It might be helpful to run through the program with students in class before giving it to them to try on their own. If they choose to see a sample question, then a question with random values will appear so they can see how the answers are entered:





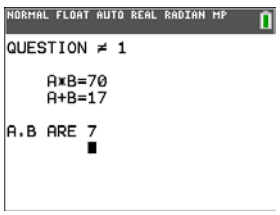
They can choose to time themselves (using their own timer) or practice a fixed set of questions and are given at Doug Smeltz's Web Site at **dsmeltz.eboard.com**

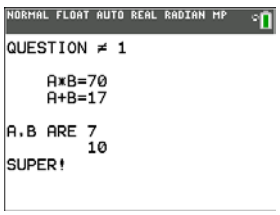
Using the program for class discussion



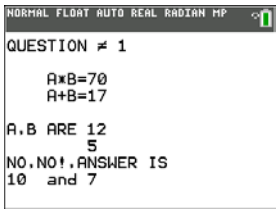
For discovery, you can break the class into groups and ask them to each explore separate options to see how sign changes affect the answers. Choices available are shown on the screen to the right. Perhaps ask your students to run the program until they answer 8 out of 10 questions correct (adjust the level accordingly). The program calibrates their skill level at the end.
See the *How Do You Know That?* for questions to help students reflect on their learning.
The fifth menu option (Pot Luck) interleaves all of the previous four options.

The program expects the user to type one value, followed by ENTER,
then the other value followed by ENTER without commas. Order is not important.
Correct answers are applauded,

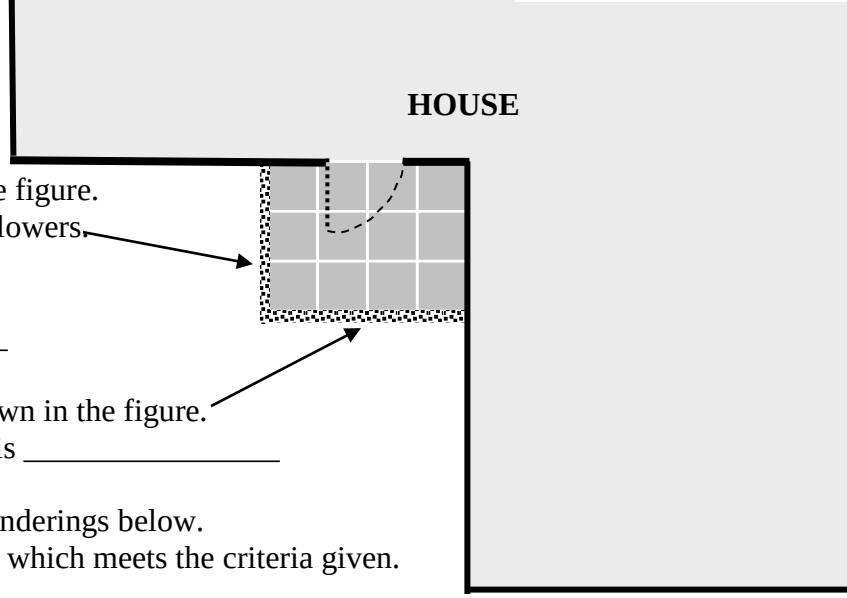




while incorrect responses are shown the actual answer.



Herbert's Patio



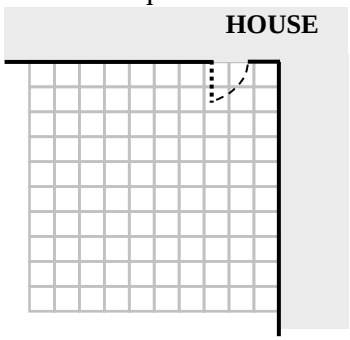
Herbert uses square 1 ft. by 1 ft. blocks
to create a patio against his house as shown in the figure.
He wants to surround the patio with a border of flowers.

Report the **area** of the patio shown in the figure.
Use correct units. The area is _____

Report the length of the patio **flower border** shown in the figure.
Use correct units. The length of the patio border is _____

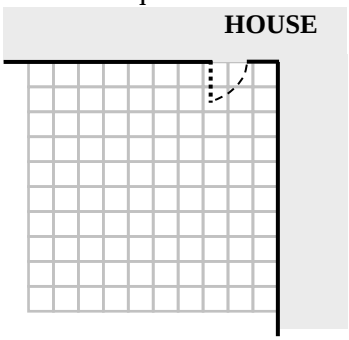
For convenience, a grid has been drawn on the renderings below.
Use the grid to sketch possible rectangular patios which meets the criteria given.
Then report your patio's dimension.

1. flower bed border: 9 feet
   area: 18 square feet



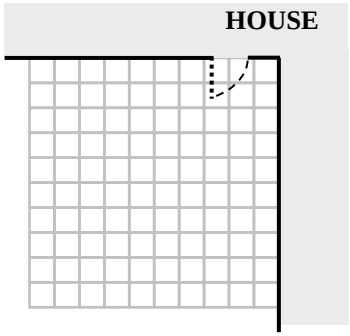
dimensions: __ ft. by__ ft.

2. flower bed border: 6 feet
   area: 9 square feet



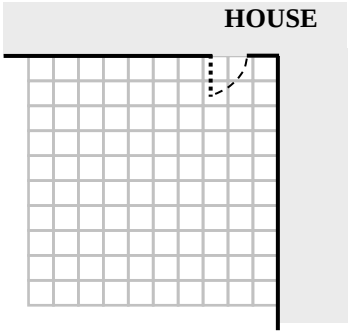
dimensions: __ ft. by__ ft.

3. flower bed border: 8 feet
   area: 15 square feet



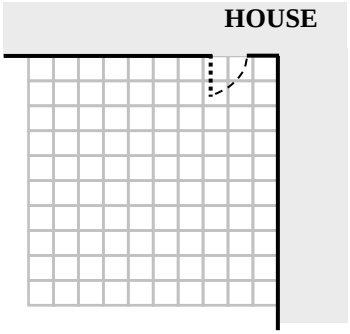
dimensions: ___ ft. by ____ft.

4. flower bed border: 9 feet
   area: 20 square feet



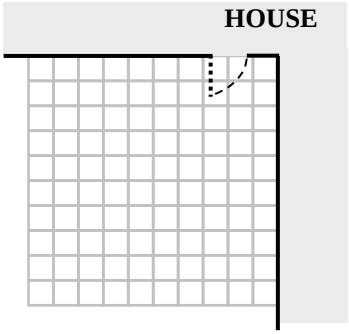
dimensions: __ ft. by__ ft.

5. flower bed border: 11 feet
   area: 30 square feet



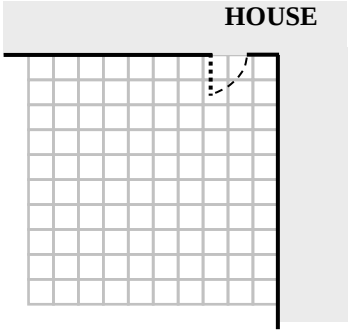
dimensions: __ ft. by__ ft.

6. flower bed border: 12 feet
   area: 27 square feet



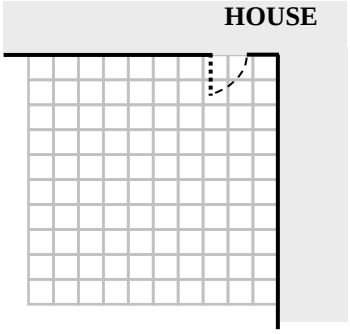
dimensions: ___ ft. by ____ft.

7. flower bed border: 12 feet
   area: 36 square feet



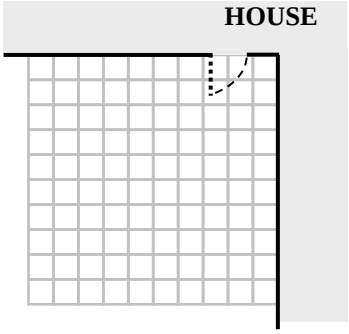
dimensions: __ ft. by__ ft.

8. flower bed border: 11 feet
   area: 24 square feet



dimensions: __ ft. by__ ft.

9. flower bed border: 13 feet
   area: 42 square feet



dimensions: ___ ft. by ____ft.

How Do You Know That?

Run the program NUMPAIRS, choosing the option `1:SUM,PRODUCT>0`.
After you have a suitable score, answer these questions:

If A*B is **positive** and A+B is **positive**, ***what*** do you know about the *signs* (+ or –) of A and B?

_____

How **do you know that?** _____

Run the program NUMPAIRS, choosing the option `2:PRODUCT>0`.
After you have a suitable score, answer these questions:

1. If the product A*B is **positive**, ***what*** do you know about the *signs* (+ or –) of A and B?

   _____

   How **do you know that?** _____

2. If A*B is **positive** and A+B is **negative**, ***what*** do you know about the *signs* (+ or –) of A and B?

   _____

   How **do you know that?** _____

Run the program NUMPAIRS, choosing the option `3:SUM=0`.
After you have a suitable score, answer these questions:

If the sum of two numbers is zero, ***what*** **do you know about** the two numbers? (For example, what do you know about their product?)

_____

How **do you know that?** _____

Run the program NUMPAIRS, choosing the option `4:PRODUCT<0`.
After you have a suitable score, answer these questions:

1. If A*B is **negative**, ***what*** do you know about the *signs* (+ or –) of A and B?

   _____

   How **do you know that?** _____

2. If A*B is **negative** and A+B is **negative**, ***what*** do you know about the *signs* (+ or –) of A and B?

   _____

   How **do you know that?** _____

3. If A*B is **negative** and A+B is **positive**, ***what*** do you know about the *signs* (+ or –) of A and B?

   _____

   How **do you know that?** _____

Diamond Problems

Another name for finding the pair of numbers is called “diamond problems”.
They have various levels of difficulty:

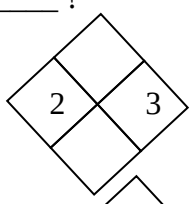
- Level 1 – given the pair, find the sum and product.
  A worksheet builder at https://www.worksheetworks.com/math/diamond-problems.html will create Level 1 diamond problems that you can print for students.
  Or, if students want Internet practice, they can go to
  http://emathlab.com/Algebra/DiamondProblems/BBallDiamondLev1.php
- Level 2 – given one of the pairs and either a sum or product, find the missing pieces.
  This is available at http://emathlab.com/Algebra/DiamondProblems/BBallDiamondLev2.php
- Level 3 – given the sum or product, find the number pairs
  Also available at http://emathlab.com/Algebra/DiamondProblems/BBallDiamondLev2.php
  The advantage of the NUMPAIRS program is that you can specify the kinds of products and sums.

Alternatively, a “low tech” option can be used with the following student handouts.
Feel free to use or adapt.

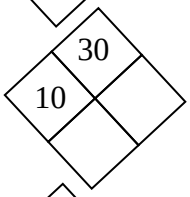
Later in the course, students will need to expand something like $(x + 1)(x+6)$ to create a trinomial.
The calculator program TRNMLFUN enables students to practice various levels of this skill.

Question shells can be used to elicit how students are thinking about the connections.
The shell below is provided, and *students* (as opposed to the teacher) create appropriate questions to complete the blanks. This open question activity can

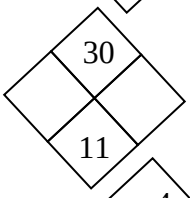
What is similar about _____ and _____ ?

For example, below are possibilities:
What is similar about solving diamond problems such as 

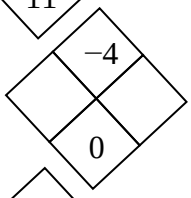
and finding $(x+2)(x+3)$?

What is similar about solving diamond problems such as 

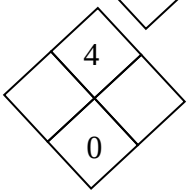
and completing the blanks to write
$(x + 10)(x + ___) = x^2 + ___\, x + 30$?

What is similar about solving diamond problems such as 

and factoring $x^2 + 11x + 30$?

What is similar about solving diamond problems such as 

and factoring $x^2 - 4$?

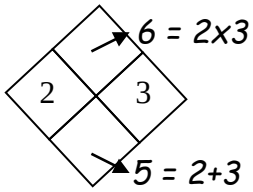
What is similar about solving diamond problems such as 

and trying to factor $x^2 + 4$?

Diamond Problems Level 1

Complete these problems by filling in remaining squares.
The product of the pair is in the north square.
The sum of the pair is in the south square.

Example:



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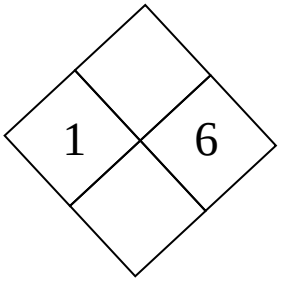

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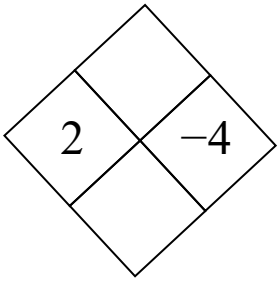

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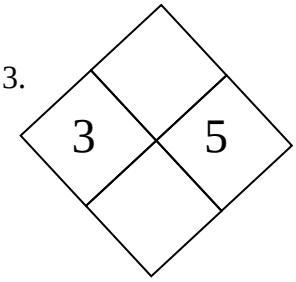

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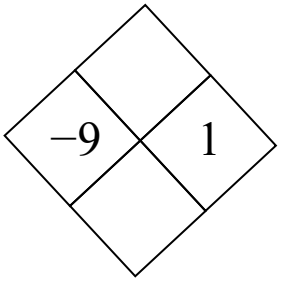

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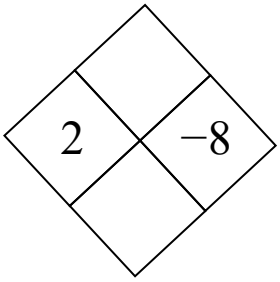

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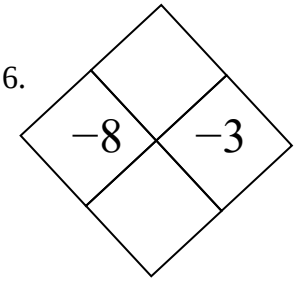

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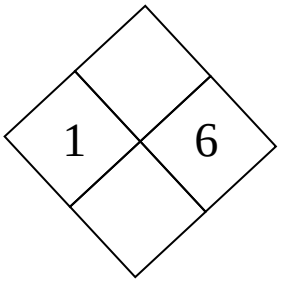

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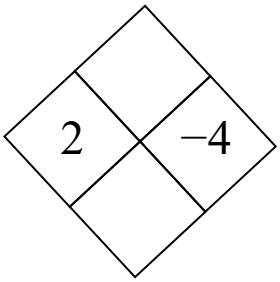

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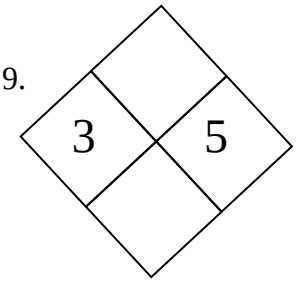

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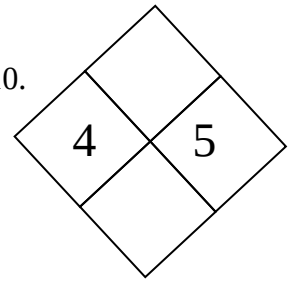

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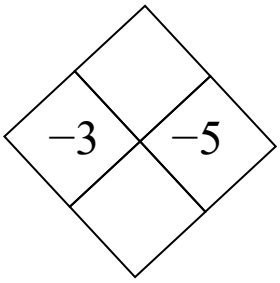

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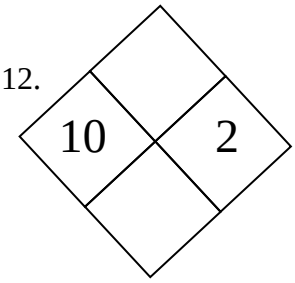
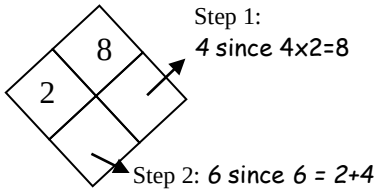


Diamond Problems Level 2

Complete these problems by filling in remaining squares.

Example:



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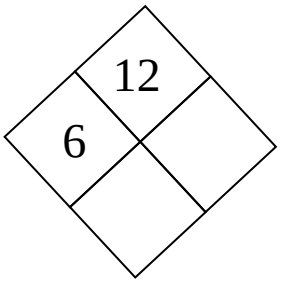

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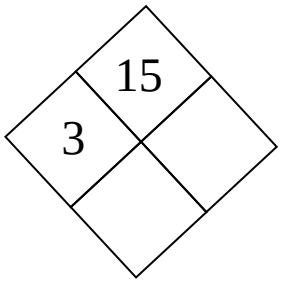

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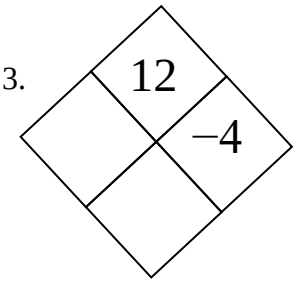

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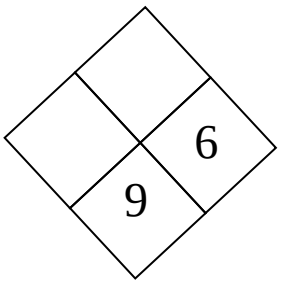

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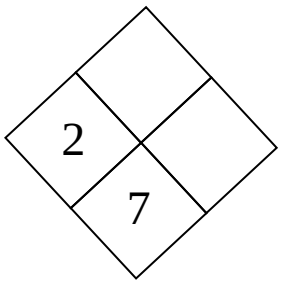

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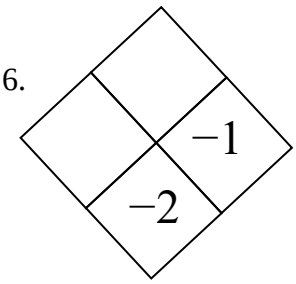

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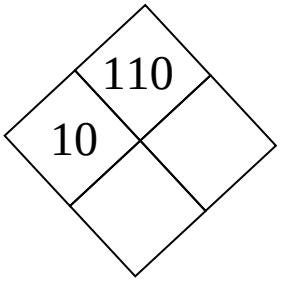

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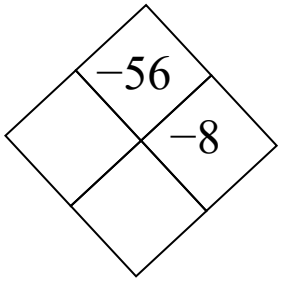

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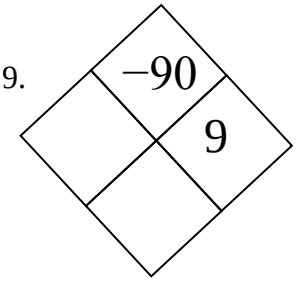

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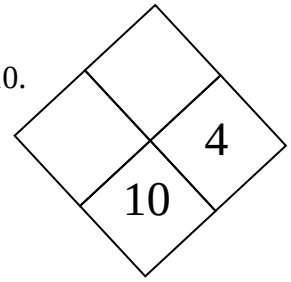

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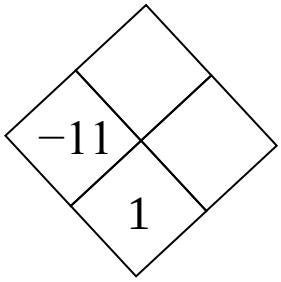

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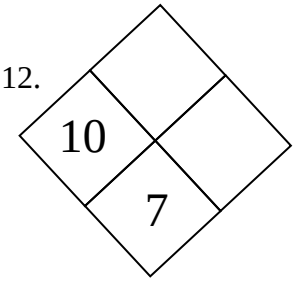
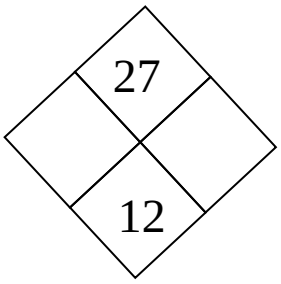


Diamond Problems Level 3

Complete these problems by filling in remaining squares.

1.



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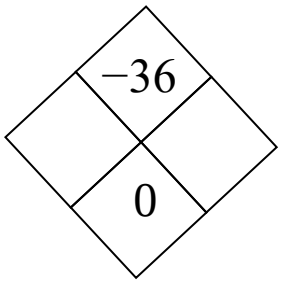

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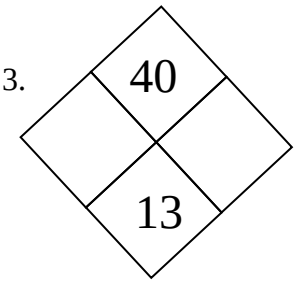

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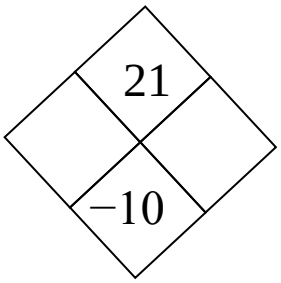

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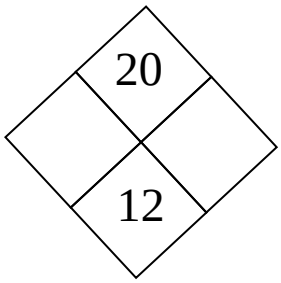

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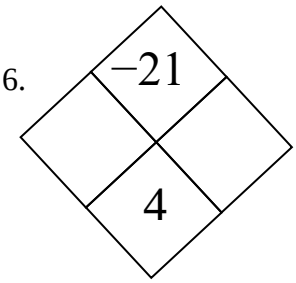

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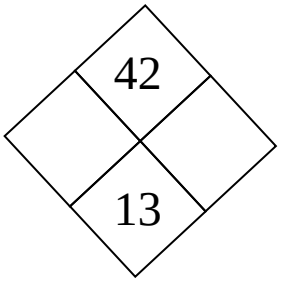

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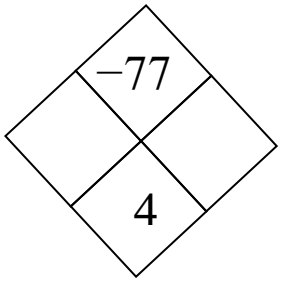

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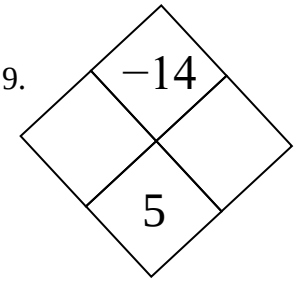

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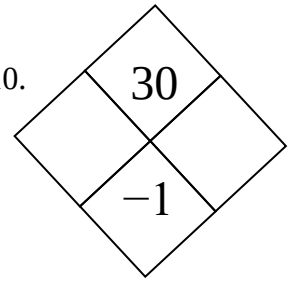

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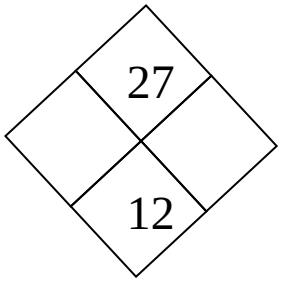
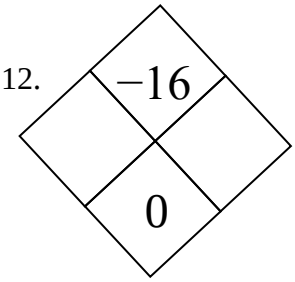
12.