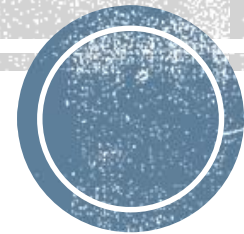


Factoring Trinomials

$$x^2 + bx + c$$

Lesson 7.7



Essential Question How can you factor the trinomial $x^2 + bx + c$ into the product of two binomials?

Consider the polynomial $x^2 + bx + c$, where b and c are integers. To factor this polynomial as $(x + p)(x + q)$, you need to find integers p and q such that $p + q = b$ and $pq = c$.

Key Idea

Factoring $x^2 + bx + c$ When c Is Positive

Algebra $x^2 + bx + c = (x + p)(x + q)$ when $p + q = b$ and $pq = c$.

When c is positive, p and q have the same sign as b .



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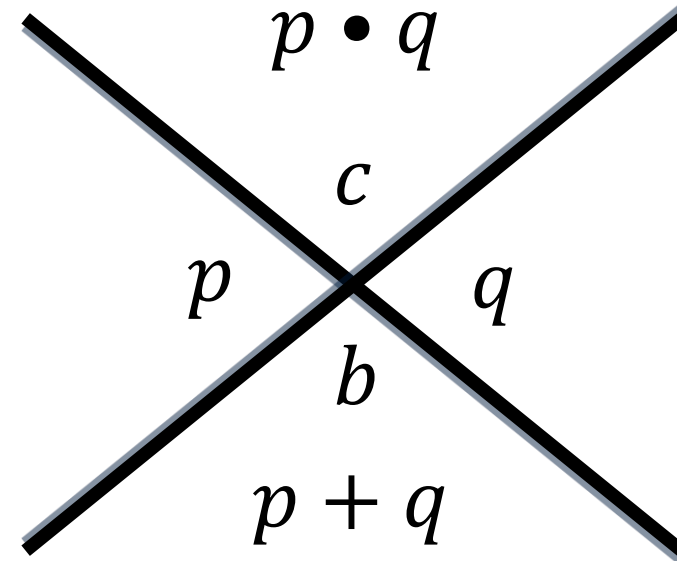
Algebra $x^2 + bx + c = (x + p)(x + q)$ when $p + q = b$ and $pq = c$.

When c is positive, p and q have the same sign as b .

Examples $x^2 + 6x + 5 = (x + 1)(x + 5)$

$$x^2 - 6x + 5 = (x - 1)(x - 5)$$



EXAMPLE**1****Factoring $x^2 + bx + c$ When b and c Are Positive****Factor $x^2 + 10x + 16$.**Notice that $b = 10$ and $c = 16$.Find two factors of 16 that when **multiplied** together give the **top** number, and when **added** together give the **bottom** number.**The Magic X**

EXAMPLE**1****Factoring $x^2 + bx + c$ When b and c Are Positive****Factor $x^2 + 10x + 16$.**Notice that $b = 10$ and $c = 16$.

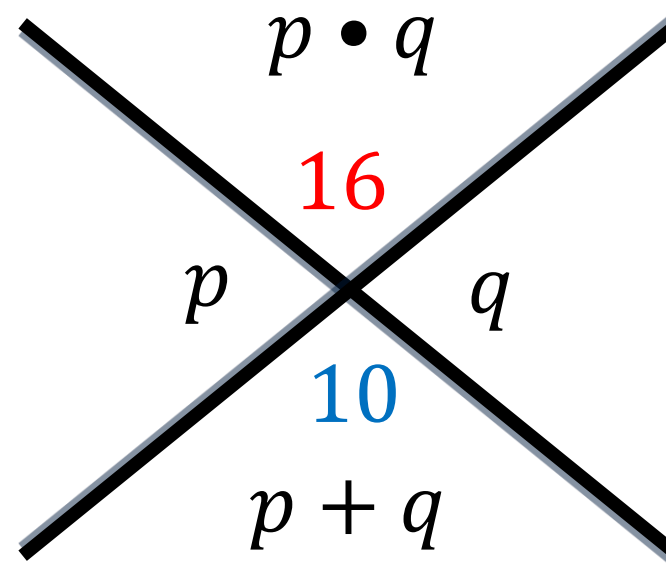
Find two factors of 16 that when **multiplied** together give the **top** number, and when **added** together give the **bottom** number.

Factors of 16:

$$1, 16 = 17$$

$$2, 8 = 10$$

$$4, 4 = 8$$

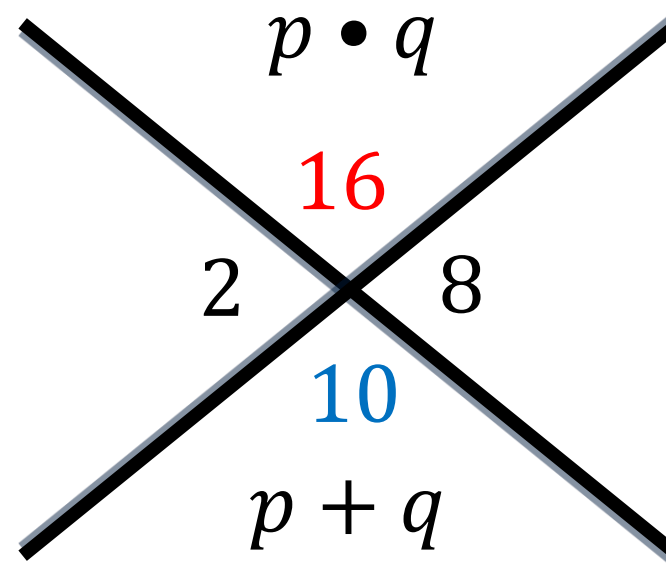
The Magic X

EXAMPLE**1****Factoring $x^2 + bx + c$ When b and c Are Positive****Factor $x^2 + 10x + 16$.**Notice that $b = 10$ and $c = 16$.Find two factors of 16 that when **multiplied** together give the **top** number, and when **added** together give the **bottom** number.**Factors of 16:**

$$1, 16 = 17$$

$$2, 8 = 10$$

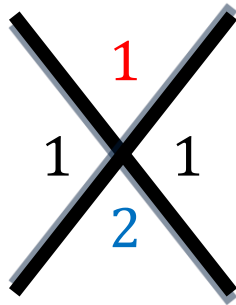
$$4, 4 = 8$$

The Magic XWhen c is positive, p and q have the same sign as b .Factored Form: $(x + 2)(x + 8)$ 

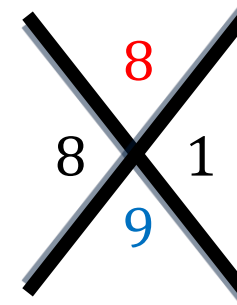
● On Your Own

Factor the polynomial.

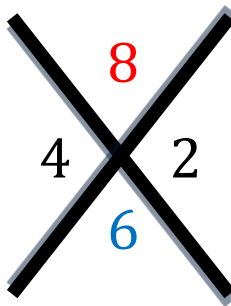
1. $x^2 + 2x + 1 = (x + 1)(x + 1)$



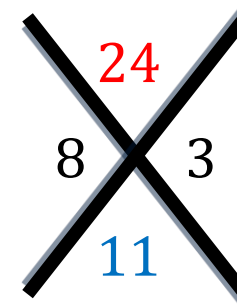
2. $x^2 + 9x + 8 = (x + 8)(x + 1)$



3. $y^2 + 6y + 8 = (y + 4)(y + 2)$



4. $z^2 + 11z + 24 = (z + 8)(z + 3)$

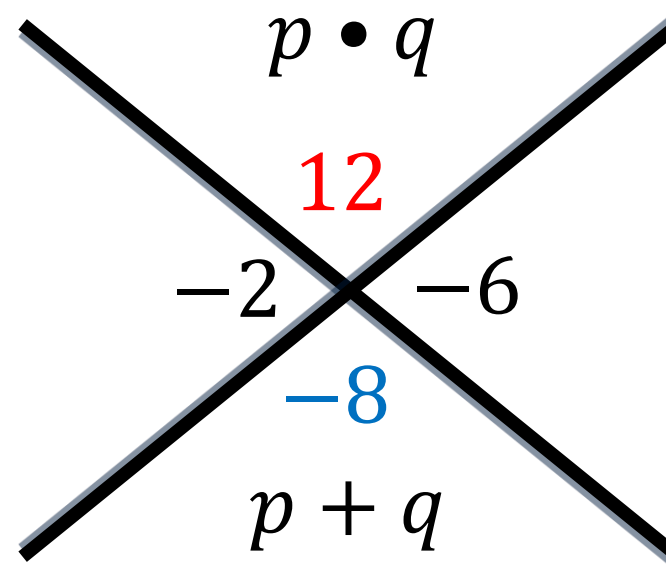


EXAMPLE**2****Factoring $x^2 + bx + c$ When b Is Negative and c Is Positive****Factor $x^2 - 8x + 12$.**Notice that $b = -8$ and $c = 12$.Find two negative factors of 12 that when **multiplied** together equals **positive 12**, and when **added** equals **negative 8**.**Factors of 12:**

$$-1, -12 = -13$$

$$\textcircled{-2, -6} = -8$$

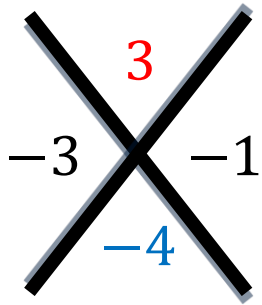
$$-3, -4 = -7$$

The Magic XWhen c is positive, p and q have the same sign as b .Factored Form: $(x - 2)(x - 6)$ 

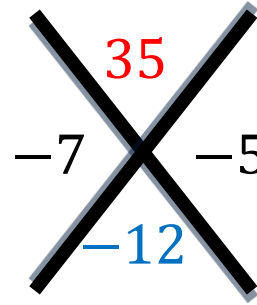
On Your Own

Factor the polynomial.

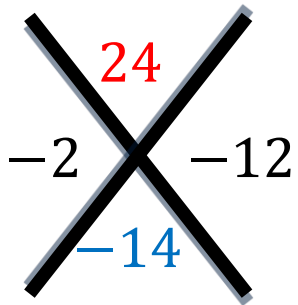
5. $w^2 - 4w + 3 = (w - 3)(w - 1)$



6. $n^2 - 12n + 35 = (n - 7)(n - 5)$



7. $x^2 - 14x + 24 = (x - 2)(x - 12)$



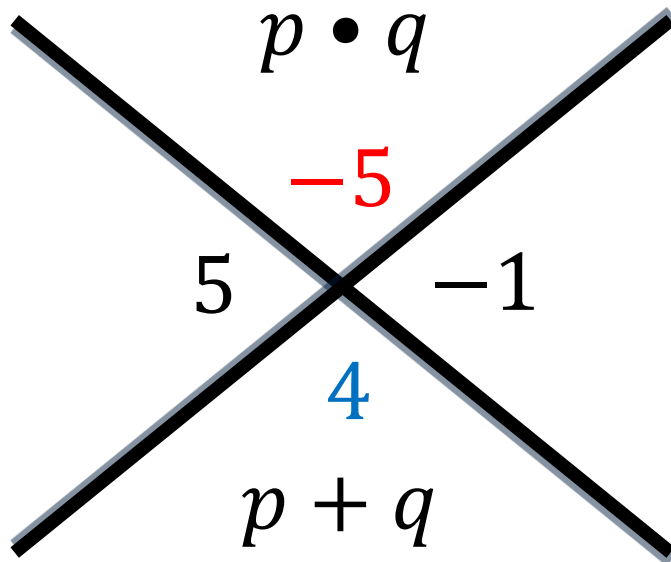
Key Idea

Factoring $x^2 + bx - c$

If the middle term is positive and the last term is negative, then one factor is negative and the other factor is positive. The larger number must be positive.

Example $x^2 + 4x - 5$

The Magic X



$$= (x + 5)(x - 1)$$



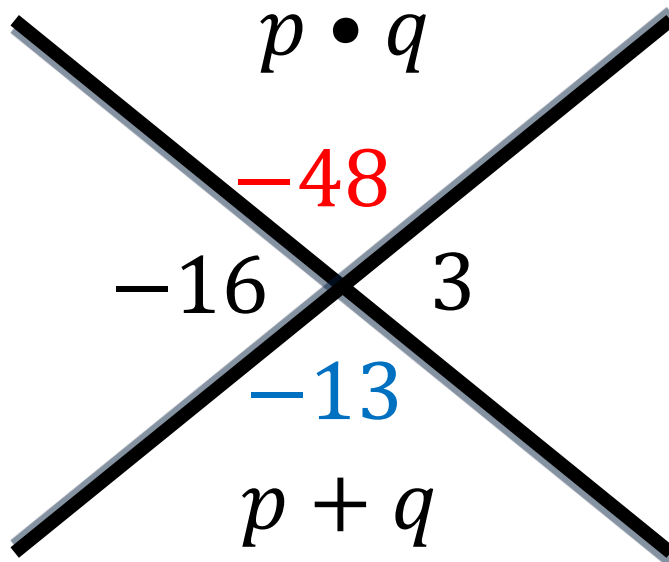
Key Idea

Factoring $x^2 - bx - c$

If the middle term is negative and the last term is negative, then one factor is negative and the other factor is positive. The larger number must be negative.

Example $x^2 - 13x - 48$

The Magic X



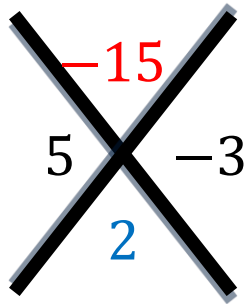
$$= (x - 16)(x + 3)$$



On Your Own

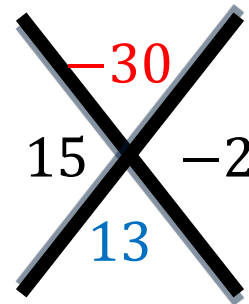
Factor the polynomial.

8. $x^2 + 2x - 15 = (x + 5)(x - 3)$



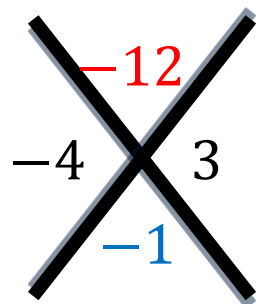
A diagram illustrating the AC method for factoring the polynomial $x^2 + 2x - 15$. It shows a large 'X' shape. The top-left branch is labeled -15 in red. The top-right branch is labeled -3 in black. The bottom-left branch is labeled 5 in black. The bottom-right branch is labeled 2 in blue.

9. $y^2 + 13y - 30 = (y + 15)(y - 2)$



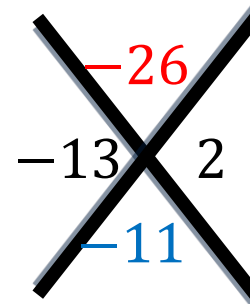
A diagram illustrating the AC method for factoring the polynomial $y^2 + 13y - 30$. It shows a large 'X' shape. The top-left branch is labeled -30 in red. The top-right branch is labeled -2 in black. The bottom-left branch is labeled 15 in black. The bottom-right branch is labeled 13 in blue.

10. $z^2 - z - 12 = (z - 4)(z + 3)$



A diagram illustrating the AC method for factoring the polynomial $z^2 - z - 12$. It shows a large 'X' shape. The top-left branch is labeled -12 in red. The top-right branch is labeled 3 in black. The bottom-left branch is labeled -4 in black. The bottom-right branch is labeled -1 in blue.

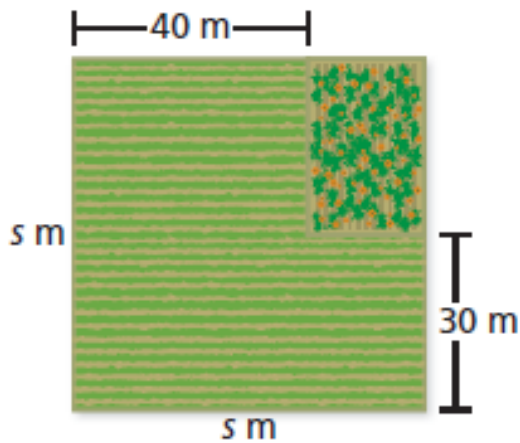
11. $m^2 - 11m - 26 = (m - 13)(m + 2)$



A diagram illustrating the AC method for factoring the polynomial $m^2 - 11m - 26$. It shows a large 'X' shape. The top-left branch is labeled -26 in red. The top-right branch is labeled 2 in black. The bottom-left branch is labeled -13 in black. The bottom-right branch is labeled -11 in blue.



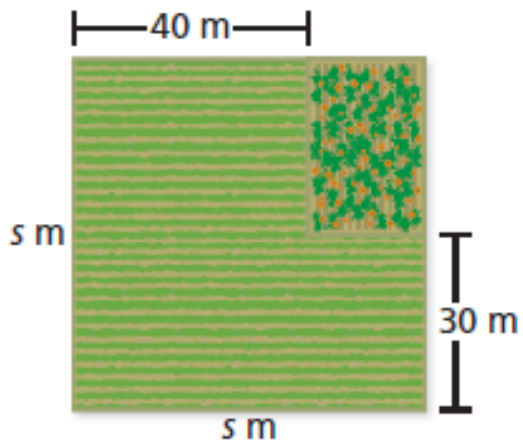
Real-Life Application



A farmer plants a rectangular pumpkin patch in the northeast corner of the square plot of land. The area of the pumpkin patch is 600 square meters. What is the area of the square plot of land?



Real-Life Application

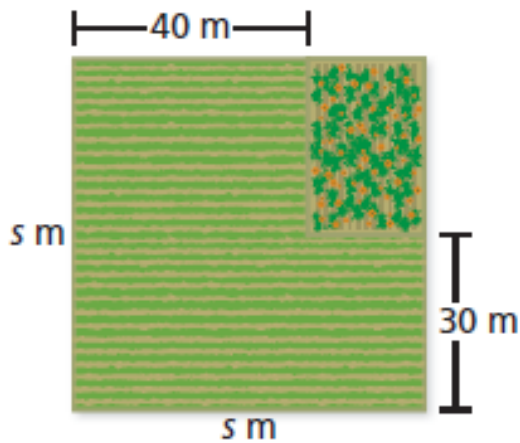


A farmer plants a rectangular pumpkin patch in the northeast corner of the square plot of land. The area of the pumpkin patch is 600 square meters. What is the area of the square plot of land?

The length of the pumpkin patch is $(s - 30)$ meters and the width is $(s - 40)$ meters. Write and solve an equation for its area.



Real-Life Application



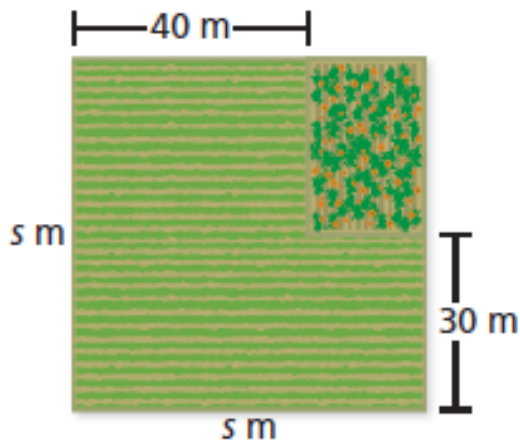
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$$600 = (s - 30)(s - 40)$$



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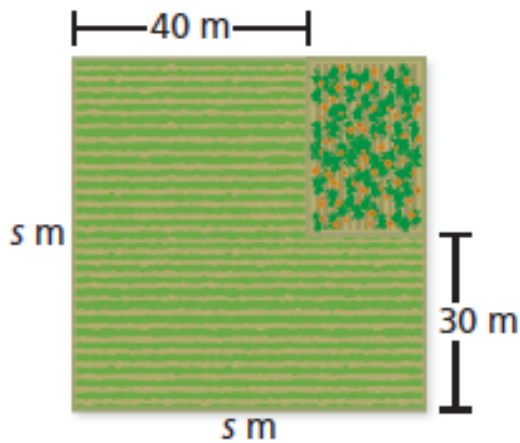
The length of the pumpkin patch is $(s - 30)$ meters and the width is $(s - 40)$ meters. Write and solve an equation for its area.

$$600 = (s - 30)(s - 40)$$

$$600 = s^2 - 70s + 1200$$



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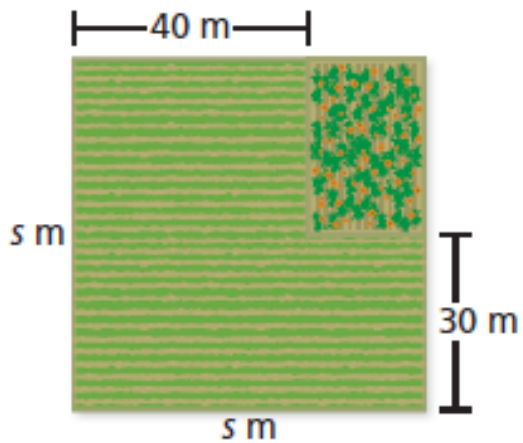
$$600 = (s - 30)(s - 40)$$

$$600 = s^2 - 70s + 1200$$

$$0 = s^2 - 70s + 600$$



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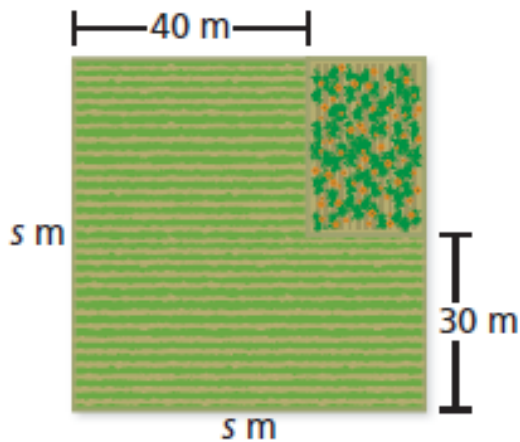
$$600 = s^2 - 70s + 1200$$

$$0 = s^2 - 70s + 600$$

$$0 = (s - 10)(s - 60)$$



Real-Life Application



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$$600 = (s - 30)(s - 40)$$

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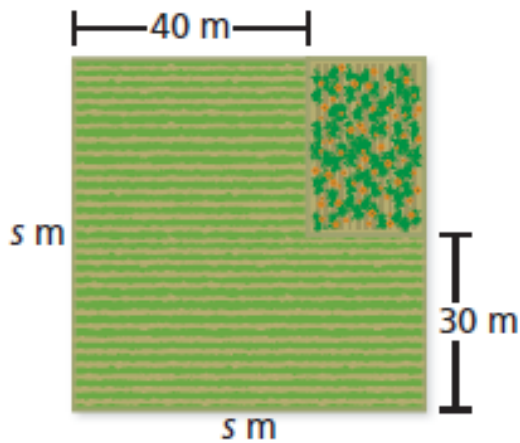
$$0 = s^2 - 70s + 600$$

$$0 = (s - 10)(s - 60)$$

$$s - 10 = 0 \quad \text{or} \quad s - 60 = 0$$



Real-Life Application



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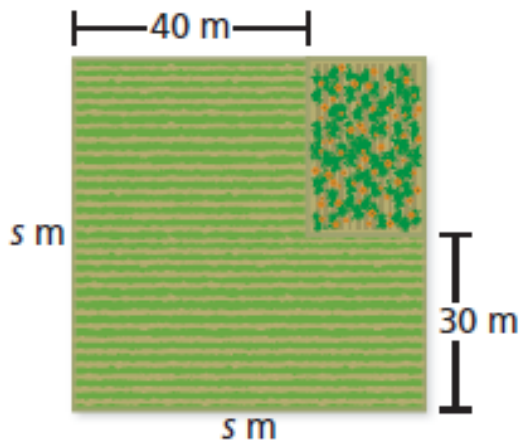
$$0 = (s - 10)(s - 60)$$

$$s - 10 = 0 \quad \text{or} \quad s - 60 = 0$$

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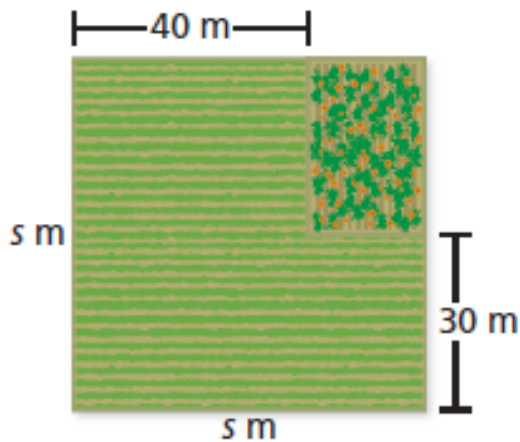
$$s - 10 = 0 \quad \text{or} \quad s - 60 = 0$$

$$s = 10 \quad \text{or} \quad s = 60$$

The diagram shows that the side length is at least 30 meters, so 10 meters does not make sense in this situation. The width is 60 meters.



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$$0 = s^2 - 70s + 600$$

$$0 = (s - 10)(s - 60)$$

$$s - 10 = 0 \quad \text{or} \quad s - 60 = 0$$

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The diagram shows that the side length is at least 30 meters, so 10 meters does not make sense in this situation. The width is 60 meters.

So the area of the plot of land is $60(60) = 3600$ square meters.



Summary

Factoring $x^2 + bx + c$ as $(x + p)(x + q)$

The diagram shows the relationships between the signs of b and c and the signs of p and q .

