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# 7.4 Factoring $x^2 + bx + c$

**For use with Exploration 7.4**

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

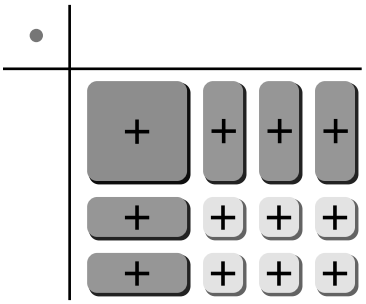
## 1 EXPLORATION: Finding Binomial Factors

**Go to *BigIdeasMath.com* for an interactive tool to investigate this exploration.**

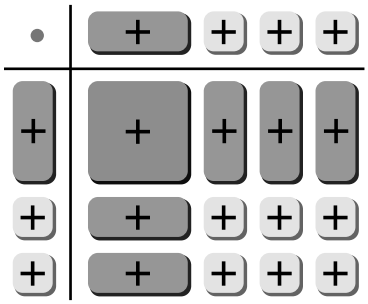
**Work with a partner.** Use algebra tiles to write each polynomial as the product of two binomials. Check your answer by multiplying.

**Sample** $x^2 + 5x + 6$

**Step 1** Arrange algebra tiles that model $x^2 + 5x + 6$ into a rectangular array.



**Step 2** Use additional algebra tiles to model the dimensions of the rectangle.

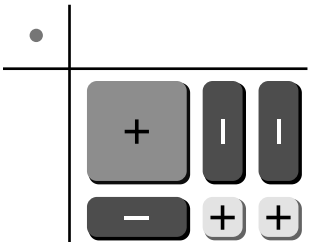


**Step 3** Write the polynomial in factored form using the dimensions of the rectangle.

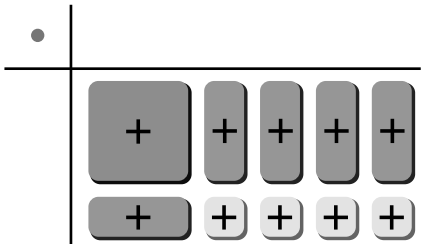
width length

Area = $x^2 + 5x + 6 = (x + 2)(x + 3)$

**a.** $x^2 - 3x + 2 =$ _____



**b.** $x^2 + 5x + 4 =$ _____



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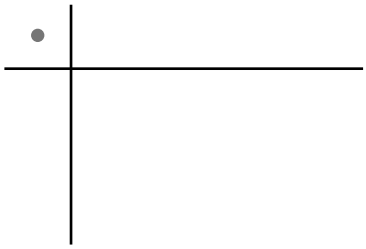
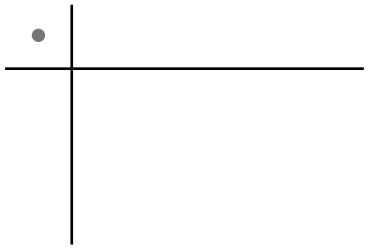
## 7.4 Factoring $x^2 + bx + c$ (continued)

### 1 EXPLORATION: Finding Binomial Factors (continued)

**c.** $x^2 - 7x + 12 =$ _____



**d.** $x^2 + 7x + 12 =$ _____



## Communicate Your Answer

**2.** How can you use algebra tiles to factor the trinomial $x^2 + bx + c$ into the product of two binomials?

**3.** Describe a strategy for factoring the trinomial $x^2 + bx + c$ that does not use algebra tiles.

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# 7.4 Practice

**For use after Lesson 7.4**

## Core Concepts

### 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 $b$.

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

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

**Notes:**

### Factoring $x^2 + bx + c$ When $c$ Is Negative

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

When $c$ is negative, $p$ and $q$ have different signs.

**Example** $x^2 - 4x - 5 = (x + 1)(x - 5)$

**Notes:**

## Worked-Out Examples

### Example #1

**Factor the polynomial.**

$s^2 + 3s - 40$

| **Factors of −40** | −1, 40 | 1, −40 | −2, 20 | 2, −20 | −4, 10 | 4, −10 | −5, 8 | 5, −8 |
|---|---|---|---|---|---|---|---|---|
| **Sum of factors** | 39 | −39 | 18 | −18 | 6 | −6 | 3 | −3 |

So, $s^2 + 3s - 40 = (s - 5)(s + 8)$.

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**7.4 Practice (continued)**

### Example #2

**Solve the equation.**

$$b^2 + 5 = 8b - 10$$
$$b^2 + 5 - 8b = 8b - 8b - 10$$
$$b^2 - 8b + 5 = -10$$
$$b^2 - 8b + 5 + 10 = -10 + 10$$
$$b^2 - 8b + 15 = 0$$
$$(b - 3)(b - 5) = 0$$

| **Factors of 15** | $-1, -15$ | $-3, -5$ |
|---|---|---|
| **Sum of factors** | $-16$ | $-8$ |

$b - 3 = 0$ *or* $b - 5 = 0$

$+3 \quad +3$ $+5 \quad +5$

$b = 3$ $b = 5$

The roots are $b = 3$ and $b = 5$.

## Practice A

**In Exercises 1–12, factor the polynomial.**

**1.** $c^2 + 8c + 7$

**2.** $a^2 + 16a + 64$

**3.** $x^2 + 11x + 18$

**4.** $d^2 + 6d + 8$

**5.** $s^2 + 11s + 10$

**6.** $u^2 + 10u + 9$

**7.** $b^2 + 3b - 54$

**8.** $y^2 - y - 2$

**9.** $u^2 + 3u - 18$

**10.** $z^2 - z - 56$

**11.** $h^2 + 2h - 24$

**12.** $f^2 - 3f - 40$

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## 7.4 Practice (continued)

**In Exercises 13–18, solve the equation.**

**13.** $g^2 - 13g + 40 = 0$

**14.** $k^2 - 5k + 6 = 0$

**15.** $w^2 - 7w + 10 = 0$

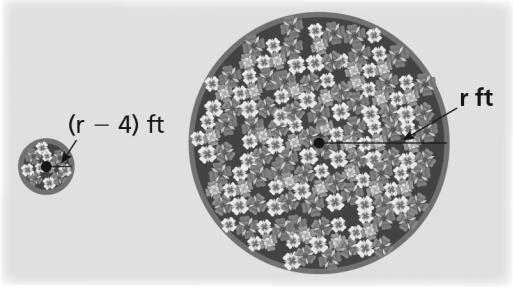
**16.** $x^2 - x = 30$

**17.** $r^2 - 3r = -2$

**18.** $t^2 - 7t = 8$

**19.** The area of a right triangle is 16 square miles. One leg of the triangle is 4 miles longer than the other leg. Find the length of each leg.

**20.** You have two circular flower beds, as shown. The sum of the areas of the two flower beds is $136\pi$ square feet. Find the radius of each bed.



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# Practice B

**In Exercises 1–12, factor the polynomial.**

**1.** $x^2 + 5x + 4$

**2.** $w^2 + 9w + 14$

**3.** $y^2 + 15y + 36$

**4.** $x^2 - 14x + 45$

**5.** $j^2 - 16j + 39$

**6.** $m^2 - 19m + 90$

**7.** $y^2 + 2y - 35$

**8.** $w^2 - 8w - 20$

**9.** $b^2 - b - 30$

**10.** $p^2 - 6p - 27$

**11.** $q + q^2 - 56$

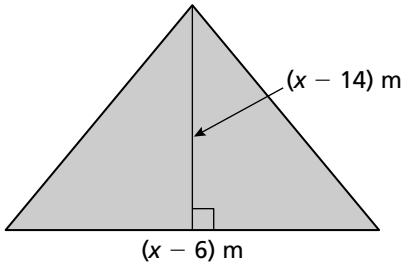
**12.** $-36 + t^2 + 5t$

**13.** Describe and correct the error in factoring the polynomial.

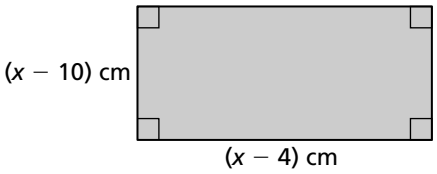
$$x^2 + 4x - 96 = (x - 12)(x + 8)$$

**In Exercises 14 and 15, find the dimensions of the polygon with the given area.**

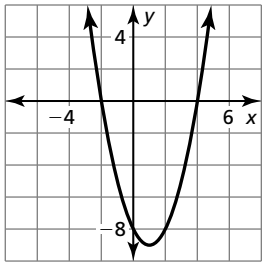
**14.** Area $= 120$ m$^2$




**15.** Area $= 55$ cm$^2$




**16.** The graph shows $y = x^2 - 2x - 8$.




**a.** Explain how you can use the graph to factor the polynomial.

**b.** Factor the polynomial.