

# 5.3-Factoring Quadratic Expressions

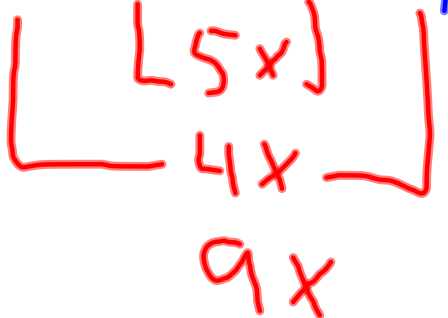
**Factoring**  $x^2 + bx + c$

To factor an expression of the form  $x^2 + bx + c$  where  $a = 1$ , look for integers  $r$  and  $s$  such that  $r \cdot s = c$  and  $r + s = b$ . Then factor the expression.

$$x^2 + bx + c = (x + r)(x + s)$$

**Example:**

$$x^2 + 9x + 20 = (x + 5)(x + 4)$$



## Factoring the Difference of Two Squares

$$a^2 - b^2 = (a + b)(a - b)$$

Example:

$$9x^2 - 49 = (3x + 7)(3x - 7)$$

## Factoring Perfect-Square Trinomials

$$a^2 + 2ab + b^2 = (a + b)^2$$

$$a^2 - 2ab + b^2 = (a - b)^2$$

Example:

$$x^2 + 6x + 9 = (x + 3)(x + 3) = (x + 3)^2$$

$$x^2 - 6x + 9 = (x - 3)(x - 3) = (x - 3)^2$$

## Zero-Product Property

If  $pq = 0$ , then  $p = 0$  or  $q = 0$ .

**Example:** Find the zeros of each function

a)  $h(x) = 3x^2 + 12x$

$$3x(x+4) = 0$$

$$x = 0, -4$$

$$3x = 0$$

$$x + 4 = 0$$

b)  $j(x) = x^2 + 4x - 21$

$$(x+7)(x-3) = 0$$

$$x = -7, 3$$

$$ax^2 + bx + c$$

$$(+)(+)$$

$$ax^2 + bx - c$$

or

$$ax^2 - bx - c$$

$$(+)(-)$$

$$ax^2 - bx + c$$

$$(-)(-)$$

$$3x^2 + 6x + 3 = 0$$

$$(3x + 3)(x + 1)$$

$$\begin{array}{c} \text{L } 3x \text{ J} \\ \text{L } 3x \text{ J} \end{array}$$

$$6x$$

$$x = -1$$

$$3(x^2 + 2x + 1)$$

$$3(x + 1)(x + 1)$$

$$x = -1$$

# Homework

Pg. 296-297 #48-66 even, 82-86 even, 98-102 even

$$48) x^2 - 10x - 56$$

$$(x+4)(x-14)$$

$$50) -x^2 + x + 30$$

$$-(x^2 - x - 30)$$

$$-(x+5)(x-6)$$



$$56) 12x^2 - 3x - 9$$

$$3(4x^2 - x - 3)$$

$$3(x - 1)(4x + 3)$$

$$58) 15x^2 = 7x + 2$$

↓

$$15x^2 - 7x - 2 = 0$$

$$(5x + 1)(3x - 2) = 0$$

Red annotations: A bracket under  $(5x + 1)$  is connected to  $-10x$ . A bracket under  $(3x - 2)$  is connected to  $-7x$ . A bracket under  $(3x - 2)$  is also connected to  $-12x$ . The terms  $-10x$ ,  $-12x$ , and  $-7x$  are written in red below the brackets.

$$x = -\frac{1}{5}, \frac{2}{3}$$

$$60) \quad 4x - 4 = -15x^2$$

$+15x^2$                        $+15x^2$

$$15x^2 + 4x - 4 = 0$$

$$(5x - 2)(3x + 2) = 0$$

$$x = \frac{2}{5}, -\frac{2}{3}$$

$$66) x^4 - 81 = 0$$

$$(x^2 + 9)(x^2 - 9) = 0$$

$$(x^2 + 9)(x + 3)(x - 3) = 0$$

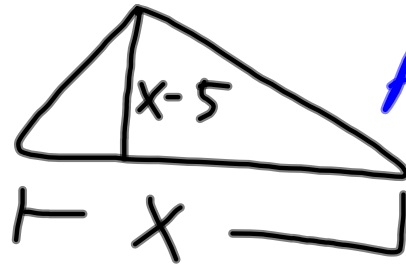
$$x = -3, 3$$

$$84) f(x) = x^2 + 8x + 12$$

$$(x+6)(x+2) = 0$$

$$x = -6, -2$$

98)



$$A = \frac{1}{2} b h$$

$$2 \left[ \frac{1}{2} (x) (x-5) = 12 \right]$$

$$x(x-5) = 24$$

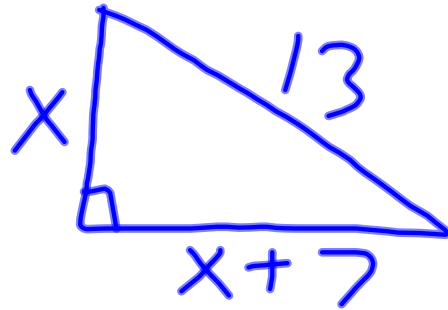
$$x^2 - 5x = 24$$

$$x^2 - 5x - 24 = 0$$

$$(x+3)(x-8) = 0$$

$x \Rightarrow 8$

100)



$$(x+7)(x+7)$$
$$x^2 + 7x + 7x + 49$$

$$x^2 + (x+7)^2 = 13^2$$

$$x^2 + x^2 + 14x + 49 = 169$$

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$$\frac{1}{2} [2x^2 + 14x - 120 = 0]$$

$$x^2 + 7x - 60 = 0$$

$$(x+12)(x-5) = 0$$

$$x = -12, 5$$

$$102) \quad h(T) = -16T^2 + 180T$$

$$0 = -16T^2 + 180T$$

$$0 = 4T(-4T + 45)$$

$$T = 0, \quad 11.25 \text{ sec.}$$