Sec. 9.4 Factoring to Solve Quadratic Equations

Zero Product Property

If $ab = 0$, then $a = 0$ or $b = 0$ for all real numbers a and b.

Problem 1:

What is the solution of the equation

a. $(2x + 3)(x - 1) = 0$?

"a" $2x + 3 = 0$

$-3 \quad -3$

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

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

"b" $x - 1 = 0$

$+1 \quad +1$

$x = 1$

b. $(x - 1)(x + 5) = 0$

$x - 1 = 0$

$+1 \quad +1$

$x = 1$

$x + 5 = 0$

$-5 \quad -5$

$x = 5$

c. $(7n - 2)(5n + 4) = 0$

$7n - 2 = 0$

$+2 \quad +2$

$\frac{7n}{7} = \frac{2}{7}$

$n = \frac{2}{7}$

$5n + 4 = 0$

$-4 \quad -4$

$\frac{5n}{5} = \frac{-4}{5}$

$n = -\frac{4}{5}$

Problem 2: Solve

a. $x^2 - x - 12 = 0$

-12: $1 \cdot 12$, $2 \cdot 6$, $3 \cdot 4$

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

$x+3=0$ $\quad x-4=0$

$-3\ -3$ $\quad +4\ +4$

$\boxed{x=-3}$ $\quad \boxed{x=4}$

b. $m^2 - 5m - 14 = 0$

-14: $1 \cdot 14$, $2 \cdot 7$

$(m+2)(m-7)=0$

$m+2=0$ $\quad m-7=0$

$-2\ -2$ $\quad +7\ +7$

$\boxed{m=-2}$ $\quad \boxed{m=7}$

c. $p^2 + p - 20 = 0$

-20: $1 \cdot 20$, $2 \cdot 10$, $-4 \cdot 5$

$(p-4)(p+5)=0$

$p-4=0$ $\quad p+5=0$

$+4\ +4$ $\quad -5\ -5$

$\boxed{p=4}$ $\quad \boxed{p=-5}$

d. $2a^2 - 15a + 18 = 0$

36: $1 \cdot 36$, $2 \cdot 18$, $\boxed{-3 \cdot -12}$, $4 \cdot 9$

$2a^2 - 3a - 12a + 18 = 0$

$a(2a-3) - 6(2a-3) = 0$

$(2a-3)(a-6)=0$

$2a-3=0$ $\quad a-6=0$

$+3\ +3$ $\quad +6\ +6$

$\frac{2a}{2} = \frac{3}{2}$ $\quad \boxed{a=6}$

$\boxed{a=\frac{3}{2}}$

Problem 3: Solve.

a. $3x^2+13x=-4$

$+4 \quad +4$

$3x^2+13x+4=0$

$3x^2+1x+12x+4=0$

$x(3x+1)+4(3x+1)=0$

12
1·12
2·6
3·4

$(3x+1)$

b. $x^2+14x=-49$

$+49 \quad +49$

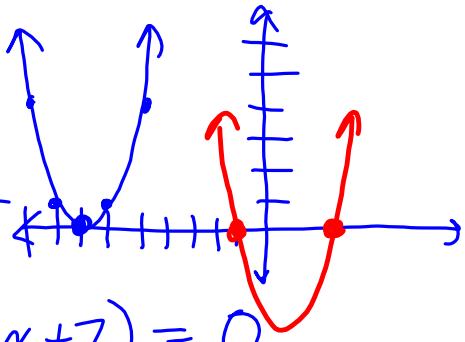
$x^2+14x+49=0$

$(x+7)^2=0 \quad (x+7)(x+7)=0$

$x+7=0$

$-7 \quad -7$

$x=-7$



c. $4x^2-21x=18$

$-18 \quad -18$

$4x^2-21x-18=0$

$4x^2+3x-24x-18=0$

$x(4x+3)-6(4x+3)=0$

$(x-6)(4x+3)=0$

$x-6=0 \quad 4x+3=0$

$+6 \quad +6 \quad -3 \quad -3$

$x=6$

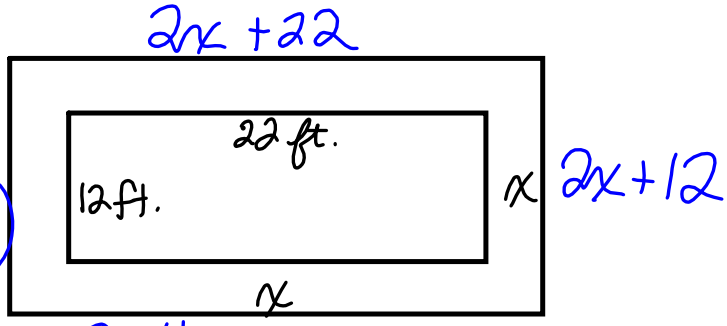
$\frac{4x}{4}=\frac{-3}{4}$

$x=-\frac{3}{4}$

−72
1·72
2·36
3·24
4·18
6·12
8 9

Problem 4:

Jason has a patio of uniform width around the perimeter of his rectangular pool. The pool measures 22 ft by 12 ft. If the area of the pool and the patio is 504 ft^2, what is the width of the patio?



$A = l \cdot w$

$504 = (2x+22)(2x+12)$

$504 = 4x^2 + 24x + 44x + 264$

$-504 \quad\quad -504$

$0 = 4x^2 + 68x - 240$

$\frac{0}{4} = \frac{4x^2}{4} + \frac{68x}{4} - \frac{240}{4}$

$0 = x^2 + 17x - 60$

$0 = (x-3)(x+20)$

$x - 3 = 0 \quad\quad x + 20 = 0$

$+3 \;+3 \quad\quad -20 \;-20$

$x = 3 \quad\quad x = -20$

3 ft

12
22
24
24
264

−60
1 · 60
2 · 30
3 · 20