Sec 9.1 The Square Root Property Completing the Square

Quadratic Equations: $ax^2 + bx + c = 0$

$3x^2 = 5x + 28$

$3x^2 - 5x - 28 = 0$

$(x - 4)(3x + 7) = 0$

$x - 4 = 0$ $\quad$ $3x + 7 = 0$

$+4 \quad +4$ $\quad$ $-7 \quad -7$

$x = 4$ $\quad$ $\frac{3x}{3} = \frac{-7}{3}$

$x = -7/3$

$x = 4, -7/3$

-84	-5
$-12, 7$	-5 ✓

$\frac{-12}{3}, \frac{7}{3}$

$-4, 7/3$

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

wont factor

what to do? To Be Cont...

Square Root Property

if $x^2 = k$ then $x = \sqrt{k}$ or $x = -\sqrt{k}$

often Shortened to $x = \pm\sqrt{k}$

$x^2 - 12 = 0$

$\sqrt{x^2} = \sqrt{12}$

$x = \pm\sqrt{12}$

$x = \pm 2\sqrt{3}$

two answers: $x = 2\sqrt{3}, -2\sqrt{3}$

Example 4

$\sqrt{(x-5)^2} = \sqrt{36}$

$x - 5 = \pm\sqrt{36}$

$x - 5 = \pm 6$

$+5 \quad +5$

$x = 5 \pm 6$ ← Not finished answer

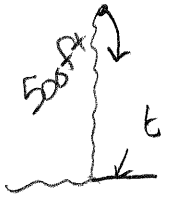
$5 + 6 \qquad 5 - 6$

$\boxed{x = 11, -1}$

#35 free falling objects $d = 16t^2$

d = distance fallen in ft

t = time in sec



$d = 500$ ft $\quad t = ?$

$\frac{500}{16} = \frac{16t^2}{16}$

$\pm\sqrt{\frac{125}{4}} = \sqrt{t^2}$

$t = \frac{\pm\sqrt{\frac{125}{4}}}{}$

$= \pm 5.6$

≈ 5.6 sec

#29 $\sqrt{(3x-1)^2} = \sqrt{7}$

$3x - 1 = \pm\sqrt{7}$

$+1 \quad +1$

$\frac{3x}{3} = \frac{1 \pm \sqrt{7}}{3}$

$\boxed{x = \frac{1 \pm \sqrt{7}}{3}}$ ← answer

$\boxed{\frac{1+\sqrt{7}}{3}, \quad \frac{1-\sqrt{7}}{3}}$

$x^2 + 4x + 2 = 0$ create $(x+a)^2 = \#$

Completing the Square

$(x+a)^2 = x^2 + 2ax + a^2$

$x^2 + 10x + 25 = (x+5)^2$

$x^2 + 2 \cdot 5x + 5^2$

$\frac{10}{2} = 5$

$(5)^2$

Ex: $x^2 + 4x + 2 = 0$

$-2 \quad -2$

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

$\frac{4}{2} = 2$

$(2)^2 = 4$

$\sqrt{(x+2)^2} = \sqrt{2}$

$x + 2 = \pm\sqrt{2}$

$-2 \quad -2$

$\boxed{x = -2 \pm \sqrt{2}}$

Ex: $x^2 - 8x + 10 = 0$

$-10 \quad -10$

$x^2 - 8x + 16 = -10 + 16$

$\sqrt{(x-4)^2} = \sqrt{6}$

$-8/2 = -4$

$(-4)^2 = 16$

$x - 4 = \pm\sqrt{6}$

$+4 \quad +4$

$x = 4 \pm \sqrt{6}$

Check

$(4+\sqrt{6})^2 - 8(4+\sqrt{6}) + 10 = 0$

$16 + 8\sqrt{6} + 6 - 32 - 8\sqrt{6} + 10 = 0$

$32 - 32 = 0$ ✓

#55 $x^2 - 2x - 24 = 0$ $\quad x = 6, -4$

$+24 \quad +24$

$x^2 - 2x + 1 = 24 + 1$

$-2/2 = -1$

$(-1)^2 = 1$

$\sqrt{(x-1)^2} = \sqrt{25}$

$x - 1 = \pm 5$

$+1 \quad +1$

$x = 1 \pm 5$ $\quad x = 1+5$ $\quad x = 1-5$

$\boxed{x = 6, -4}$

#65 $\frac{2k^2}{2} + \frac{5k}{2} - \frac{2}{2} = \frac{0}{2}$

$k^2 + \frac{5}{2}k - 1 = 0$

$5/2 \cdot 1/2 = 5/4$

$(5/4)^2 = 25/16$

$k^2 + \frac{5}{2}k + \frac{25}{16} = 1 + \frac{25}{16}$

$\sqrt{\left(k + \frac{5}{4}\right)^2} = \sqrt{\frac{41}{16}}$

$k + \frac{5}{4} = \pm\frac{\sqrt{41}}{4}$

$-5/4 \quad -5/4$

$k = \frac{-5}{4} \pm \frac{\sqrt{41}}{4}$

$k = \frac{-5 \pm \sqrt{41}}{4}$

$$\sqrt{-16} = 4i$$

#76 $\sqrt{x^2} = \sqrt{-18}$

$x = \pm\sqrt{-18}$

$= \pm i\sqrt{18}$

$\boxed{\pm 3i\sqrt{2}}$