Solving Quadratic Equations by the Square Root Property

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Review – Solve by Factoring

$x^2 = 25$ $x^2 - 25 = 0$ $(x-5)(x+5) = 0$ $x-5=0$ or $x+5=0$ $x=5$ $x=-5$ $\{5, -5\}$

$x^2 = 36$ $x^2 - 36 = 0$ $(x-6)(x+6) = 0$ $x-6=0$ or $x+6=0$ $x=6$ $x=-6$ $\{-6, 6\}$

$x^2 = 4$ $\{-2, 2\}$ $x^2 - 4 = 0$ $(x+2)(x-2) = 0$ $x+2=0$ or $x-2=0$ $x=-2$ $x=2$

Square Root Property

If k is a real number and if $x^2 = k$, then $x = \pm\sqrt{k}$ ($x = \sqrt{k}$ or $x = -\sqrt{k}$).

$x^{\sqrt{2}} = 25$
$x = \pm\sqrt{25}$
$x = \pm 5$

Solve using the Square Root Property

$x^2 = k$, $x = \pm\sqrt{k}$

$x^2 - 9 = 0 \Rightarrow x^2 = 9 \Rightarrow x = \pm\sqrt{9}$

$x = \pm 3$ $\{-3, 3\}$

$x^2 = 7 \Rightarrow x = \pm\sqrt{7}$ $\{\sqrt{7}, -\sqrt{7}\}$

$x^2 + 4 = 0 \Rightarrow x^2 = -4$

$-4 \quad -4$

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

$x = \pm 2i$ $\{-2i, 2i\}$

More Examples

$x^2 = k$

$3y^2 - 24 = 0 \Rightarrow 3y^2 = 24$

$y^2 = 8 \Rightarrow y = \pm\sqrt{8}$

$y = \pm\sqrt{4 \cdot 2} = \pm 2\sqrt{2}$ $\{2\sqrt{2}, -2\sqrt{2}\}$

$(x-1)^2 = 16 \Rightarrow x - 1 = \pm\sqrt{16}$

$x - 1 = \pm 4$

$x = 1 \pm 4$

$x = 1 + 4$ or $x = 1 - 4$

$x = 5$ $\quad x = -3$ $\{-3, 5\}$

$(x+2)^2 = 5 \Rightarrow x + 2 = \pm\sqrt{5}$

$x = -2 \pm \sqrt{5}$

$x = -2 + \sqrt{5}$ $\quad x = -2 - \sqrt{5}$

Application

The area of a circle is given by $A = \pi r^2$.
If a circle has area of 81π square inches,
what is its radius?

$\frac{81\pi}{\pi} = \frac{\pi r^2}{\pi}$

$81 = r^2$

$\pm\sqrt{81} = r$

$\pm 9 = r$

radius is 9 or ~~-9~~

9 inches

Application

The amount A that P dollars invested at an annual interest rate r will grow to in 2 years is $A = P(1+r)^2$. At what interest rate will \$100 grow to \$110.25 in 2 years?

.05 = 5%

P = 100, A = 110.25

$\frac{110.25}{100} = \frac{100(1+r)^2}{100}$

$1.1025 = (1+r)^2$

$(1+r)^2 = 1.1025$

$1+r = \pm\sqrt{1.1025}$

$1+r = \pm 1.05$

$r = -1 \pm 1.05$

$r = -1+1.05$ or $r = -1-1.05$

$r = .05$ or $r = -2.05$