L2 - Solving by Squaring

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11:55 AM

$ax^2+bx+c=0$

Quadratic Equations

Lesson 2 Solving Quadratics by Completing the Square

or not possible!

Sometimes factoring quadratic equations is not practical. We can use the method of **completing the square** from ~~Chapter 3~~ Unit 2 to help us find the zeros and roots.

Ex. 1: Solve $\sqrt{(x-1)^2} = \pm\sqrt{49}$ and check your solutions(s).

$x-1=\pm 7$

$x = \pm 7 + 1 \rightarrow x_1 = 7+1 = \boxed{8}$

$x_2 = -7+1 = \boxed{-6}$

Check:

$(8-1)^2 = 49$ ✓

$(-6-1)^2 = 49$ ✓

Ex. 2: Solve by completing the square:

Won't Factor...

a) $x^2 - 21 = -10x$

$x^2+10x-21=0$

$(x^2+10x+25-25)-21=0$

$(x^2+10x+25)-25-21=0$

$(x+5)^2-46=0$

$\sqrt{(x+5)^2} = \pm\sqrt{46}$

$x+5=\pm\sqrt{46}$

$\boxed{x=\pm\sqrt{46}-5}$

46

2 ^ 23

b) $-2x^2 + 4x + 9 = 0$

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

$-2(x^2-2x+1-1)+9=0$

$-2(x^2-2x+1)+2+9=0$

$-2(x-1)^2+11=0$

$-2(x-1)^2=-11$

$\sqrt{(x-1)^2} = \pm\sqrt{\frac{11}{2}}$

$x = \pm\frac{\sqrt{11}}{\sqrt{2}} + 1$

Rationalize...

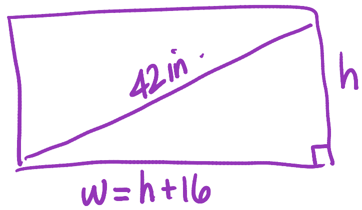
$\sqrt{\frac{11}{2}} = \frac{\sqrt{11}}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} = \frac{\sqrt{22}}{2}$

$\boxed{x = \pm\frac{\sqrt{22}}{2} + 1}$

Solving quadratic equations by completing the square:

1. Set the equation equal to zero and complete the square (follow the steps in section 3.3).
2. Isolate the squared term.
3. Take the positive and negative square root.
4. Solve the 2 corresponding equations for x.

Ex. 3: A wide-screened television has a diagonal measure of 42 in. The width of the screen is 16 in. more than the height. Determine the dimensions of the screen to the nearest tenth of an inch.



$$a^2+b^2=c^2$$
$$(h+16)^2+h^2=42^2$$
$$(h+16)(h+16)+h^2=1764$$
$$h^2+16h+16h+256+h^2=1764$$
$$\frac{2h^2}{2}+\frac{32h}{2}-\frac{1508}{2}=\frac{0}{2}$$

Graphing
Factoring
C. the Square

$$\rightarrow h^2+16h-754=0$$

$$h^2+16h+64-64-754=0$$
$$(h+8)^2-818=0$$
$$(h+8)^2=818$$
$$h+8=\pm\sqrt{818}$$
$$h=\pm\sqrt{818}-8$$

$$h=\cancel{-36.6},\ 20.6$$

$\boxed{\text{height} = 20.6\text{ in.} \quad \text{width} = 36.6\text{ in.}}$

An **extraneous root** is a solution that does not satisfy any initial restrictions. This often happens in word problems, since we usually need positive solutions.

Ex. 4: Solve by completing the square

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

$$\left[\frac{1}{2}\left(\frac{k}{2}\right)\right]^2=\left[\frac{k}{4}\right]^2=\frac{k^2}{16}$$

$$2\left(x^2+\frac{k}{2}x\right)-4=0$$
$$2\left(x^2+\frac{k}{2}x+\frac{k^2}{16}-\frac{k^2}{16}\right)-4=0$$
$$2\left(x^2+\frac{k}{2}x+\frac{k^2}{16}\right)-\frac{k^2}{8}-4=0$$

half

$$2\left(x+\frac{k}{4}\right)^2+\frac{-k^2-32}{8}=0$$

$$2\left(x+\frac{k}{4}\right)^2=\frac{k^2+32}{8}$$
$$\sqrt{\left(x+\frac{k}{4}\right)^2}=\pm\sqrt{\frac{k^2+32}{16}}$$
$$x+\frac{k}{4}=\frac{\pm\sqrt{k^2+32}}{4}$$
$$\boxed{x=\frac{\pm\sqrt{k^2+32}-k}{4}}$$

Homework: IB Textbook Pg. 73 #1 - ~~20~~ 19