LESSON MAKER PRO

Square It Out

Transform quadratic equations, then solve for x.

HIGH SCHOOL · HSA-REI.B.4a

CCSS.Math.Content.HSA-REI.B.4a "Use the method of completing the square to transform any quadratic equation in x into an equation of the form (x - p) 2 = q that has the same solutions. Derive the quadratic formula from this form."

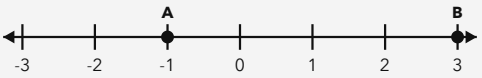
NAME _____ DATE _____

PART 1 PRACTICE: COMPLETE THE SQUARE

To complete the square, move the constant term, then add the square of half the x coefficient to both sides. For $ax^2 + bx + c = 0$, where a is not 0, divide by a first. This process leads to $x = (-b \pm \sqrt{b^2 - 4ac})/(2a)$.

WORKED EXAMPLE

Solve $x^2 - 2x - 3 = 0$ by completing the square. Use the marked points on the number line to check your solutions.

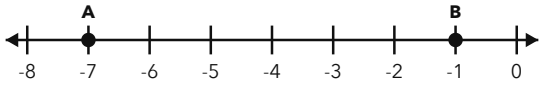


1. $x^2 - 2x = 3$
2. $x^2 - 2x + 1 = 3 + 1$
3. $(x - 1)^2 = 4$
4. $x - 1 = \pm 2$, so $x = -1$ or $x = 3$

Answer: x = -1 or x = 3

PRACTICE 6 problems

1 The number line marks two possible roots, A and B. Complete the square to decide whether each marked point solves $x^2 + 8x + 7 = 0$. Write the completed-square equation and the solutions.



ANSWER _____

2 The number line marks two possible roots, A and B. Complete the square to decide whether each marked point solves $x^2 - 10x + 21 = 0$. Write the completed-square equation and the solutions.



ANSWER _____

3 Solve $2x^2 + 8x - 10 = 0$ by completing the square.

ANSWER _____

4 Solve $4x^2 + 4x - 3 = 0$ by completing the square.

ANSWER _____

5 Solve $x^2 + 2x + 5 = 0$ by completing the square. State whether there are real solutions.

ANSWER _____

6 Solve $5x^2 - 20x + 15 = 0$ by completing the square.

ANSWER _____

APPLY IT Show your work

1 PART 2 APPLY, 1. A gaming app models the height of a launched character by $h = -x^2 + 6x + 7$, where h is height in meters and x is time in seconds. When does the character reach the ground? Use completing the square and give the meaningful time.

WORK SPACE

ANSWER _____

2 PART 2 APPLY, 2. The profit for a student club concert is modeled by $P = -x^2 + 10x - 16$, where P is profit in hundreds of dollars and x is the number of tens of tickets sold. How many tickets must the club sell to break even?

WORK SPACE

ANSWER _____

CHALLENGE One step up

PART 3 CHALLENGE. Solve $6x^2 + 5x - 4 = 0$ by completing the square. Show the completed-square equation, then explain why taking a square root gives two possible values for x.

WORK SPACE AND ANSWER

Square It Out

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	The number line marks two possible roots, A and B. Complete the square to decide whether each marked point solves $x^2 + 8x + 7 = 0$. Write the completed-square equation and the solutions.	**$(x + 4)^2 = 9$; x = -7 or x = -1**
2	The number line marks two possible roots, A and B. Complete the square to decide whether each marked point solves $x^2 - 10x + 21 = 0$. Write the completed-square equation and the solutions.	**$(x - 5)^2 = 4$; x = 3 or x = 7**
3	Solve $2x^2 + 8x - 10 = 0$ by completing the square.	**x = 1 or x = -5**
4	Solve $4x^2 + 4x - 3 = 0$ by completing the square.	**x = 1/2 or x = -3/2**
5	Solve $x^2 + 2x + 5 = 0$ by completing the square. State whether there are real solutions.	**No real solutions**
6	Solve $5x^2 - 20x + 15 = 0$ by completing the square.	**x = 1 or x = 3**

PART 2 · APPLY IT

1. **7 seconds** Set h equal to 0, giving $x^2 - 6x - 7 = 0$. Completing the square gives $(x - 3)^2 = 16$, so x = 7 or x = -1; only 7 seconds is meaningful.
2. **20 tickets or 80 tickets** Set P equal to 0 and rewrite as $x^2 - 10x + 16 = 0$. Completing the square gives $(x - 5)^2 = 9$, so x = 2 or x = 8, which means 20 or 80 tickets.

CHALLENGE

$x^2 + 5/6x = 2/3$; $x^2 + 5/6x + 25/144 = 2/3 + 25/144$; $(x + 5/12)^2 = 121/144$. Therefore x = 1/2 or x = -4/3. A number and its opposite can have the same square, so taking a square root requires ±.

Accept equivalent completed-square forms and solutions written in either order. For equations with no real solutions, accept a correct completed-square equation with a negative value on the right side.