LESSON MAKER PRO

Roots to Equations

Build polynomial equations from their roots.

HIGH SCHOOL · A.CED.A.1.b

A.CED.A.1.b "Create polynomial equations given roots."

NAME _____ DATE _____

FROM ROOT TO FACTOR

A root r gives the factor (x-r), and a repeated root needs a repeated factor. Multiply the factors, use any given leading coefficient, and expand to make an equation equal to 0. For Problems 1-6, use the lowest possible degree and a leading coefficient of 1 unless another is given.

WORKED EXAMPLE

Create a polynomial equation with roots -9 and 13 and leading coefficient 6. Write it in expanded form.

1. Write one factor for each root: $(x+9)(x-13)$.
2. Use the leading coefficient: $6(x+9)(x-13)=0$.
3. Multiply the factors: $6(x^2-4x-117)=0$.
4. Distribute 6: $6x^2-24x-702=0$.

Answer: $6x^2-24x-702=0$

PRACTICE 6 problems

1 Write an expanded polynomial equation with roots 1 and 4.

ANSWER _____

2 Write an expanded polynomial equation with roots -2 and 3.

ANSWER _____

3 Write an expanded polynomial equation with roots -4 and -1.

ANSWER _____

4 Write an expanded polynomial equation with roots 0 and 5.

ANSWER _____

5 Write an expanded polynomial equation with roots -1 and 2 and leading coefficient 3.

ANSWER _____

6 Write an expanded polynomial equation with root 2 repeated twice and root -3 once.

ANSWER _____

APPLY IT Show your work

1 In a video game, a character jumps from the ground at x=0 seconds and lands at x=2 seconds. At x=1 second, the character is 4 meters above the ground. Assuming height is quadratic, write an equation for the height h(x), in meters.

WORK SPACE

ANSWER _____

2 A school gaming tournament models its profit P(x), in dollars, as a quadratic in the number x of tickets sold. The model predicts zero profit at 10 and 50 tickets and a profit of $800 at 30 tickets. Write an equation for P(x).

WORK SPACE

ANSWER _____

CHALLENGE One step up

Write an expanded polynomial equation with roots 1/2 and -3/4. Its coefficients must be integers, and its leading coefficient must be the smallest possible positive integer. Explain why your leading coefficient is the smallest possible.

WORK SPACE AND ANSWER

ANSWER KEY # Roots to Equations

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Write an expanded polynomial equation with roots 1 and 4.	**$x^2-5x+4=0$**
2	Write an expanded polynomial equation with roots -2 and 3.	**$x^2-x-6=0$**
3	Write an expanded polynomial equation with roots -4 and -1.	**$x^2+5x+4=0$**
4	Write an expanded polynomial equation with roots 0 and 5.	**$x^2-5x=0$**
5	Write an expanded polynomial equation with roots -1 and 2 and leading coefficient 3.	**$3x^2-3x-6=0$**
6	Write an expanded polynomial equation with root 2 repeated twice and root -3 once.	**$x^3-x^2-8x+12=0$**

PART 2 · APPLY IT

1. **$h(x)=-4x^2+8x$** The ground-level times give h(x)=ax(x-2). Substitute h(1)=4 to get -a=4, so a=-4.
2. **$P(x)=-2x^2+120x-1000$** The break-even points give P(x)=a(x-10)(x-50). Substitute P(30)=800 to get -400a=800, so a=-2.

CHALLENGE

$8x^2+2x-3=0$. The monic equation is $x^2+(1/4)x-3/8=0$. To make the constant term an integer, the leading coefficient must be a positive multiple of 8, so 8 is the smallest choice.

For Problems 1-6, accept only expanded equations with the specified leading coefficient and 0 on the right. For the word problems, accept equivalent factored equations for h(x) and P(x).