LESSON MAKER PRO

Factor Zero Detectives

Use factors to find where polynomial values equal zero.

HIGH SCHOOL · HSA-APR.B

CCSS.Math.Content.HSA-APR.B "Understand the relationship between zeros and factors of polynomials"

NAME _____ DATE _____

FACTORS REVEAL ZEROS

If P(a) = 0, then x - a is a factor of P(x). After you factor a polynomial, set each factor equal to 0 to find its zeros.

WORKED EXAMPLE

Factor $P(x) = x^2 - 13x + 42$ and find its zeros.

1. Find two numbers with a product of 42 and a sum of -13: -6 and -7.
2. Write P(x) = (x - 6)(x - 7).
3. Set x - 6 = 0, so x = 6.
4. Set x - 7 = 0, so x = 7.

Answer: P(x) = (x - 6)(x - 7); the zeros are 6 and 7.

PRACTICE 6 problems

1 Factor $f(x) = x^2 + x - 12$. Then find the zeros.

ANSWER _____

2 Is x = -3 a zero of $h(x) = x^2 + 3x$? Use the factor relationship to justify your answer.

ANSWER _____

3 Find k so that x + 8 is a factor of $q(x) = x^2 + kx - 32$.

ANSWER _____

4 Write a monic quadratic polynomial with zeros 1 and -9.

ANSWER _____

5 Factor $r(x) = x^3 - x^2 - 12x$ completely. Then list all zeros.

ANSWER _____

6 Factor $s(x) = x^3 - 9x^2 + 20x$ completely. Then list all zeros.

ANSWER _____

APPLY IT Show your work

1 During a game-design project, an animated ball's height is modeled by $h(t) = -3t^2 + 30t - 27$, where t is time in seconds. At what times is the ball on the ground?

WORK SPACE

ANSWER _____

2 A student council models the net profit from a ticket price p by $P(p) = -p^2 + 28p - 160$, where p is in dollars. Which ticket prices make the profit equal to 0?

WORK SPACE

ANSWER _____

CHALLENGE One step up

A student says that $x^3 + 9x^2 + 15x - 25$ has zeros 1 and -5, with -5 repeated. Check the claim by factoring the polynomial completely. Then explain why the repeated zero appears twice.

WORK SPACE AND ANSWER

Factor Zero Detectives

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Factor $f(x) = x^2 + x - 12$. Then find the zeros.	**$f(x) = (x + 4)(x - 3)$; the zeros are -4 and 3.**
2	Is $x = -3$ a zero of $h(x) = x^2 + 3x$? Use the factor relationship to justify your answer.	**Yes. $h(x) = x(x + 3)$, so $x + 3$ is a factor and $x = -3$ is a zero.**
3	Find k so that $x + 8$ is a factor of $q(x) = x^2 + kx - 32$.	**$k=4$**
4	Write a monic quadratic polynomial with zeros 1 and -9.	**$(x - 1)(x + 9) = x^2 + 8x - 9$**
5	Factor $r(x) = x^3 - x^2 - 12x$ completely. Then list all zeros.	**$r(x) = x(x - 4)(x + 3)$; the zeros are 0, 4, and -3.**
6	Factor $s(x) = x^3 - 9x^2 + 20x$ completely. Then list all zeros.	**$s(x) = x(x - 4)(x - 5)$; the zeros are 0, 4, and 5.**

PART 2 · APPLY IT

1. **The ball is on the ground at t = 1 second and t = 9 seconds.** Factor $h(t)$ as $-3(t - 1)(t - 9)$. Set each factor equal to 0.
2. **The break-even ticket prices are $8 and $20.** Factor $P(p)$ as $-(p - 8)(p - 20)$. The zeros are $p = 8$ and $p = 20$.

CHALLENGE

$x^3 + 9x^2 + 15x - 25 = (x - 1)(x + 5)^2$. The zeros are 1 and -5. The zero -5 appears twice because $x + 5$ is a factor twice.

Accept equivalent factored forms with factors in any order. In the challenge, the correct standard-form expansion includes the nonzero term 15x.