LESSON MAKER PRO

# Root Candidate Hunt

*Find the rational roots a polynomial could have.*

**HIGH SCHOOL · A3.A.20**

**A3.A.20** "Find the possible rational roots using the Rational Root Theorem."

NAME _____ DATE _____

### THE RATIONAL ROOT THEOREM

For a polynomial with integer coefficients and a nonzero constant term, any rational root in simplest form is p/q. The numerator p must divide the constant term, and the denominator q must divide the leading coefficient. List both signs and remove repeats, but remember that candidates are not necessarily roots.

### WORKED EXAMPLE

List all possible rational roots of $11x^3 + 13x^2 - 17x + 19$.

1. The factors of the constant term, 19, are 1 and 19.
2. The factors of the leading coefficient, 11, are 1 and 11.
3. Form ±p/q using these factors. None of the resulting fractions repeat.

**Answer: ±1, ±19, ±1/11, ±19/11**

## PRACTICE 6 problems

**1** List all possible rational roots of $x^3 - 4x^2 + x - 6$.

**ANSWER** _____

**2** List all possible rational roots of $2x^3 + x^2 - 5x + 3$.

**ANSWER** _____

**3** For $3x^4 - 2x^2 + 4x - 4$, list the positive factors of the constant term and leading coefficient. Then list all possible rational roots.

**ANSWER** _____

**4** List only the positive rational root candidates for $4x^3 + 7x^2 - 2x - 5$.

**ANSWER** _____

**5** List only the negative rational root candidates for $8x^3 + 5x^2 - x + 3$.

**ANSWER** _____

**6** List all possible rational roots of $5x^4 - x^3 + 9x + 1$.

**ANSWER** _____

## APPLY IT Show your work

**1** An indie game studio models its net earnings, in thousands of dollars, x months after a launch as $3x^3 - 8x^2 + 5x - 2$. List all positive rational candidates for when net earnings are 0. Do not test the candidates.

WORK SPACE

**ANSWER** _____

**2** A sneaker resale pop-up models its net earnings, in hundreds of dollars, x weeks after opening as $4x^3 - 4x^2 - x - 3$. During its first two weeks, what positive rational candidates could make net earnings 0? Do not test the candidates.

WORK SPACE

**ANSWER** _____

## CHALLENGE One step up

The constant term of $6x^4 - 7x^3 - 5x^2 + 2x$ is 0. Factor out x, then list all possible rational roots, including 0. Explain why 0 belongs.

WORK SPACE AND ANSWER

**ANSWER KEY** # Root Candidate Hunt



## PART 1 · PRACTICE

| # | PROBLEM | ANSWER |
|---|---|---|
| 1 | List all possible rational roots of $x^3 - 4x^2 + x - 6$. | **±1, ±2, ±3, ±6** |
| 2 | List all possible rational roots of $2x^3 + x^2 - 5x + 3$. | **±1/2, ±1, ±3/2, ±3** |
| 3 | For $3x^4 - 2x^2 + 4x - 4$, list the positive factors of the constant term and leading coefficient. Then list all possible rational roots. | **Constant term factors: 1, 2, 4. Leading coefficient factors: 1, 3. Possible rational roots: ±1/3, ±2/3, ±4/3, ±1, ±2, ±4.** |
| 4 | List only the positive rational root candidates for $4x^3 + 7x^2 - 2x - 5$. | **1/4, 1/2, 1, 5/4, 5/2, 5** |
| 5 | List only the negative rational root candidates for $8x^3 + 5x^2 - x + 3$. | **-1/8, -1/4, -3/8, -1/2, -3/4, -1, -3/2, -3** |
| 6 | List all possible rational roots of $5x^4 - x^3 + 9x + 1$. | **±1/5, ±1** |

## PART 2 · APPLY IT

1. **1/3, 2/3, 1, 2** The positive factors of 2 are 1 and 2, and those of 3 are 1 and 3. Form positive ratios and remove repeats.
2. **1/4, 1/2, 3/4, 1, 3/2** Using factors of 3 over factors of 4 gives 1/4, 1/2, 3/4, 1, 3/2, and 3. Exclude 3 because it is outside the first two weeks.

## CHALLENGE

**Factoring gives $x(6x^3 - 7x^2 - 5x + 2)$. The possible rational roots are 0, ±1/6, ±1/3, ±1/2, ±2/3, ±1, and ±2. Zero belongs because the factored expression equals 0 when x = 0.**

Accept equivalent ordering and either ± notation or separate positive and negative values. A candidate does not need to be an actual root.