Today's Objectives

- Decide **which potential rational zeros of a polynomial are actual zeros** using relevant mathematical theorems and reading graphs using supporting technology.
- Success Criteria
  - Identify potential rational zeros using the rational root theorem
  - Estimate zeros using a graph
  - Use Polynomial division to confirm actual zeros
- Vocabulary: root, zero, x-intercept, factor, solution

Factors of a Polynomial with Real Coefficients

- **Theorem:** Every polynomial function (with real coefficients) can be uniquely factored into a product of linear factors and/or irreducible quadratic factors.

- **Corollary:** A polynomial function of odd degree has at least one real zero.

AM: Factor 4th degree polynomials

4. $2x^4 - 17x^3 + 37x^2 + 8x - 48$

p $= -48$	q $= 2$	p/q
$\pm 1, \pm 2, \pm 3, \pm 4, \pm 6, \pm 8, \pm 12, \pm 16, \pm 24, \pm 48$	$\pm 1, \pm 2$	± 1, ± 8, $\pm 1/2$, ± 2, ± 12, $\pm 3/2$, ± 3, ± 16, ± 4, ± 24, ± 6, ± 48

$\pm 1/2, \pm 3/2$

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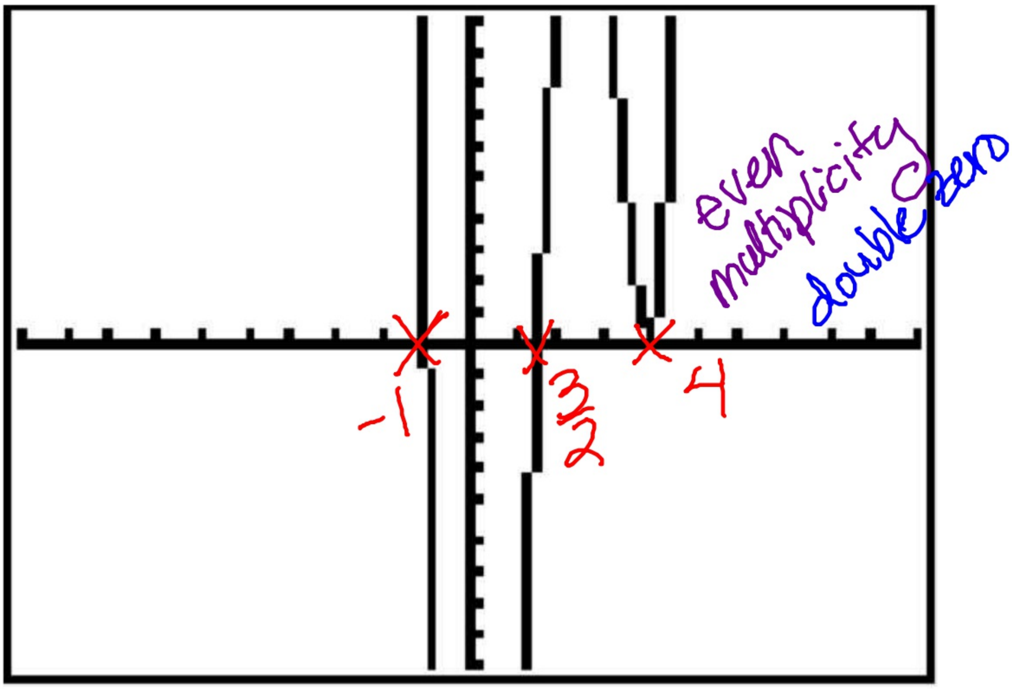
4. $2x^4 - 17x^3 + 37x^2 + 8x - 48$



$-1 \quad \frac{3}{2} \quad 4 \; (2\text{xs})$

$$2x^4 - 17x^3 + 37x^2 + 8x - 48$$

$$\begin{array}{r|rrrrr} -1 & 2 & -17 & 37 & 8 & -48 \\ + & \downarrow & -2 & 19 & -56 & 48 \\ \hline & 2 & -19 & 56 & -48 & 0 \end{array} \Rightarrow (x+1)$$

$$(2x^3 - 19x^2 + 56x - 48)(x+1)$$

$$\begin{array}{r|rrrr} 4 & 2 & -19 & 56 & -48 \\ + & \downarrow & 8 & -44 & 48 \\ \hline & 2 & -11 & 12 & 0 \end{array} \Rightarrow (x-4)$$

$$\begin{array}{r|rr} 4 & 2 & -8 \\ + & \downarrow & 8 \\ \hline & 2 & 0 \end{array}$$

$$(2x^2 - 11x + 12)(x-4)(x+1)$$

$$\begin{array}{r|rrr} \frac{3}{2} & 2 & -11 & 12 \\ + & \downarrow & 3 & -12 \\ \hline & 2 & -8 & 0 \end{array} \Rightarrow (x - \tfrac{3}{2})$$

$$(2x-8)(x - \tfrac{3}{2})(x-4)(x+1)$$

$$2(x-4)(x-\tfrac{3}{2})(x-4)(x+1)$$

$$(x-4)^2(2x-3)(x+1)$$

Zero or Root	x-intercept	Linear Factor	Multiplicity
-1	$(-1, 0)$	$(x+1)$	1
$3/2$	$(3/2, 0)$	$(x-3/2)$	1
4	$(4, 0)$	$(x-4)$	2
The factored form of $f(x)$ is …	$(x+1)(x-4)^2(2x-3)=f(x)$		