

Solutions

1.1 Zeros and Multiplicity

1.1.1. List zeros and multiplicities of $(x - 4)^3(x + 1)^2$.

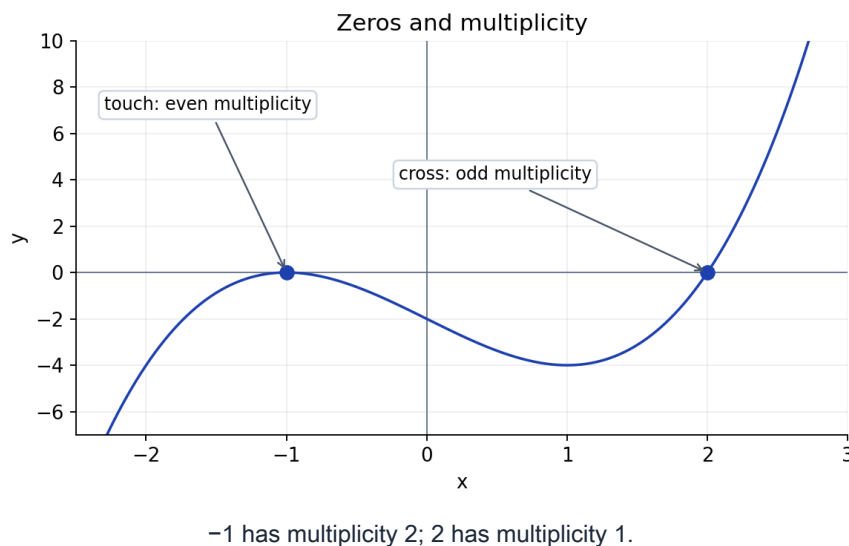
Solution. 4 has multiplicity 3 and -1 has multiplicity 2. The graph crosses at 4 and touches at -1 .

1.1.2. Write a monic quadratic with zeros -2 and 5.

Solution. $f(x) = (x + 2)(x - 5) = x^2 - 3x - 10$.

1.1.3. Use the graph of $y = (x + 1)^2(x - 2)$ to describe its zeros and whether it crosses or touches.

Solution. The zero -1 has multiplicity 2 and touches the axis. The zero 2 has multiplicity 1 and crosses.



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1.2 End Behavior

1.2.1. Describe the ends of $f(x) = 5x^6 - x^2 + 2$.

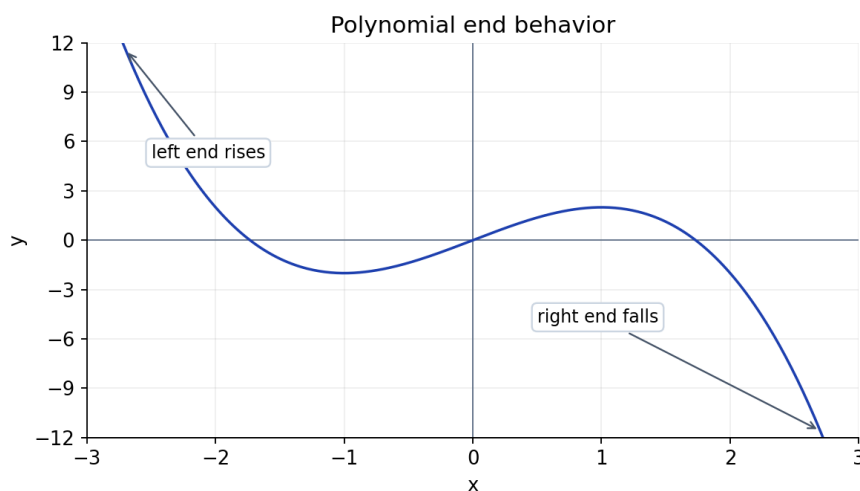
Solution. The degree is even and the leading coefficient is positive, so both ends rise toward ∞ .

1.2.2. Describe the ends of $g(x) = -x^5 + 2x^2$.

Solution. The negative odd-degree leading term makes the left end rise and the right end fall.

1.2.3. Use the graph of $y = -x^3 + 3x$ to identify its end behavior.

Solution. The negative cubic leading term means $y \rightarrow \infty$ as $x \rightarrow -\infty$, and $y \rightarrow -\infty$ as $x \rightarrow \infty$.



The left end tends to positive infinity; the right end tends to negative infinity.

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1.3 Complex Solutions

1.3.1. Solve $x^2 + 4 = 0$.

Solution. $x^2 = -4$, so $x = \pm 2i$.

1.3.2. Simplify $(3 + 2i) + (1 - 5i)$.

Solution. Combine real and imaginary parts: $4 - 3i$.

1.3.3. Multiply $(2 + i)(2 - i)$.

Solution. The product is $4 - i^2 = 5$. Complex conjugates have a real product.