

Unit 3: Polynomial, Radical,
and Rational Functions

3.4 Graphing Polynomials

Factored Form: $P(x) = (x+a)(x-b)(x-c)(x-d)$ ↓ leading coefficient
Expanded Form: $P(x) = ax^4 + bx^3 + cx^2 + dx + e$

Degree: 4
 $a < 0$

Unit 3: Polynomial, Radical,
and Rational Functions

$P(x) = (x+a)(x-b)(x-c)$
Expanded Form: $P(x) = ax^3 + bx^2 + cx + d$

Degree: 3
 $a > 0$

positive

negative

III to I

$(-\infty, a)$ $(1, 3)$ $(3, \infty)$
 $P(x)$ increasing $P(x)$ decreasing $P(x)$ increasing

Domain:	$(-\infty, a)$	(a, b)	(b, c)	(c, ∞)
Pos./Neg.	Neg.	Pos.	Neg.	Pos.

Multiplicity: - the power of the factor $(x-a)^2(x+b)$

Even Power: the graph is tangent to the x-axis (bounces off) touches at one point

Odd Power: the graph cuts the x-axis

Ex.) Sketch and find degree, multiplicity, and the roots of the following:

a) $P(x) = a(x+5)(x-3)^2$
 Degree: 3
 $a > 0$
 Roots: $x = -5$ mult. of 1
 $x = 3$ mult. of 2

b) $P(x) = a(x+3)^3(x-4)^2$
 Degree: 5
 $a < 0$ Q II to IV
 Roots: $x = -3$ mult. of 3 (odd \Rightarrow cut)
 $x = 4$ mult. of 2 (even \Rightarrow bounce)

Mult. of:

1:

3:

5:

Ex.) Given $P(x) = 3(x-2)(x+1)(x-4)^2$, sketch the graph.

Degree: 4
 Roots:
 $x = 2$ mult. 1
 $x = -1$ mult. 1
 $x = 4$ mult. 2

Ex.) Sketch $P(x) = -2(x+3)^2(x-5)^3$.

Degree: 5
 Roots:
 $x = -3$ mult. 2
 $x = 5$ mult. 3