

Polynomial Graph-Matching Card Sort

Cut, sort, justify, and record three levels of polynomial matches.

EXPANDED EQUATION

FACTORED FORM

GRAPH

ZEROS

MULTIPLICITY

END BEHAVIOR

DEGREE

LEADING COEFF.

Inside this file

- Three complete levels: introductory quadratics and cubics, standard Algebra 2, and a fourth- and fifth-degree challenge set.
- Eight card types per function: expanded equation, factored form, graph, zeros, multiplicity, end behavior, degree, and leading coefficient.
- A recording sheet before each level. Card codes are scrambled separately by category, so the codes help students record answers without giving the matches away.
- Print single-sided at 100%. Cut on the dashed borders. Color is optional; every category is labeled in text for grayscale printing.

ACCURACY NOTE

Every graph in this file was plotted directly from its listed polynomial. All 14 expanded forms were recomputed from their factors, and every zero, multiplicity, degree, leading coefficient, and end-behavior card was checked against the key before this file was published.

CHECK YOUR WORK WITH A TEST POINT

Zeros line up with the x-intercepts. Multiplicity matches the cross-or-touch behavior. End behavior agrees with the degree and the leading sign.

Then test it. Pick one or two x-values between the turns, put them into the equation, and check that the points you get land on the curve. A point in the wrong region means the match is wrong.

Introductory Card Sort - Recording Sheet

STUDENT PAGE

Write the card code from each match

Name: _____ Date: _____ Partner: _____

This level has 4 function families and uses graph cards G-1 to G-4.

GRAPH	EQUATION	FACTORED	ZEROS	MULTIPLICITY	END	DEGREE	LEADING
G-____	_____	_____	_____	_____	_____	_____	_____
G-____	_____	_____	_____	_____	_____	_____	_____
G-____	_____	_____	_____	_____	_____	_____	_____
G-____	_____	_____	_____	_____	_____	_____	_____

Two matches to justify

1. Choose one repeated zero. How does the graph show whether its multiplicity is even or odd?

2. Choose one function. Explain how degree parity and the leading coefficient predict both end directions.

CHECK BEFORE YOU FINISH

Zeros line up with the x-intercepts. Multiplicity matches the cross-or-touch behavior. End behavior agrees with the degree and the leading sign.

Then test it. Pick one or two x-values between the turns, put them into the equation, and check that the points you get land on the curve. A point in the wrong region means the match is wrong.

LEADING COEFFICIENT	L-2
Leading coefficient +1	

MULTIPLICITY	M-4
$x = -2: m = 1$ $x = 1: m = 1$	

END BEHAVIOR	B-1
$x \rightarrow -\infty, f(x) \rightarrow -\infty$ $x \rightarrow +\infty, f(x) \rightarrow +\infty$	

ZEROS	Z-2
Zeros: $\{-1, 2\}$	

FACTORED FORM	F-1
$y = -(x + 2)(x - 1)(x - 3)$	

ZEROS	Z-1
Zeros: $\{-2, 1, 3\}$	

END BEHAVIOR	B-4
$x \rightarrow -\infty, f(x) \rightarrow -\infty$ $x \rightarrow +\infty, f(x) \rightarrow -\infty$	

FACTORED FORM	F-4
$y = -(x - 1)^2$	

END BEHAVIOR

B-3

$$x \rightarrow -\infty, f(x) \rightarrow +\infty$$

$$x \rightarrow +\infty, f(x) \rightarrow +\infty$$

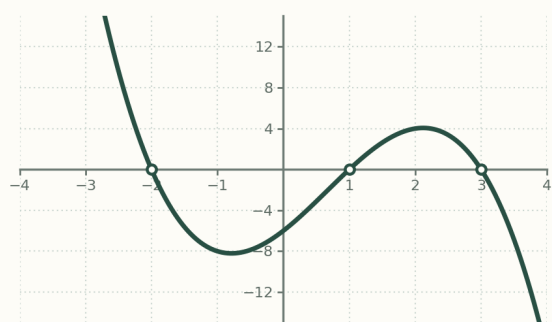
EXPANDED EQUATION

E-1

$$y = x^2 + x - 2$$

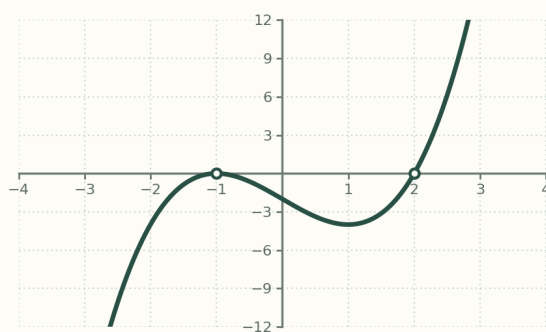
GRAPH

G-3



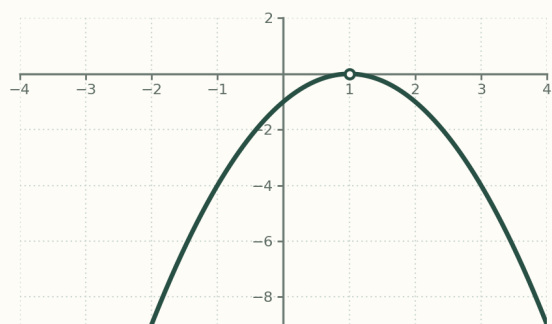
GRAPH

G-4



GRAPH

G-1



EXPANDED EQUATION

E-2

$$y = -x^3 + 2x^2 + 5x - 6$$

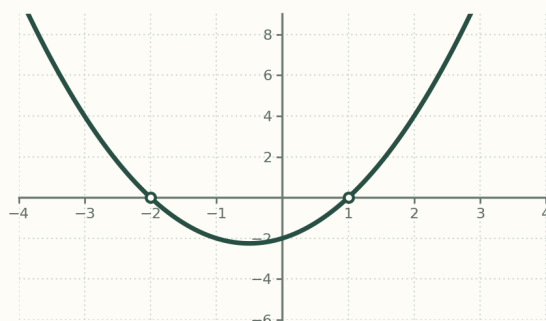
EXPANDED EQUATION

E-3

$$y = x^3 - 3x^2 - 2x + 6$$

GRAPH

G-2



x = 1: m = 2

MULTIPLICITY	M-1
$x = -2: m = 1$ $x = 1: m = 1$ $x = 3: m = 1$	

DEGREE	D-3
Degree 3	

ZEROS	Z-3
Zeros: {1}	

DEGREE	D-1
Degree 2	

LEADING COEFFICIENT	L-3
Leading coefficient -1	

MULTIPLICITY	M-2
$x = -1: m = 2$ $x = 2: m = 1$	

DEGREE	D-4
Degree 2	

LEADING COEFFICIENT	L-1
Leading coefficient +1	

Standard Algebra 2 Card Sort - Recording Sheet

STUDENT PAGE

Write the card code from each match

Name: _____ Date: _____ Partner: _____

This level has 5 function families and uses graph cards G-1 to G-5.

GRAPH	EQUATION	FACTORED	ZEROS	MULTIPLICITY	END	DEGREE	LEADING
G-____	_____	_____	_____	_____	_____	_____	_____
G-____	_____	_____	_____	_____	_____	_____	_____
G-____	_____	_____	_____	_____	_____	_____	_____
G-____	_____	_____	_____	_____	_____	_____	_____
G-____	_____	_____	_____	_____	_____	_____	_____

Two matches to justify

1. Choose one repeated zero. How does the graph show whether its multiplicity is even or odd?

2. Choose one function. Explain how degree parity and the leading coefficient predict both end directions.

CHECK BEFORE YOU FINISH

Zeros line up with the x-intercepts. Multiplicity matches the cross-or-touch behavior. End behavior agrees with the degree and the leading sign.

Then test it. Pick one or two x-values between the turns, put them into the equation, and check that the points you get land on the curve. A point in the wrong region means the match is wrong.

ZEROS

Z-4

Zeros: $\{-2, -1, 3\}$

FACTORED FORM

F-3

$$y = 2(x + 3)(x - 1)^2$$

MULTIPLICITY

M-4

$$\begin{aligned}x = -1: m &= 3 \\x = 2: m &= 1\end{aligned}$$

ZEROS

Z-2

Zeros: $\{-2, 2\}$

MULTIPLICITY

M-3

$$\begin{aligned}x = -2: m &= 1 \\x = -1: m &= 1 \\x = 3: m &= 2\end{aligned}$$

MULTIPLICITY

M-2

$$\begin{aligned}x = -2: m &= 2 \\x = 2: m &= 2\end{aligned}$$

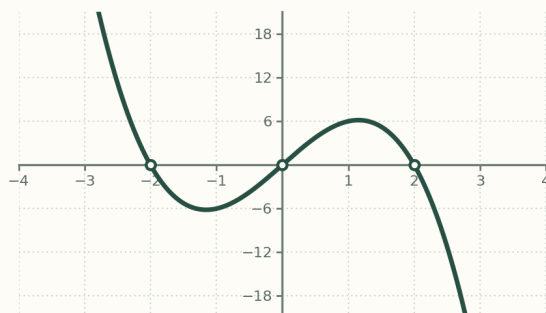
FACTORED FORM

F-2

$$y = (x - 3)^2(x + 1)(x + 2)$$

GRAPH

G-1



MULTIPLICITY

M-5

$$x = -3: m = 1$$
$$x = 1: m = 2$$

END BEHAVIOR

B-2

$$x \rightarrow -\infty, f(x) \rightarrow -\infty$$
$$x \rightarrow +\infty, f(x) \rightarrow -\infty$$

DEGREE

D-4

Degree 4

ZEROS

Z-1

Zeros: $\{-2, 0, 2\}$

LEADING COEFFICIENT

L-3

Leading coefficient -1

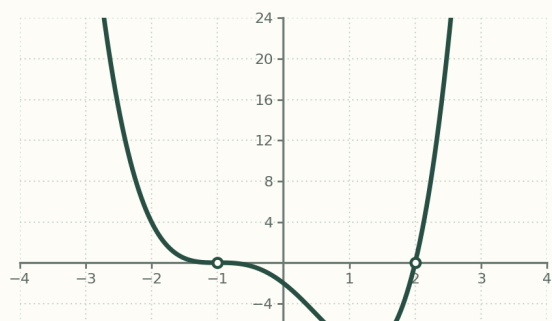
FACTORED FORM

F-4

$$y = -2x(x - 2)(x + 2)$$

GRAPH

G-4



EXPANDED EQUATION

E-1

$$y = -2x^3 + 8x$$

END BEHAVIOR	B-3
$x \rightarrow -\infty, f(x) \rightarrow +\infty$ $x \rightarrow +\infty, f(x) \rightarrow -\infty$	

LEADING COEFFICIENT	L-2
Leading coefficient -2	

DEGREE	D-5
Degree 4	

EXPANDED EQUATION	E-2
$y = -x^4 + 8x^2 - 16$	

DEGREE	D-2
Degree 4	

ZEROS	Z-3
Zeros: $\{-3, 1\}$	

EXPANDED EQUATION	E-3
$y = 2x^3 + 2x^2 - 10x + 6$	

EXPANDED EQUATION	E-5
$y = x^4 + x^3 - 3x^2 - 5x - 2$	

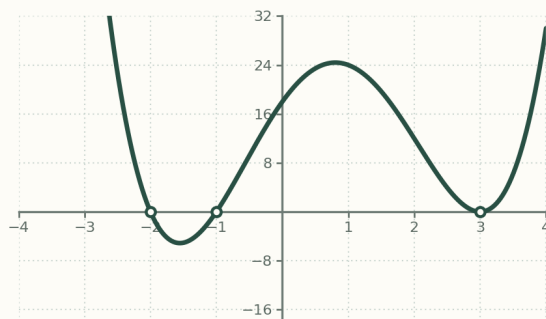
FACTORED FORM

F-5

$$y = (x + 1)^3(x - 2)$$

GRAPH

G-5



EXPANDED EQUATION

E-4

$$y = x^4 - 3x^3 - 7x^2 + 15x + 18$$

FACTORED FORM

F-1

$$y = -(x + 2)^2(x - 2)^2$$

END BEHAVIOR

B-1

$$\begin{aligned} x \rightarrow -\infty, f(x) &\rightarrow +\infty \\ x \rightarrow +\infty, f(x) &\rightarrow +\infty \end{aligned}$$

ZEROS

Z-5

$$\text{Zeros: } \{-1, 2\}$$

MULTIPLICITY

M-1

$$\begin{aligned} x = -2: m &= 1 \\ x = 0: m &= 1 \\ x = 2: m &= 1 \end{aligned}$$

DEGREE

D-1

$$\text{Degree } 3$$

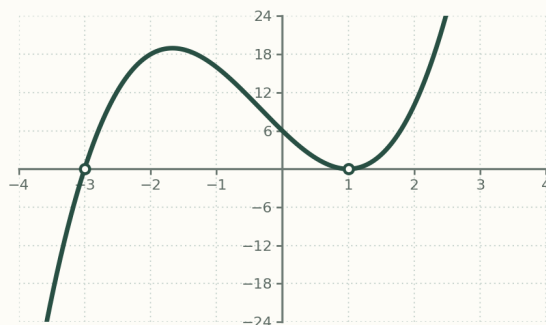
LEADING COEFFICIENT

L-4

Leading coefficient +1

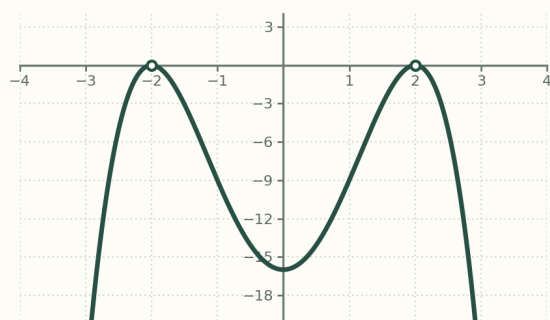
GRAPH

G-2



GRAPH

G-3



DEGREE

D-3

Degree 3

LEADING COEFFICIENT

L-5

Leading coefficient +2

END BEHAVIOR

B-5

$$\begin{aligned} x \rightarrow -\infty, f(x) &\rightarrow -\infty \\ x \rightarrow +\infty, f(x) &\rightarrow +\infty \end{aligned}$$

LEADING COEFFICIENT

L-1

Leading coefficient +1

END BEHAVIOR

B-4

$$\begin{aligned} x \rightarrow -\infty, f(x) &\rightarrow +\infty \\ x \rightarrow +\infty, f(x) &\rightarrow +\infty \end{aligned}$$

Challenge Card Sort - Recording Sheet

STUDENT PAGE

Write the card code from each match

Name: _____ Date: _____ Partner: _____

This level has 5 function families and uses graph cards G-1 to G-5.

GRAPH	EQUATION	FACTORED	ZEROS	MULTIPLICITY	END	DEGREE	LEADING
G-____	_____	_____	_____	_____	_____	_____	_____
G-____	_____	_____	_____	_____	_____	_____	_____
G-____	_____	_____	_____	_____	_____	_____	_____
G-____	_____	_____	_____	_____	_____	_____	_____
G-____	_____	_____	_____	_____	_____	_____	_____

Two matches to justify

1. Choose one repeated zero. How does the graph show whether its multiplicity is even or odd?

2. Choose one function. Explain how degree parity and the leading coefficient predict both end directions.

CHECK BEFORE YOU FINISH

Zeros line up with the x-intercepts. Multiplicity matches the cross-or-touch behavior. End behavior agrees with the degree and the leading sign.

Then test it. Pick one or two x-values between the turns, put them into the equation, and check that the points you get land on the curve. A point in the wrong region means the match is wrong.

ZEROS

Z-4

Zeros: $\{-2, 1\}$

FACTORED FORM

F-3

$$y = 0.5(x + 2)^3(x - 1)^2$$

MULTIPLICITY

M-4

$$\begin{aligned}x &= -3: m = 1 \\x &= 1: m = 4\end{aligned}$$

ZEROS

Z-2

Zeros: $\{-1, 0, 2\}$

MULTIPLICITY

M-3

$$\begin{aligned}x &= -1: m = 2 \\x &= 2: m = 3\end{aligned}$$

MULTIPLICITY

M-2

$$\begin{aligned}x &= -2: m = 3 \\x &= 1: m = 2\end{aligned}$$

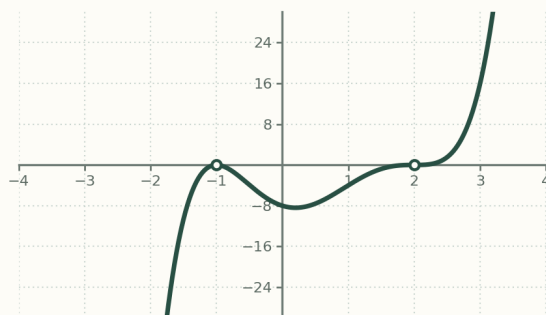
FACTORED FORM

F-2

$$y = -(x + 2)^2(x - 1)(x - 3)$$

GRAPH

G-1



MULTIPLICITY

M-5

$$x = -2: m = 2$$

$$x = 1: m = 1$$

$$x = 3: m = 1$$

END BEHAVIOR

B-2

$$x \rightarrow -\infty, f(x) \rightarrow -\infty$$

$$x \rightarrow +\infty, f(x) \rightarrow +\infty$$

DEGREE

D-4

Degree 5

ZEROS

Z-1

Zeros: $\{-2, 1, 3\}$

LEADING COEFFICIENT

L-3

Leading coefficient -1

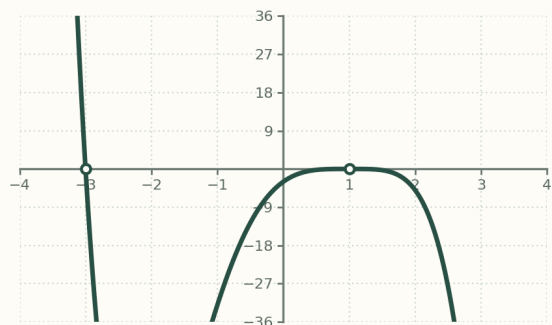
FACTORED FORM

F-4

$$y = (x + 1)^2(x - 2)^3$$

GRAPH

G-4



EXPANDED EQUATION

E-1

$$y = -x^5 + x^4 + 6x^3 - 14x^2 + 11x - 3$$

END BEHAVIOR	B-3
$x \rightarrow -\infty, f(x) \rightarrow +\infty$ $x \rightarrow +\infty, f(x) \rightarrow -\infty$	

LEADING COEFFICIENT	L-2
Leading coefficient +1	

DEGREE	D-5
Degree 4	

EXPANDED EQUATION	E-2
$y = 0.5x^5 + 2x^4 + 0.5x^3 - 5x^2 - 2x + 4$	

DEGREE	D-2
Degree 4	

ZEROS	Z-3
Zeros: {-1, 2}	

EXPANDED EQUATION	E-3
$y = -x^4 + 9x^2 + 4x - 12$	

EXPANDED EQUATION	E-5
$y = x^5 - 4x^4 + x^3 + 10x^2 - 4x - 8$	

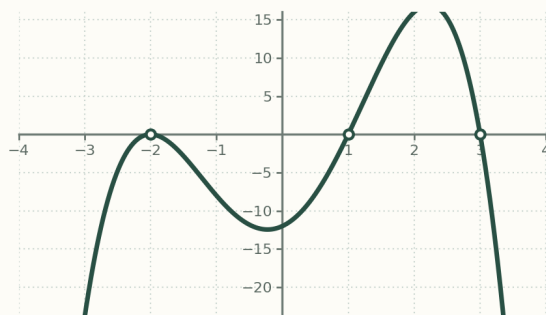
FACTORED FORM

F-5

$$y = -(x + 3)(x - 1)^4$$

GRAPH

G-5



EXPANDED EQUATION

E-4

$$y = 2x^4 - 2x^3 - 4x^2$$

FACTORED FORM

F-1

$$y = 2x^2(x - 2)(x + 1)$$

END BEHAVIOR

B-1

$$\begin{aligned} x \rightarrow -\infty, f(x) &\rightarrow -\infty \\ x \rightarrow +\infty, f(x) &\rightarrow +\infty \end{aligned}$$

ZEROS

Z-5

$$\text{Zeros: } \{-3, 1\}$$

MULTIPLICITY

M-1

$$\begin{aligned} x = -1: m &= 1 \\ x = 0: m &= 2 \\ x = 2: m &= 1 \end{aligned}$$

DEGREE

D-1

Degree 5

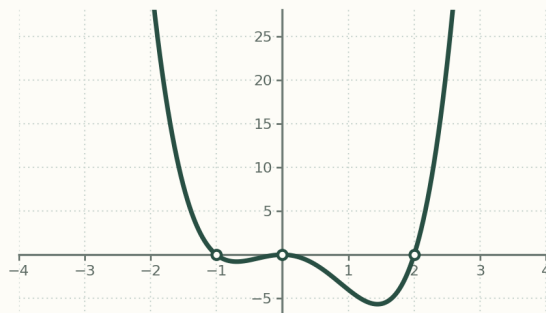
LEADING COEFFICIENT

L-4

Leading coefficient -1

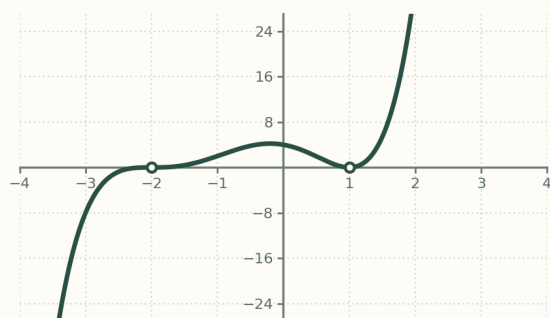
GRAPH

G-2



GRAPH

G-3



DEGREE

D-3

Degree 5

LEADING COEFFICIENT

L-5

Leading coefficient +2

END BEHAVIOR

B-5

$$\begin{aligned}x &\rightarrow -\infty, f(x) \rightarrow -\infty \\x &\rightarrow +\infty, f(x) \rightarrow -\infty\end{aligned}$$

LEADING COEFFICIENT

L-1

Leading coefficient +1/2

END BEHAVIOR

B-4

$$\begin{aligned}x &\rightarrow -\infty, f(x) \rightarrow +\infty \\x &\rightarrow +\infty, f(x) \rightarrow +\infty\end{aligned}$$