

Factor Graph Detective

Use factors to find intercepts and predict each graph's path.

HIGH SCHOOL • HSF-IF.C.7c

CCSS.Math.Content.HSF-IF.C.7c "Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior."

NAME _____

DATE _____

READ THE FACTORS

Set each factor equal to zero to find the zeros. An even multiplicity touches the x-axis, an odd multiplicity crosses it. Degree and leading coefficient tell which way the ends point.

WORKED EXAMPLE

Graph $h(x)=(x-11)^3(x+13)^4$.
Label zeros and end behavior.

1. Zeros: $x=11$ has multiplicity 3, and $x=-13$ has multiplicity 4.
2. The graph crosses at $x=11$ and touches at $x=-13$.
3. The degree is 7 and the leading coefficient is positive, so the left end falls and the right end rises.
4. Plot the zeros, then sketch the curve with those end directions.

Answer: Zeros: -13, touch; 11, cross. End behavior: left down, right up.

PRACTICE 5 problems

- 1** Graph $f(x)=(x-2)(x+6)$. Label zeros and end behavior.

ANSWER _____

- 2** Graph $f(x)=-(x+5)^2(x-10)$. Label zeros and end behavior.

ANSWER _____

- 3** Graph $f(x)=(x+12)^2$. Label zeros and end behavior.

ANSWER _____

- 4** Graph $f(x)=-5(x-14)(x+2)$. Label zeros and end behavior.

ANSWER _____

- 5** Graph $f(x)=6x^2(x-15)$. Label zeros and end behavior.

ANSWER _____

APPLY IT Show your work

- 1** A basketball video animation models the ball's height with $h(t) = -(t-2)(t-6)$. Graph the function. When is the ball at ground level, and what happens at both ends of the graph?

WORK SPACE

ANSWER _____

- 2** An esports club models a contest trend with $Q(x) = (x-2)^2(x+10)$, where x is weeks after sign-ups begin. For $x \geq 0$, identify the zero and tell whether the graph touches or crosses there. State end behavior.

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

A polynomial has a zero of -6 with multiplicity 2, a zero of 2 with multiplicity 5, and leading coefficient -1 . Write the polynomial in factored form. State where it touches or crosses and give end behavior.

PART 1 • PRACTICE

#	PROBLEM	ANSWER
1	Graph $f(x)=(x-2)(x+6)$. Label zeros and end behavior.	Zeros: -6, cross; 2, cross. End behavior: left up, right up.
2	Graph $f(x)=-(x+5)^2(x-10)$. Label zeros and end behavior.	Zeros: -5, touch; 10, cross. End behavior: left up, right down.
3	Graph $f(x)=(x+12)^2$. Label zeros and end behavior.	Zero: -12, touch. End behavior: left up, right up.
4	Graph $f(x)=-5(x-14)(x+2)$. Label zeros and end behavior.	Zeros: -2, cross; 14, cross. End behavior: left down, right down.
5	Graph $f(x)=6x^2(x-15)$. Label zeros and end behavior.	Zeros: 0, touch; 15, cross. End behavior: left down, right up.

PART 2 • APPLY IT

- The ball is at ground level at $t=2$ and $t=6$. The graph crosses at both zeros, with both ends down.** Set each factor equal to zero. The function is a quadratic with a negative leading coefficient, so both ends fall.
- For $x \geq 0$, the zero is $x=2$, and the graph touches there. End behavior: left down, right up.** The zero $x=-10$ is outside the stated domain. The factor $(x-2)^2$ has even multiplicity, and the positive cubic has left-down, right-up behavior.

CHALLENGE

$f(x)=-(x+6)^2(x-2)^5$. It touches at $x=-6$ and crosses at $x=2$. End behavior: left up, right down.

Accept equivalent factor order and equivalent end-behavior wording. Students' sketches should match the listed zeros, touch or cross behavior, and end directions.