LESSON MAKER PRO

Zero to Graph

Use zeros to predict a polynomial's shape.

HIGH SCHOOL · FA.A.35

FA.A.35 "Use the zeros of a polynomial to construct a rough graph of the function. (A-APR.3)"

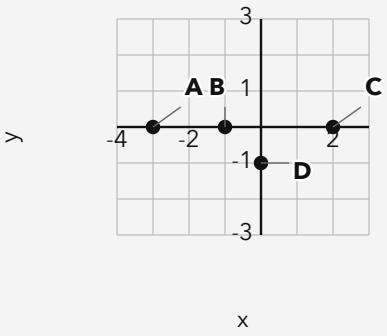
NAME _____ DATE _____

FOLLOW THE ZEROS

A graph crosses the x-axis at a zero with odd multiplicity and touches it at a zero with even multiplicity. Use the leading term to decide which way the ends go, then sketch a smooth curve through any known points.

WORKED EXAMPLE

Sketch f(x)=1/6(x+3)(x+1)(x-2) on the grid using the marked points.



1. The zeros are -3, -1, and 2.
2. Each factor occurs once, so the graph crosses at each zero.
3. The leading term is positive and cubic, so the left end falls and the right end rises.
4. At x=0, f(x)=1/6(3)(1)(-2)=-1.

Answer: Draw a smooth curve through A, B, D, and C. It crosses at A, B, and C, falls to the left, and rises to the right.

PRACTICE 4 problems

1 Sketch f(x)=(x-1)(x-3). Mark where it crosses the x-axis.

ANSWER _____

2 Sketch f(x)=-(x+4)(x-3). Mark where it crosses the x-axis.

ANSWER _____

3 Sketch $f(x)=x(x-4)^2$. Mark where it crosses or touches the x-axis.

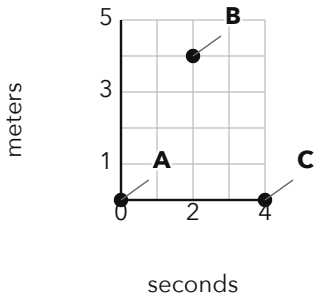
ANSWER _____

4 Sketch $f(x)=-(x+4)^2(x-1)$. Mark where it crosses or touches the x-axis.

ANSWER _____

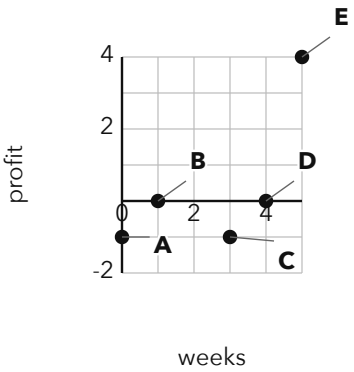
APPLY IT Show your work

1 A tossed ball's height is $h(x)=x(4-x)$ meters after x seconds. Sketch its flight through the plotted points. When does it land?



ANSWER _____

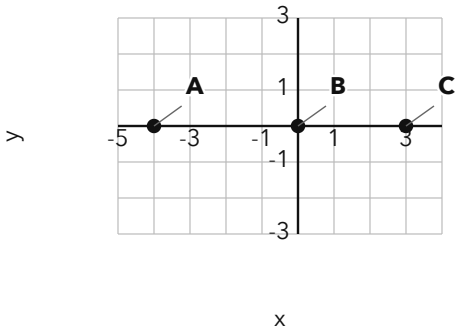
2 A creator's profit, in hundreds of dollars, is $P(x)=1/4(x-1)^2(x-4)$ after x weeks. Sketch through the plotted points. After which week does profit turn positive?



ANSWER _____

CHALLENGE One step up

Sketch $f(x)=1/12(x+4)x^2(x-3)$ using the marked zeros. Explain why the graph stays below the x-axis between -4 and 3, except at 0.



WORK SPACE AND ANSWER

Zero to Graph

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Sketch f(x)=(x-1)(x-3). Mark where it crosses the x-axis.	**Crosses at x=1 and x=3. Both ends rise.**
2	Sketch f(x)=-(x+4)(x-3). Mark where it crosses the x-axis.	**Crosses at x=-4 and x=3. Both ends fall.**
3	Sketch $f(x)=x(x-4)^2$. Mark where it crosses or touches the x-axis.	**Crosses at x=0 and touches at x=4. The left end falls and the right end rises.**
4	Sketch $f(x)=-(x+4)^2(x-1)$. Mark where it crosses or touches the x-axis.	**Touches at x=-4 and crosses at x=1. The left end rises and the right end falls.**

PART 2 · APPLY IT

1. **A downward-opening arch passes through A, B, and C. The ball lands after 4 seconds.** The height is zero at x=0 and x=4. The second zero is when the ball lands.
2. **The graph touches the axis at B, stays below it until D, then crosses upward. Profit turns positive after week 4.** The squared factor makes the graph touch, not cross, at x=1. It crosses from negative to positive at x=4.

CHALLENGE

Both ends rise. The graph crosses at -4, touches at 0 from below, and crosses at 3. Between -4 and 3, x+4 is positive and x-3 is negative, while x^2 is positive except at 0, so f(x) is negative except at 0.

Accept any smooth rough sketch with the stated intercept behavior and end behavior. Exact turning-point locations are not required.