LESSON MAKER PRO

Factor, Solve, Sketch

Use zeros and multiplicity to graph polynomials.

HIGH SCHOOL · MA.912.AR.6.6

MA.912.AR.6.6 "Solve and graph mathematical and real-world problems that are modeled with polynomial functions of degree 3 or higher. Interpret key features and determine constraints in terms of the context."

NAME _____ DATE _____

ZEROS SHOW THE GRAPH

Set each factor equal to zero to find the zeros. A factor used once usually crosses the x-axis. An even-power factor touches the x-axis and turns around.

WORKED EXAMPLE

Sketch y=(x-7)(x+3)(x-4).

1. Set each factor equal to zero.
2. x-7=0, x+3=0, and x-4=0.
3. The zeros are 7, -3, and 4. Each has multiplicity 1, so the graph crosses at each zero.

Answer: x-intercepts: (7,0), (-3,0), (4,0). Left end down, right end up.

PRACTICE 5 problems

1 Solve (x+5)(x-2)(x+1)=0.

ANSWER _____

2 Solve x(x-10)(x+2)=0.

ANSWER _____

3 Sketch y=(x+6)^2(x-9). State the x-intercepts and end behavior.

ANSWER _____

4 Sketch y=-(x-10)(x+2)(x-5)(x+1). State the x-intercepts and end behavior.

ANSWER _____

5 Sketch y=(x-11)^2(x+8). State the x-intercepts and end behavior.

ANSWER _____

APPLY IT Show your work

1 A drone club models a launched drone's height, in meters, by h(t)=-t(t-6)(t+2), where t is time in seconds. When is the drone on the ground? Give the meaningful time domain.

WORK SPACE

ANSWER _____

2 A concert team models its profit by P(x)=-(x-5)(x-12)(x+2), where x is the number of tickets sold in hundreds and 0<=x<=15. Find the break-even sales and when profit is positive.

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

Without graphing every point, describe the key features of y=-(x+9)(x-2)^2(x-6). Explain how multiplicity and degree determine the graph.

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ANSWER KEY

Factor, Solve, Sketch

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PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Solve (x+5)(x-2)(x+1)=0.	**x=-5, 2, -1**
2	Solve x(x-10)(x+2)=0.	**x=0, 10, -2**
3	Sketch y=(x+6)^2(x-9). State the x-intercepts and end behavior.	**x-intercepts: (-6,0), where the graph touches, and (9,0), where it crosses. Left end down, right end up.**
4	Sketch y=-(x-10)(x+2)(x-5)(x+1). State the x-intercepts and end behavior.	**x-intercepts: (-2,0), (-1,0), (5,0), (10,0). The graph crosses at each intercept. Both ends down.**
5	Sketch y=(x-11)^2(x+8). State the x-intercepts and end behavior.	**x-intercepts: (-8,0), where the graph crosses, and (11,0), where it touches. Left end down, right end up.**

PART 2 · APPLY IT

1. **The drone is on the ground at t=0 and t=6. Meaningful domain: 0<=t<=6.** Set each factor equal to zero to get t=0, 6, and -2. Negative time is not meaningful, so use times from launch until landing.
2. **Break-even sales: 500 tickets and 1200 tickets. Profit is positive when 500<x<1200 tickets.** The meaningful zeros are x=5 and x=12, since x=-2 is outside the context. Testing a value between the zeros shows P(x) is positive there.

CHALLENGE

The x-intercepts are (-9,0), (2,0), and (6,0). The graph crosses at -9 and 6, touches and turns at 2, and both ends point down because the polynomial has even degree with a negative leading coefficient.

Accept zeros in any order and equivalent interval notation. For sketches, accept any graph with the stated intercept behavior and end behavior.