

WARMUP

Discuss end behavior of

$$1) f(x) = -7x^4 + 3x^3 - 1 \quad \begin{array}{l} \text{Even} \\ \text{L.C.} < 0 \end{array} \quad \text{falls left and right}$$

$$2) f(x) = -3(x-7)^4(x+3)^3 \quad \begin{array}{l} \text{Odd (Degree = 7)} \\ \text{L.C.} < 0 \end{array} \quad \text{rise left, fall right}$$

$$3) f(x) = 2(x^2-4)^2(x+6) \quad \begin{array}{l} \text{Odd (Degree = 5)} \\ \text{L.C.} > 0 \end{array} \quad \text{fall left, rise right}$$

Section 3.3 Continued

If f is a polynomial and r is a real number such that $f(r)=0$, then r is a zero (or root) of f .

zero \equiv x -intercept $\equiv (x-r)$ is a factor

$$f(x) = x^2 - 5x + 4$$

$$x^2 - 5x + 4 = 0$$

$$\begin{array}{r} \cancel{-1} \cancel{4} \\ \cancel{-5} \quad \cancel{-4} \end{array} \quad (x-1)(x-4) = 0$$

$x=1 \quad x=4$

Zeros are 1 and 4

If r is a zero, then

- a) r is an x -intercept
- b) $(x-r)$ is a factor

Ex: Form a polynomial with degree 3 that has zeros 5, -5, and 7

Since 5 is a zero, $(x-5)$ is a factor
 " -5 " " " , $(x+5)$ " " "
 " 7 " " " , $(x-7)$ " " "

$$f(x) = \underbrace{(x-5)(x+5)}_{(x^2-25)}(x-7)$$

$$(A+B)(A-B) = A^2 - B^2$$

$$f(x) = \underbrace{(x^2-25)}_{(x-7)}$$

$$f(x) = x^3 - 7x^2 - 25x + 175$$

Multiplicity: In $f(x) = 3(x+2)^5(x-8)^4$

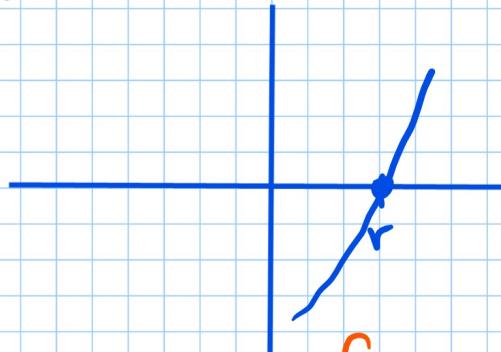
-2 and 8 are zeros

The power on the factors is called the multiplicity of that zero.

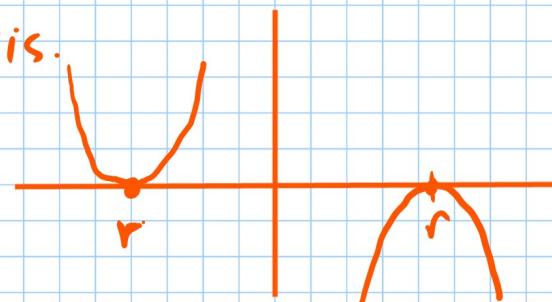
-2 is a zero of multiplicity 5

8 is a zero of multiplicity 4

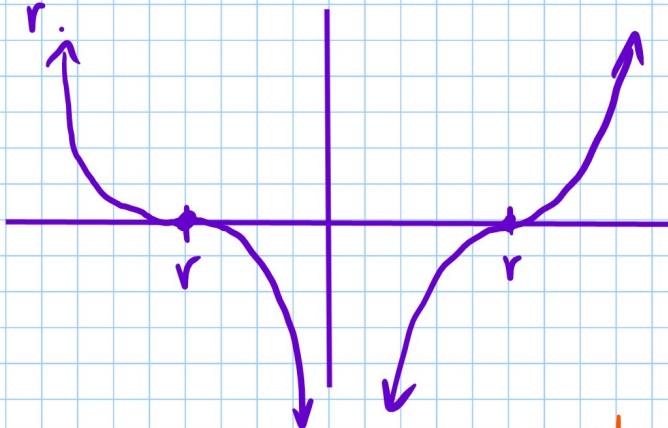
CASE 1: If r is a zero of multiplicity 1,
graph goes through the x -axis at r .



CASE 2: If r is a zero of even multiplicity
graph touches x-axis but doesn't cross the
x-axis.



CASE 3: If r is a zero of odd multiplicity ≥ 3 , graph goes through the x -axis at r but levels out at r .



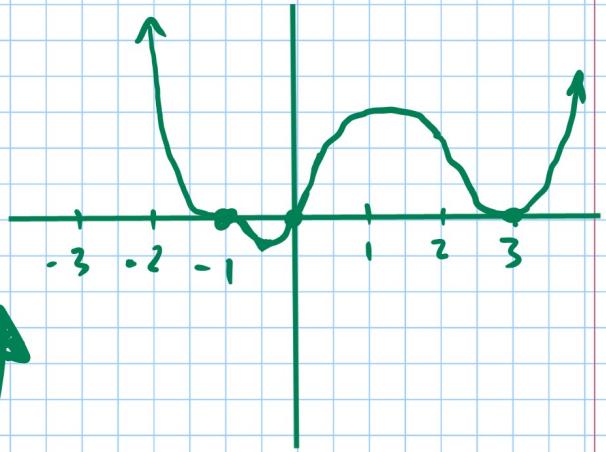
Ex: Sketch the graph of $f(x) = x(x-3)^4(x+1)^3$

degree = 8
L.C. > 0 } rises left and right

zeros: 0 mult is 1

3 mult is 4

-1 mult is 3



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For 19-29 follow last example