

Catch up.

$3+\sqrt{5}$ is a root

$\implies 3-\sqrt{5}$ a root also.

Root 4,

Root $3-\sqrt{5}$

make the polynomial.

$$\begin{array}{c} \downarrow \qquad \downarrow \qquad \downarrow \\ (x-4) \quad (x-(3-\sqrt{5})) \quad (x-(3+\sqrt{5})) \\ \hline (x-3+\sqrt{5})(x-3-\sqrt{5}) \end{array}$$

$$\begin{array}{r} x^2 - 3x - \sqrt{5}x \\ -3x \quad + 9 + 3\sqrt{5} \\ +\sqrt{5}x \quad - 5 \quad - 3\sqrt{5} \end{array}$$

$$(x-4)(x^2 - 6x + 4)$$

$3 \pm \sqrt{5}$

$$\sqrt{2} \cdot \sqrt{5} = \sqrt{10}$$

$$\begin{array}{l} 3 \cdot \sqrt{2} = 3\sqrt{2} \\ 3 \cdot \sqrt{5} = 3\sqrt{5} \\ 3 \cdot -\sqrt{5} = -3\sqrt{5} \end{array}$$

$$\sqrt{2} \cdot \sqrt{5} \dots$$

$$\begin{aligned} 3 \cdot \sqrt{2} &= 3\sqrt{2} \\ 3 \cdot \sqrt{5} &= 3\sqrt{5} \\ 3 \cdot -\sqrt{5} &= -3\sqrt{5} \end{aligned}$$

Roots: 4, $1 - 2i$
 \Downarrow $1 + 2i$

$$P(x) = (x-4)(x-(1-2i))(x-(1+2i))$$

<u>Roots</u>		<u>Factors</u>
-1	$x+1=0$ $x=-1$	$(x+1)$

The root is the number that makes the factor = 0.

30.

$$\pm \frac{p}{q} \quad \frac{6}{1} \quad \left(\begin{array}{l} \pm 1.6 \\ \pm 2.3 \end{array} \right)$$

$$x^3 - 6x^2 + 11x - 6 = 0$$

3 Roots
because $x \textcircled{3}$

Use desmos to find
a starting point

$$\begin{array}{r}
 \boxed{2} \\
 \downarrow \\
 \begin{array}{cccc}
 1 & -6 & 11 & -6 \\
 \hline
 1 & -4 & 3 & 0 \\
 \hline
 \end{array} \\
 x^2 + 4x + 3
 \end{array}$$

$$P(x) = (x-2)(x+1)(x+3) = 0$$

$$x=2 \quad x=-1 \quad x=-3$$

#24 $x^4 - 3x^3 + 5x^2 - 27x - 36 = 0$

I need 2 Freebies

$$\begin{array}{r}
 \textcircled{-1} \\
 \textcircled{4} \\
 \begin{array}{r}
 -1 \mid 1 \quad -3 \quad 5 \quad -27 \quad -36 \\
 \hline
 \quad -1 \quad 4 \quad -9 \quad 36 \\
 \hline
 1 \quad -4 \quad 9 \quad -36 \quad 0 \\
 \hline
 \end{array}
 \end{array}$$

$$\begin{array}{r}
 4 \mid 1 \quad -4 \quad 9 \quad -36 \\
 \hline
 \quad 4 \quad 0 \quad 36 \\
 \hline
 1 \quad 0 \quad 9 \quad 0 \\
 \hline
 \end{array}$$

$x^2 + 0x + 9$

Solve $x^2 + 9 = 0$

$$\sqrt{x^2} = \sqrt{-9}$$

$$x = \pm 3i$$

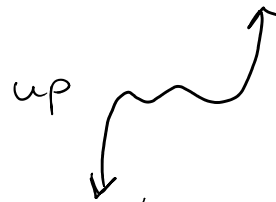
Roots = solution $-1, 4, +3i, -3i$

Degree:

~~even~~ ~~Bowl~~



~~odd~~ ~~noodle~~



A.) $(x+7)(x-9)^2(x+6)$
degree = $1+2+1 = 4$

B.) $x^7 - 3x^6 + 5x^5 + \dots$
degree = 7

Leading coefficient positive — up
negative — down

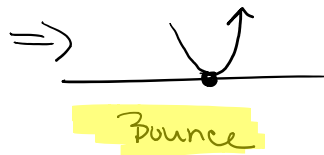
Roots of polynomial where the

Roots of polynomial where the graph crosses the x axis.

y-int when $x = 0$.

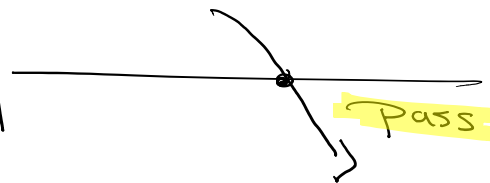
Multiplicity = exponent on a factor.

multiplicity even



multiplicity

odd



Ex:

$$f(x) = (x+1)(x-5)(x+3)$$

Shape — degree = 3 noodle

direction $c = +1$ up

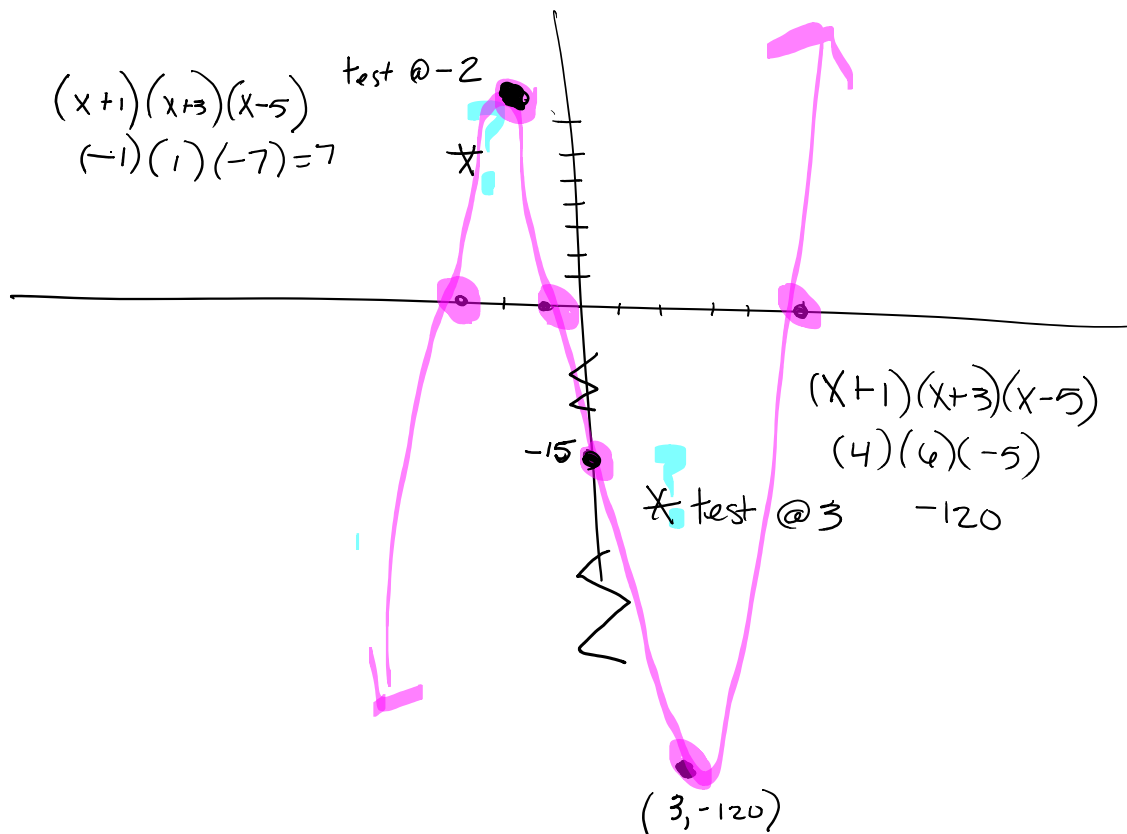
y-int $(1)(-5)(3) = -15$

Roots — pass bounce

$x = -1$ multiplicity 1 pass

$x = 5$ mult. 1 pass

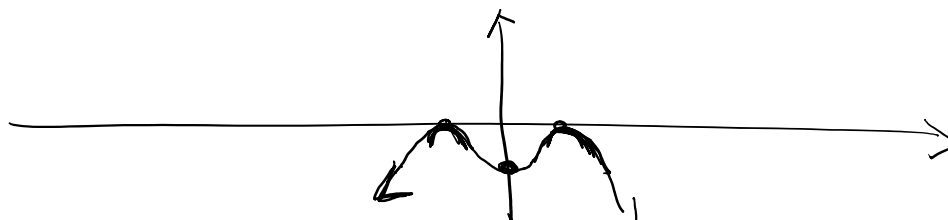
$x = -3$ mult 1 pass



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

Shape — degree $2+2 = 4$ Bowl
 direction — Lead coefficient = -1 down.
 Y-int — $-(1)^2(-1)^2 = -1$
 roots / multiplicity

Root	-1	multiplicity	2	Bounce
Root	1	"	2	Bounce



#5.

$$2x^4 - 5x^3 - 12x^2 - x + 4$$

y-int: 4
Shape degree 4 Bowl.
direction $2 > 0$ up

Roots *

Freebies: -1 multiplicity 2

$$\begin{array}{r|rrrrr} -1 & 2 & -5 & -12 & -1 & 4 \\ & \downarrow & -2 & 7 & +5 & -4 \end{array}$$

$$\begin{array}{r|rrrrr} -1 & 2 & -7 & -5 & 4 & 0 \\ & \downarrow & -2 & 9 & -4 & \end{array}$$

$$\underline{\underline{2 \quad -9 \quad 4 \quad 0}}$$

$$2x^2 - 9x + 4$$

$$(2x - 1)(x - 4)$$

$$x = \frac{1}{2} \quad x = 4$$

Roots: -1 mult 2 Bounce
 $\frac{1}{2}$ mult 1 Pass
4 mult. 1 Pass

