

Zeros: the point(s) where the graph crosses the x-axis

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What are the rational roots of  $2x^3 - x^2 + 2x + 5 = 0$ ?

P: 5                     $\pm 1, \pm 5$

Q: 2                     $\pm 1, \pm 2$

$\frac{P}{Q}$ :  $\frac{\pm 1}{1}, \frac{\pm 1}{2}, \frac{\pm 5}{1}, \frac{\pm 5}{2}$

$\frac{P}{Q}$ :  $\pm 1, \pm \frac{1}{2}, \pm 5, \pm \frac{5}{2}$

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-1	2	-1	2	5
	↓	-2	+3	-5
	2	-3	5	0

$(x+1)(2x^2 - 3x + 5)$   
↑  
factor

$(x+1)(2x-5)(x+1)$   
 $x+1=0$      $2x-5=0$      $x+1=0$

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$x^3 - x^2 - 8x + 12$

P:  ~~$\pm 1, \pm 2, \pm 3, \pm 4, \pm 6, \pm 12$~~

Q:  $\pm 1$

1:  $1^3 - 1^2 - 8(1) + 12$   
 $1 - 1 - 8 + 12$   
 $2 \neq 0$

-1:  $(-1)^3 - (-1)^2 - 8(-1) + 12$   
 $-1 - 1 + 8 + 12$   
 $16 \neq 0$

②  $(2)^3 - (2)^2 - 8(2) + 12$   
 $8 - 4 - 16 + 12$   
 $4 - 16 + 12$   
 $0 = 0$

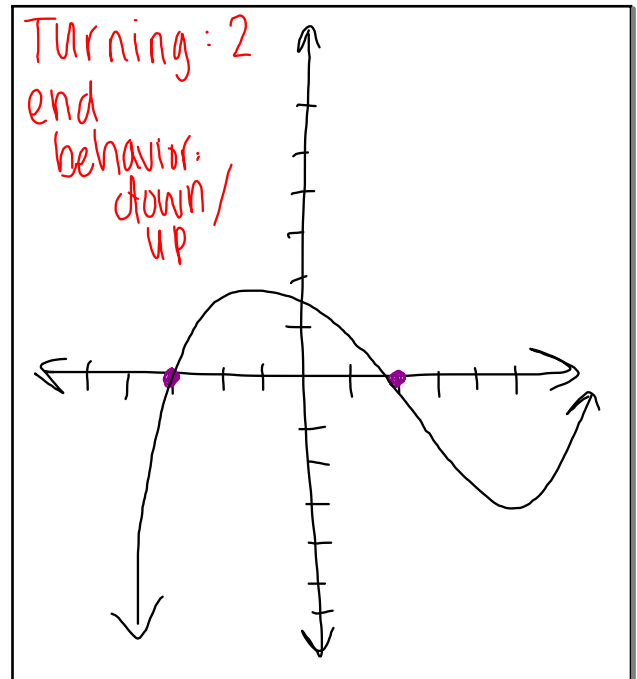
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$$\begin{array}{r}
 2 \overline{) 1 \quad -1 \quad -8 \quad +12} \\
 \underline{\phantom{2} \downarrow \phantom{2} \phantom{2} \phantom{2}} \phantom{2} \phantom{2} \phantom{2} \phantom{2}} \\
 1 \quad 1 \quad -6 \quad 0
 \end{array}$$

$(x-2)(x^2+1x-6)$   $\frac{6}{1 \ 2 \ 3}$   
 $(x-2)(x+3)(x-2)$

$x-2=0$	$x+3=0$	$x-2=0$
$+2 \ +2$	$-3 \ -3$	$+2 \ +2$
$x=2$	$x=-3$	$x=2$

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What are the rational roots of  $2x^3 + x^2 - 7x - 6 = 0$ ?

$P: 6 \quad \pm 1, \pm 2, \pm 3, \pm 6$   
 $Q: 2 \quad \pm 1, \pm 2$

$\frac{P}{Q}: \pm 1, \pm 2, \pm 3, \pm 6, \pm \frac{1}{2}, \pm \frac{3}{2}$

$1: 2(1) + 1 - 7 - 6 = 10 \neq 0$   
 $2: 2(2) + 1 - 7 - 6 = 10 \neq 0$

$-1: 2(-1) + 1 + 7 - 6 = 0$   
 $-2: 2(-2) + 1 + 7 - 6 = 0$

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$$\begin{array}{r}
 -1 \overline{) 2 \quad 1 \quad -7 \quad -6} \\
 \underline{\phantom{-1} \downarrow \phantom{-1} \phantom{-1} \phantom{-1}} \phantom{-1} \phantom{-1} \phantom{-1} \phantom{-1}} \\
 2 \quad -1 \quad -6 \quad 0
 \end{array}$$

$(x+1)(2x^2 - x - 6)$   
 $x^2 - x - 12 \quad \frac{12}{1 \ 12}$

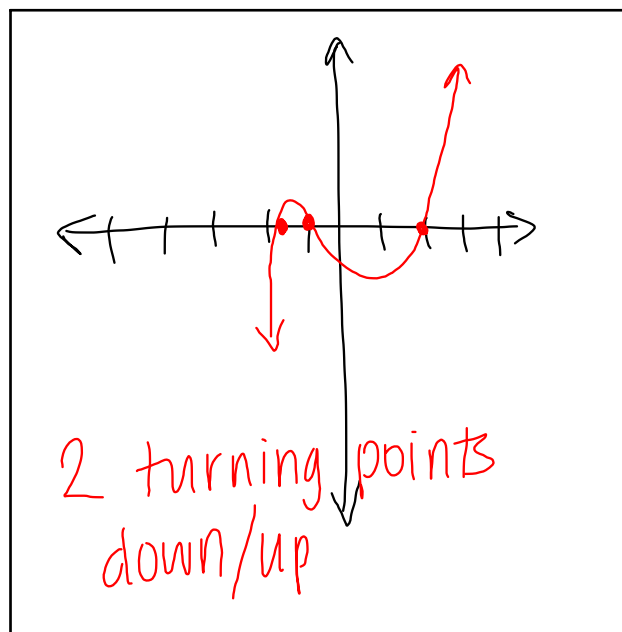
$(x+1)(x+3)(x-\frac{4}{2}) \quad \frac{2 \ 6}{3 \ 4}$

$(x+1)(2x+3)(x-2)$

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$x+1=0$	$2x+3=0$	$x-2=0$
$-1 \quad -1$	$+3 \quad -3$	$+2 \quad +2$
$x=-1$	$\frac{2x}{2} = \frac{-3}{2}$	$x=2$
	$x = -\frac{3}{2}$	
	$x = -1.5$	

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