Trig 4.4

Identify possible rational roots of a polynomial equation
Determine the number of positive and negative real roots of a polynomial function

rational

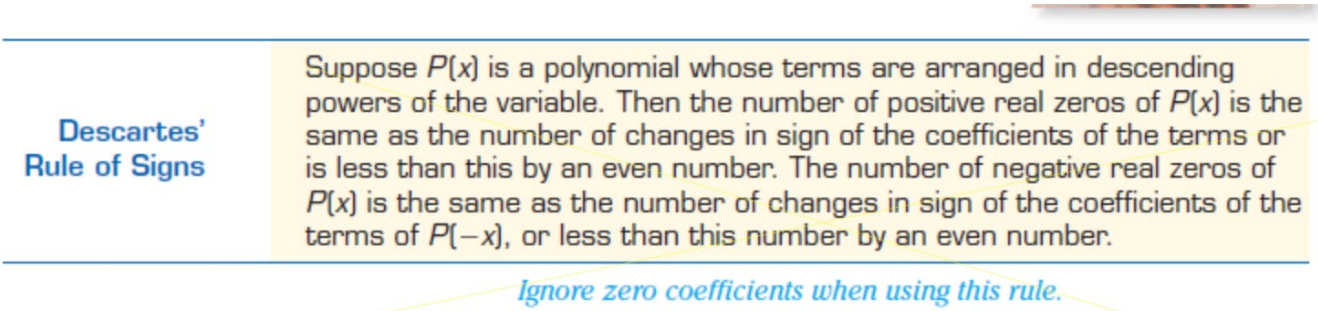
real

complex $2+3i \quad 2-3i$

conjugate pairs

Descarte's rule of signs

whiteboards



Descartes' Rule of Signs

Suppose $P(x)$ is a polynomial whose terms are arranged in descending powers of the variable. Then the number of positive real zeros of $P(x)$ is the same as the number of changes in sign of the coefficients of the terms or is less than this by an even number. The number of negative real zeros of $P(x)$ is the same as the number of changes in sign of the coefficients of the terms of $P(-x)$, or less than this number by an even number.

Ignore zero coefficients when using this rule.

positive real = # sign changes
OR n-2
n-4, etc.
why....?
shortcut for negative real (almost always works)
When would it not work?

pos.

3 Find the number of possible positive real zeros and the number of possible negative real zeros for $f(x) = 2x^5 + 3x^4 - 6x^3 + 6x^2 - 8x + 3$. Then determine the rational zeros.

-2 3, 1,

pos. 4, 2, 0

$f(-x) = -2x^5 + 3x^4 + 6x^3 + 6x^2 + 8x + 3$

ⓒ

3, 1

neg 1

imag 0, 2, 4

+2

neg= degree - pos. (almost always works...)

$x = 2 + \sqrt{3}$

$x = 2 - \sqrt{3}$

Find the number of possible positive real zeros and the number of possible negative real zeros for each function. Then determine the rational zeros.

7. $f(x) = 8x^3 - 6x^2 - 23x + 6$ **8.** $f(x) = x^3 + 7x^2 + 7x - 15$

$x = 2$

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

$x = -\frac{3}{2}.$

pos. 2, 0

neg. 1

imag. 0, 2

$$\pm \frac{1, 2, 3, 6}{1, 2, 4, 8}$$

$$\pm\left(\checkmark 1 \quad \frac{1}{2} \quad \frac{1}{4} \quad \frac{1}{8} \quad \checkmark 2 \quad 3 \quad \frac{3}{2} \quad \frac{3}{4} \quad \frac{3}{8} \quad 6\right)$$

$8x^3 - 6x^2 - 23x + 6$

$\frac{4}{16} = \frac{1}{4}$

$$\begin{array}{r|rrrr} 2 & 8 & -6 & -23 & 6 \\ & \downarrow & 16 & 20 & -6 \\ \hline & 8 & 10 & -3 & 0 \end{array}$$

$8x^2 + 10x - 3$

$$x = \frac{-10 \pm \sqrt{100 - 4 \cdot 8 \cdot -3}}{16}$$

$$= \frac{-10 \pm \sqrt{196}}{16}$$

$$x = \frac{-10 \pm 14}{16} \qquad \frac{-24}{16} = \frac{-3}{2}$$

$\pm\ 1, 2, 3, 6$

Find the number of possible positive real zeros and the number of possible negative real zeros for each function. Then determine the rational zeros.

17. $f(x) = 1x^3 \underset{0}{-} 7x - 6$ **18.** $f(x) = x^3 - 2x^2 - 8x$

pos = 1

neg = 2, 0

$$\begin{array}{r|rrrr} -1 & 1 & 0 & -7 & -6 \\ & \downarrow & -1 & 1 & 6 \\ \hline & 1 & -1 & -6 & 0 \end{array}$$

$x = -1$

$x = 3$

$x = -2$

$$\begin{array}{ccc} & -6 & \\ -3 & \times & 2 \\ & -1 & \end{array}$$

$x^2 - x - 6$

What if some of them are irrational?

Imaginary?

WB 4.4