Sec 3.4
Descartes' Rule of Signs

put this on your card

We can determine the number of positive real zeros by looking at SIGN CHANGES.

$$f(x) = 3x^7 - 2x^5 - x^4 + 7x^2 + x - 3$$

sign change

$\therefore$ 3 positive real zeros or

$3 - 2 = 1$ positive real zeros

even #

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

2 sign changes

$\therefore$ 2 positive real zeros

or $2-2 = 0$ positive real zeros

even

$f(x) = -7x^6 - 5x^4 + x + 9$

1 sign change

$\therefore$ 1 positive real zero } only possibility

or 1-2

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

1 2 3

# of possible positive real zeros

3 or 1

To determine the possible number of *negative* real zeros...

- replace x with -x

- "clean it up" (e.g. raise to power, multiply negatives)

- count the sign changes

3 or 1

For example- $f(x) = x^3 + 2x^2 + 5x + 4$

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

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

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

There are three sign changes, so either three or 1 negative real zeros.

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

2 sign changes $\therefore$ there are

2 or 0 poss pos real zeros

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

$= -6x^5 + 4x^3 - 3x^2 + 5$

3 sign changes $\therefore$ 3 or 1 poss neg real zeros

Put one (or all three) examples on your notecard...

Try...
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determine the possible number of real zeros
#33,35,37

and...
find all zeros of 39, 43

33. no positive, 3 or 1 negative real roots
35. 3 or 1 positive, no negative
37. 2 or 0 positive, 2 or 0 negative
39. -2,5,1
43. -1, 2+2i, 2-2i

ex $f(x) = 4x^5 \underbrace{+3x^3}_{1} - 6x^2 - 7x - 2$

$\boxed{\text{Positive} = 1}$

$$f(-x) = 4(-x)^5 + 3(-x)^3 - 6(-x)^2 - 7(-x) - 2$$

$$= -4x^5 - 3x^3 \underbrace{-6x^2 +}_{1} \underbrace{7x -}_{2} 2$$

$\boxed{\text{Negative} = 2, 0}$