

# Long Division

$$(x^3 + x - 7) \div (x + 5)$$

$$\begin{array}{r}
 x^2 - 5x + 26 - \frac{137}{x+5} \\
 x+5 \overline{) x^3 + 0x^2 + x - 7} \\
 \underline{-(x^3 + 5x^2)} \quad \downarrow \\
 -5x^2 + x \\
 \underline{-(-5x^2 - 25x)} \quad \downarrow \\
 26x - 7 \\
 \underline{-(26x + 130)} \\
 -137
 \end{array}$$

$$x^2 - 5x + 26 - \frac{137}{x+5}$$

Since we got a remainder  $x+5$  is not a factor of  $x^3 + x - 7$ .

To be a factor you cannot have a remainder unless it's zero.

## Descartes's Rule of signs

$$f(x) = 3x^4 - x^3 - 36x^2 + 60x - 16$$

1
2
3  
 # of changes

+ real solutions: 3, 1

$$\begin{aligned}
 f(-x) &= 3(-x)^4 - (-x)^3 - 36(-x)^2 + 60(-x) - 16 \\
 &= 3x^4 + x^3 - 36x^2 - 60x - 16
 \end{aligned}$$

1  
1 neg real solutions

+R	3	1
-R	1	1
non real	0	2

$3+1=4$  I can only have 4  
 $1+1=2$  I need 2 more 2 non real

ex)  $f(x) = x^3 - 4x^2 - 2x + 20$

$$\begin{array}{r}
 20 \\
 4, 5 \\
 1, 20 \\
 2, 10
 \end{array}$$

P.R.R =  $\pm 20, \pm 10, \pm 5, \pm 4, \pm 2, \pm 1$

### Descartes's Rule of sign

+R	2	0
-R	1	1
non real	0	2

$f(1) \neq 0$  not a root/zero  
 $f(-1) \neq 0$  not a root/zero

$f(-2) = 0$   $x = -2$  is a zero and a root

$x+2$  is a factor of  $f(x)$

[ex] cont.

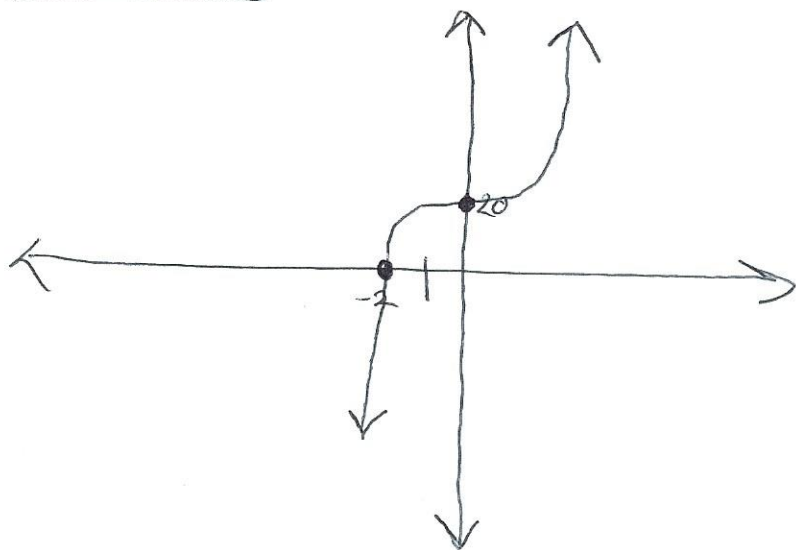
$$x^3 - 4x^2 - 2x + 20 \div x + 2$$

$$\begin{array}{r} x^2 - 6x + 10 \\ x+2 \overline{) x^3 - 4x^2 - 2x + 20} \\ \underline{-(x^3 + 2x^2)} \phantom{+ 20} \\ -6x^2 - 2x \phantom{+ 20} \\ \underline{-(-6x^2 - 12x)} \phantom{+ 20} \\ 10x + 20 \\ \underline{-10x + 20} \\ 0 \end{array}$$

3 solutions

$$\begin{aligned} x &= -2 \\ x &= 3+i \\ x &= 3-i \end{aligned}$$

Graph



3-7-19 Pg 2  
Math 2311

$$(x+2)(x^2 - 6x + 10)$$

$$\begin{aligned} x+2 &= 0 \\ x &= -2 \end{aligned}$$

$$a=1 \quad b=-6 \quad c=10$$

$$x = \frac{6 \pm \sqrt{(-6)^2 - 4(1)(10)}}{2(1)}$$

$$x = \frac{6 \pm \sqrt{36 - 40}}{2}$$

$$x = \frac{6 \pm \sqrt{-4}}{2}$$

$$x = \frac{6 \pm i2}{2}$$

$$x = 3 \pm i$$

$$x = 3+i \quad x = 3-i$$