Long Division

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

$$\begin{array}{r} x^2 - 5x + 26 - \frac{137}{x+5} \\ x+5 \,\big)\, \cancel{x^3} + 0x^2 + x - 7 \\ -(\cancel{x^3} + 5x^2) \qquad\qquad \\ -5\cancel{x^2} + x \qquad \\ -(-\cancel{5x^2} - 25x) \qquad \\ 26x - 7 \\ -(\cancel{26x} + 130) \\ \hline -137 \end{array}$$

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

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.

Descarte's Rule of signs

$f(x) = \underbrace{3x^4 - x^3}_{1} \underbrace{- 36x^2 + 60x}_{2} \underbrace{- 16}_{3}$

\# of changes

$+$ real solutions: 3, 1

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

$= 3x^4 \underbrace{+ x^3 - 36x^2}_{1} - 60x - 16$

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

$\boxed{ex}$ $f(x) = \underbrace{x^3 - 4x^2}_{1} \underbrace{- 2x}_{x} \underbrace{+ 20}_{2}$

20: 4,5; 1,20; 2,10

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

Descarte's Rule of sign

+R	2	0
−R	1	1
non real	0	2

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

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

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

$\boxed{x+2}$ is a factor of $f(x)$

$\boxed{ex}$ cont.

3-7-19 Pg 2
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$x^3-4x^2-2x+20 \div x+2$

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

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

$x+2=0$
$x=-2$

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

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

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

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

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

$x=3\pm i$

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

3 solutions

$x=-2$
$x=3+i$
$x=3-i$

Graph