① (5pts) $x=-5, m=3;\ x=2+i, m=1;$ Degree $=5$

$$(x+5)^3(x-(2+i))(x-(2-i))$$

② (10pts)

$$(x+(2-7i))(x+(2+7i))$$

$$= x^2+(2+7i)x+(2-7i)x+(2-7i)(2+7i)$$

$$= x^2+2x+7ix+2x-7ix+4+49$$

$$= \boxed{x^2+4x+53}$$

③ (5pts) $P(x) = x^5-3x^4+4x^3-4x^2-62x+5$. $P(-2)=$

-2	1	-3	4	-4	-62	5
		-2	10	-28	64	-4
	1	-5	14	-32	2	$1 = P(-2)$

④ (5pts)

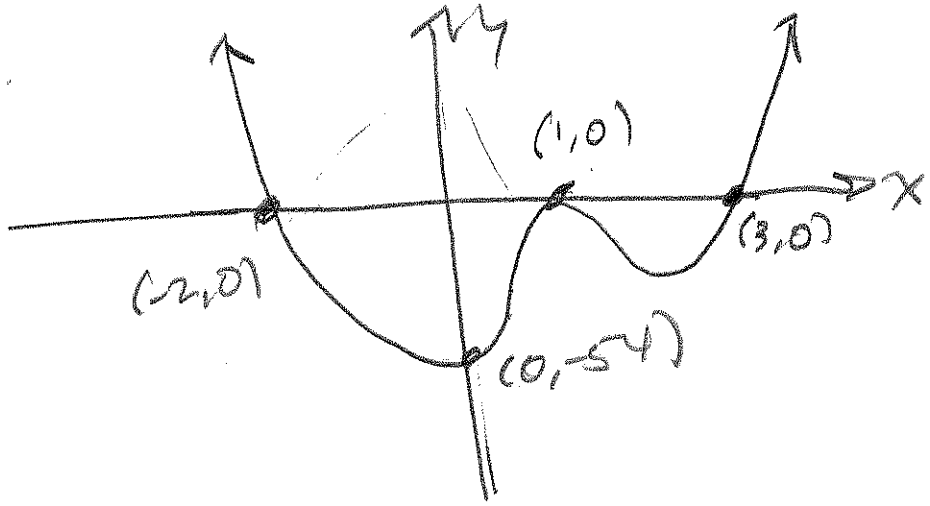
$$\begin{array}{r} x^3-3x^2+2x+2 \\ x^2+2 \overline{)\ x^5-3x^4+4x^3-4x^2-62x+5} \\ -(x^5\qquad +2x^3) \\ \hline -3x^4+2x^3-4x^2-62x+5 \\ -(-3x^4\qquad -6x^2) \\ \hline 2x^3+2x^2-62x+5 \\ -(2x^3\qquad +4x) \\ \hline 2x^2-66x+5 \\ -(2x^2\qquad +4) \\ \hline -66x+1 \end{array}$$

So, $\boxed{P(x)=(x^2+2)(x^3-3x^2+2x+2)-66x+1}$

(5) $f(x) = x^6 - 9x^5 + 24x^4 + 2x^3 - 99x^2 + 135x - 54$

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

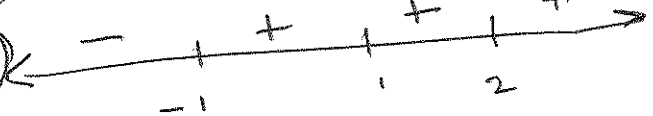
(2) (10pts)



(b) $3(x-2)^2(x+1)(x-1)^2 > 0$

screwup in test

(c) (5pts)



$(-1,1) \cup (1,2) \cup (2,\infty)$

BASED on $3(x-2)^2(x+1)(x-1)^2$

BASED ON PIC:

$(-\infty,-2) \cup (3,\infty)$

BASED ON PIC:

$(-\infty,-2] \cup [3,\infty)$

(5pts) (d) $\dfrac{3(x-2)^2}{(x+1)(x-1)^2}$

$(-1,1) \cup (1,2] \cup [2,\infty)$

$= (-1,1) \cup (1,\infty)$

POORLY POSED QUESTION, BECAUSE INEQUALITIES DIDN'T MATCH Function @ top of page

(6) (10 pts)

$f(x) = 4x^4 - 8x^3 - 10x^2 + 34x - 20$

$\pm 1, \pm 2, \pm 4, \pm 5, \pm 10, \pm 20$

$\pm \frac{1}{2}, \pm \frac{1}{2}, \pm \frac{1}{4}, \pm \frac{1}{5} \pm \frac{1}{10} \pm \frac{1}{20}, \pm \frac{5}{2}, \pm \frac{5}{4}$ ...

Descartes's: 3 or 1 pos. zeros

$f(-x) = 4x^4 + 8x^3 - 10x^2 - 34x - 20$ 1 neg. zero

1] $4 \quad -8 \quad -10 \quad +34 \quad -20$

$\quad\quad 4 \quad -4 \quad -14 \quad 20$

$-2]\ 4 \quad -4 \quad -14 \quad 20$

$\quad\quad -8 \quad 24 \quad -20$

$\quad 4 \quad -12 \quad 10$

REAL Zeros: $x = 1, -2$

$f(x) = (x-1)(x+2)(4x^2 - 12x + 10)$

Factored over $\mathbb{R}$.

$b^2 - 4ac = (-12)^2 - 4(4)(10)$

$= 144 - 160$

$= -16$ No real zeros for depressed polynomial $4x^2 - 12x + 10$

(7) (5pts) $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{12 \pm \sqrt{-16}}{2(4)}$

$= \frac{12 \pm 4i}{8} = \frac{3 \pm i}{2}$ are nonreal zeros

$f(x) = 4(x-1)(x+2)\left(x - \left(\frac{3+i}{2}\right)\right)\left(x - \left(\frac{3-i}{2}\right)\right)$

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(8 pts) $R(x) = \dfrac{x^3 - 6x^2 + 3x + 10}{x^3 - 4x^2 - 7x + 10} = \dfrac{(x-2)(x+1)(x-5)}{(x-5)(x+2)(x-1)}$

$D: \{x \mid x \neq -2, 1, 5\}$

Lowest terms: $R(x) = \dfrac{(x-2)(x+1)}{(x+2)(x-1)}$, so

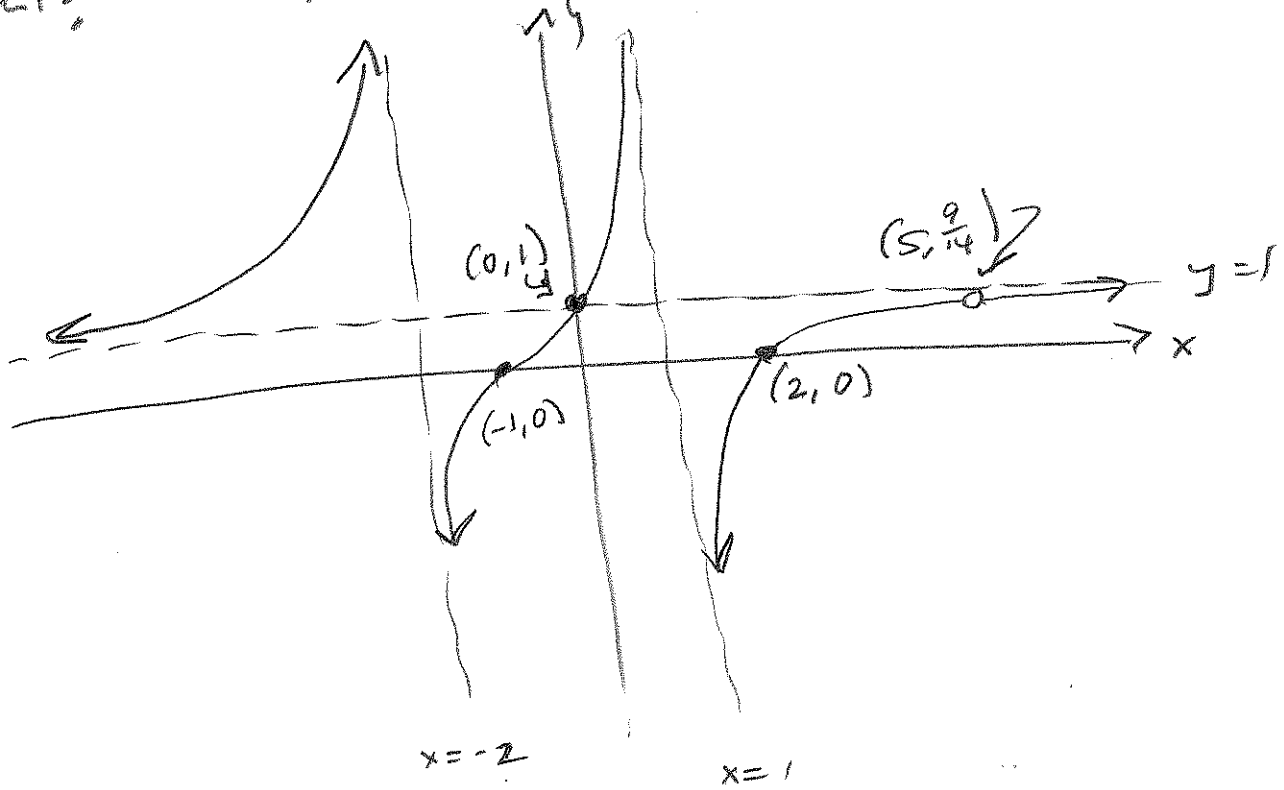
@ $x=5$ is a hole: $\dfrac{(5-2)(5+1)}{(5+2)(5-1)} = \dfrac{(3)(6)}{(7)(4)} = \dfrac{(3)(3)}{(7)(2)}$

$= \dfrac{9}{14} \rightarrow$ Hole @ $(5, \frac{9}{14})$

$x = -2$ & $x = 1$ are vertical Asymptotes

Horizontal Asymptote: $y = \dfrac{x^3}{x^3} = 1$

x-ints: $(2,0), (-1,0)$ y-int: $(0, \frac{10}{10}) = (0,1)$



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