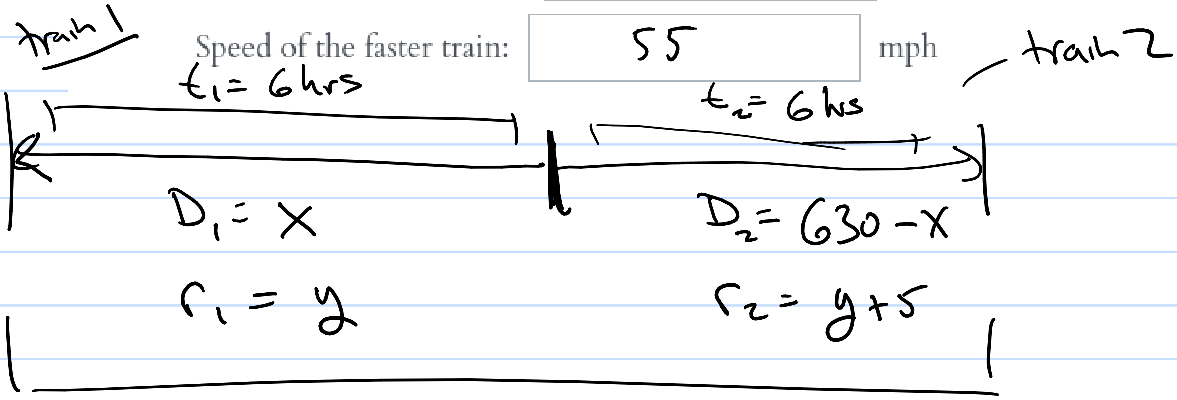
Math 112

Q's (4.3 #12) $D = rt$

12 Two trains going in opposite directions leave the same station at the same time. One train travels **5** mph faster than the other. In **6** hours the trains are **630** miles apart. Find the speed of each train.

Speed of the slower train: 50 mph

Speed of the faster train: 55 mph



$r_c = \frac{630}{6} \rightarrow$ $D_c = 630$, $t_c = 6$ hrs   combined

$= 105$ mph

$r_1 + r_2 = 105$

$y + (y+5) = 105 \rightarrow 2y + 5 = 105$

$y = 50$ mph

$y + 5 = 55$ mph

Q

$$\frac{1}{(x-5)} - \frac{6}{1}\frac{(x-5)}{(x-5)} = \frac{(1) - (6 \cdot (x-5))}{x-5} = \frac{1 - 6x + 30}{x-5}$$

$$= \boxed{\frac{-6x + 31}{x-5}}$$

ex $\frac{1}{a} + \frac{2 \cdot a}{1 \cdot a} = \frac{1+2a}{a}$

ex $\frac{3}{x} - \frac{4}{x} = \frac{3-4}{x}$

$\frac{1}{7} - \frac{6 \cdot 7}{1 \cdot 7} = \frac{1-42}{7}$

Ex $f(x) = \frac{1 \cdot x^3 - 81x}{1 \cdot x^3 + 10x^2 + 25x} = \frac{x(x^2-81)}{x(x^2+10x+25)} = \frac{\cancel{x}(x+9)(x-9)}{\cancel{x}(x+5)^2}$

$= \boxed{\frac{(x+9)(x-9)}{(x+5)^2}}$, $x \neq 0$

hole: $(0, \frac{-81}{25})$ $\frac{(0+9)(0-9)}{(0+5)^2} = \frac{-81}{25}$ $\boxed{(0, -81/25)}$

Vertical asym: $x = -5$ $\boxed{-5}$

Horz or slant asym: $y = \frac{1}{1} = 1$

Domain: all reals except $x \neq 0$ $x \neq -5$

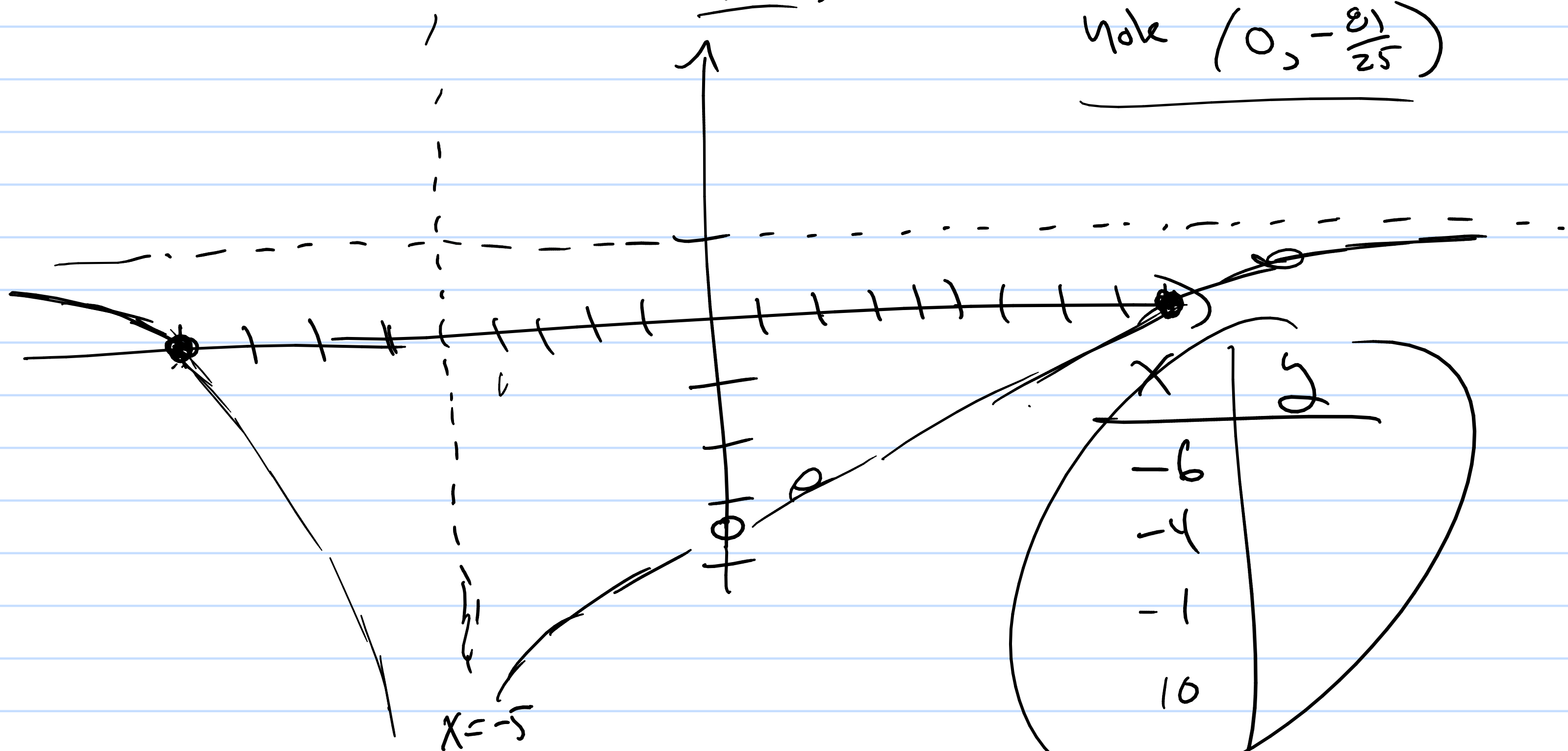
-5 0

$(-\infty, -5) \cup (-5, 0) \cup (0, \infty)$

roots @ $x = 9, x = -9$

$$f(x) = \frac{x^3 - 81x}{x^3 + 10x^2 + 25x} = \frac{(x+9)(x-9)\,x}{(x+5)^2} \quad x \neq 0$$

hole $\left(0, -\frac{81}{25}\right)$



x	y
-6	
-4	
-1	
10	

Rational Inequalities

$\boxed{1^{st}}$ make this into

$$\frac{p(x)}{d(x)} \;\; \leq \;\; < \;\; \geq \;\; > \;\; 0$$

single rational inequality; zero

ex

$$\frac{1}{x+1} - \frac{3}{x} > x + 2$$

$$\frac{1}{x+1} - \frac{3}{x} - \frac{x}{1} - \frac{2}{1} > 0$$

$\boxed{\text{common denom is } x(x+1)}$

$$\frac{1}{x+1} - \frac{3}{x} > x + 2$$

$$\frac{1}{(x+1)} - \frac{3}{(x)} - \frac{x}{1} - \frac{2}{1} > 0$$

$$\frac{x}{x}\cdot\frac{1}{(x+1)} - \frac{3}{x}\,\frac{(x+1)}{(x+1)} - \frac{x}{1}\,\frac{x(x+1)}{x(x+1)} - \frac{2}{1}\,\frac{x(x+1)}{x(x+1)} > 0$$

$$\frac{x - 3(x+1) - x^2(x+1) - 2x(x+1)}{x(x+1)} > 0$$

$$\frac{-x^3 - 3x^2 - 4x - 3}{x(x+1)} > 0$$

$\boxed{2^{nd}\text{ Step}}$

$$\frac{p(x)}{d(x)} \begin{matrix} \geq \\ > \\ < \\ \leq \end{matrix} 0$$

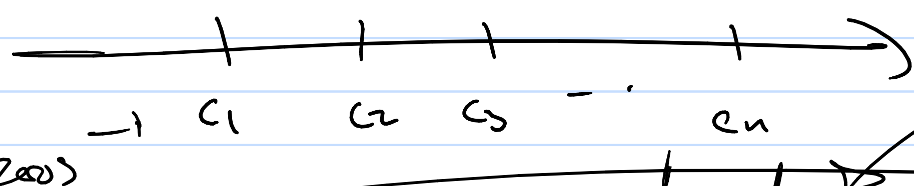
if $<$, $>$ — if $\leq$, $\geq$

a) find zeros of $p(x)$ ($\boxed{\text{open}}$ or $\boxed{\text{closed}}$)

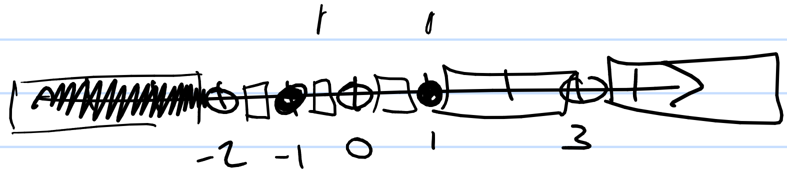
b) find zeros of $d(x)$ (open points)

c) put them on number line

Sign diagram to get ans



$\boxed{\text{ex}}$ Started w/ $\frac{(x+1)(x-1)}{x(x+2)(x-3)} \leq 0$



Q (factoring)

$$x^3 - 2x^2 - 81x + 162$$

$1, 2, 3,$

$$\begin{array}{c|cccc} 2 & 1 & -2 & -81 & 162 \\ & & 2 & 0 & -162 \\ \hline & 1 & 0 & -81 & 0 \\ & x^2 & x & 1 & \end{array}$$

$$x^2(x-2) - 81(x-2)$$

$$(x-2)(x^2-81)$$

$$(x-2)(x^2-81)$$

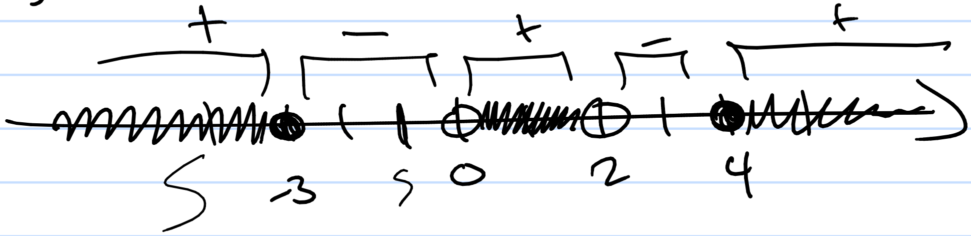
$$(x-2)(x+9)(x-9)$$

Q Sign diagrams:

$$\frac{(x+3)(x-4)}{x(x-2)} \geq 0$$

zeros of top $-3, 4$

zeros of bot $0, 2$



$x=4$

$x=-1$

$$\boxed{(-\infty, -3] \cup (0, 2) \cup [4, +\infty)}$$