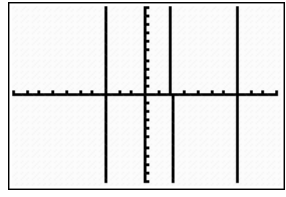


$$4x^5 - 32x^4 + 9x^3 + 194x^2 - 505x + 546$$

$$(x-2)(3+x)(x-7)(2x-2-3i)(2x-2+3i)$$

$$\begin{array}{r} -3 \overline{) 4 \quad -32 \quad 9 \quad 194 \quad -505 \quad +546} \\ \underline{-12 \quad 132 \quad -423 \quad 687 \quad -546} \\ 4 \quad -44 \quad 141 \quad -229 \quad 182 \quad 0 \\ \text{ } \quad \text{ } \quad \text{ } \quad \text{ } \quad \text{ } \quad \text{ } \\ \text{ } \quad \text{ } \quad \text{ } \quad \text{ } \quad \text{ } \quad \text{ } \end{array}$$

$\begin{matrix} \color{red}{x^4} & \color{red}{x^3} & \color{red}{x^2} & \color{red}{x} & \color{red}{c} & \color{red}{r} \end{matrix}$



Graph suggests $x = -3, 2, 7$

This says $f(x) = (x+3)(4x^4 - 44x^3 + 141x^2 - 229x + 182)$

So we split off a factor of $x + 3$. The depressed polynomial is degree 4.

That means $x - 2, x + 3, x - 7$ are factors.

Continuing where I left off:

$$\begin{array}{r} -3 \overline{) 4 \quad -32 \quad 9 \quad 194 \quad -505 \quad +546} \\ \underline{-12 \quad 132 \quad -423 \quad 687 \quad -546} \\ 2 \overline{) 4 \quad -44 \quad 141 \quad -229 \quad 182 \quad 0} \\ \underline{8 \quad -72 \quad 138 \quad -182} \\ 7 \overline{) 4 \quad -36 \quad 69 \quad -91 \quad 0 \quad \text{Sweet!}} \\ \underline{28 \quad -56 \quad 91} \\ 4 \quad -8 \quad 13 \quad 0 \quad \text{Sweet!} \\ \text{ } \quad \text{ } \quad \text{ } \quad \text{ } \\ \text{ } \quad \color{red}{x^2} \quad \color{red}{x} \quad \color{red}{c} \quad \color{red}{r} \end{array}$$

This says $f(x) = (x+3)(x-2)(x-7)(4x^2 - 8x + 13)$
 Note $4x^2 - 8x + 13$ is the Depressed Polynomial.

$a=4, b=-8, c=13$

$b^2 - 4ac = (-8)^2 - 4(4)(13) = 64 - 208 = -144$

~~$\sqrt{b^2 - 4ac} = 12$~~

$x = \frac{8 \pm 12}{2(4)} \rightarrow \begin{matrix} \frac{20}{8} = \frac{5}{2} \\ \frac{-4}{8} = -\frac{1}{2} \end{matrix}$

$\sqrt{144} = 2 \cdot 2 \cdot 3 = 12$

$\Rightarrow f(x) = 4(x+3)(x-2)(x-7)(x-\frac{5}{2})(x+\frac{1}{2})$
 pretty it up (optional)

What's wrong with this?

$= (x+3)(x-2)(x-7)(2x-5)(2x+1)$

$b^2 - 4ac = -144 \Rightarrow \sqrt{b^2 - 4ac} = 12i$

$\Rightarrow x = \frac{8 \pm 12i}{2(4)} \rightarrow \begin{matrix} \frac{4(2+3i)}{8} = \frac{2+3i}{2} \\ \frac{4(2-3i)}{8} = \frac{2-3i}{2} \end{matrix}$

$$f(x) = 4(x+3)(x-2)(x-7)\left(x - \left(\frac{2+3i}{2}\right)\right)\left(x - \left(\frac{2-3i}{2}\right)\right) \quad \text{Bring in the 4}$$
$$= (x+3)(x-2)(x-7)(2-(2+3i))(2x-(2-3i))$$

$$4x^5 - 32x^4 + 9x^3 + 194x^2 - 505x + 546$$

$$(x-2)(3+x)(x-7)(2x-2-3i)(2x-2+3i)$$

Bonus: (5 pts) What is the domain of $\sqrt{\frac{(x+2)^2}{(x-1)(x-4)}}$? (See Page 1!)

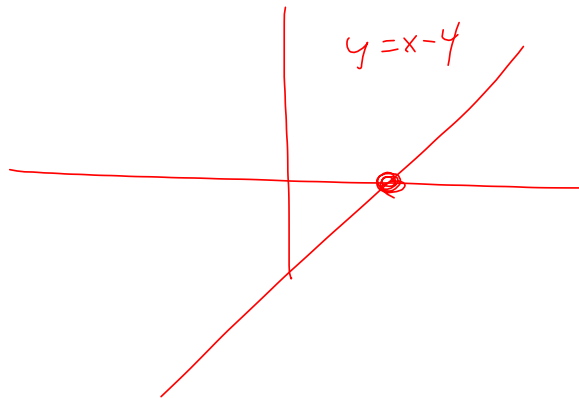
From last time. Show me you can do this. Today. Now. Please.

Need $\frac{(x+2)^2}{(x-1)(x-4)} \geq 0$ critical #s
 $x = -2, 1, 4$

$\begin{array}{ccccccc} + & y & y & N & N & N & y+ \\ y & | & + & | & - & | & + \\ \leftarrow & & & & & & \rightarrow \end{array}$
 ≥ 0

$\begin{array}{cccc} -2 & 1 & 4 & \\ = 0 & \star & \star & \end{array} \Rightarrow x \in (-\infty, 1) \cup (4, \infty) = \mathcal{D}$

End behavior: Has same sign as $(x+2)^2(x-1)(x-4) = x^4 + \dots$

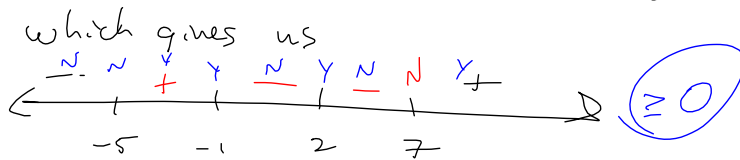


$$f(x) = \sqrt{\frac{(x+1)(x-2)^2}{(x-7)^3(x+5)}} = \sqrt{\text{STUFF}} \leftarrow \text{NAME IT}$$

Find $D(f)$

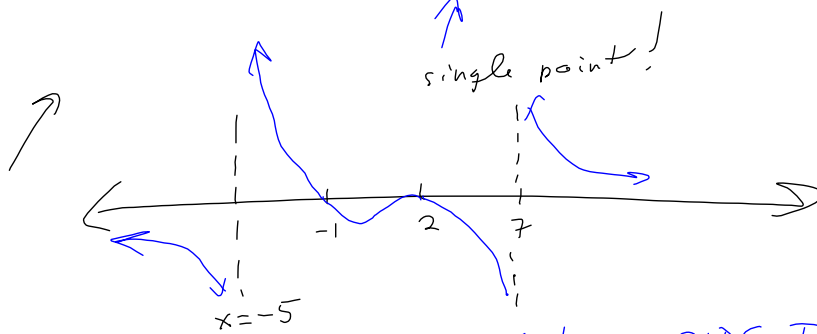
Need: $\text{STUFF} \geq 0$! \leftarrow PUT THE CONDITION ON IT.

$$(x+1)(x-2)^2(x-7)^3(x+5) = x^7 + \dots \text{ which gives us}$$



Now analyze sign changes:

$$\Rightarrow D = (-5, -1] \cup \{2\} \cup (7, \infty)$$

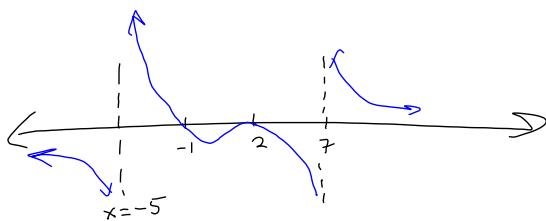


This is a graph of what's INSIDE THE

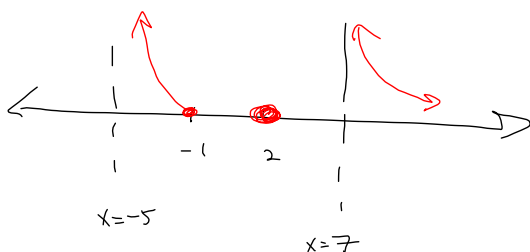
Square root:

$$\frac{(x+1)(x-2)^2}{(x+5)(x-7)}$$

$$\text{But } f(x) = \sqrt{\frac{(x+1)(x-2)^2}{(x+5)(x-7)}}$$



$$\frac{(x+1)(x-2)^2}{(x+5)(x-7)}$$



$$f(x) = \sqrt{\frac{(x+1)(x-2)^2}{(x+5)(x-7)}}$$

This is a graph (very rough) of f , itself.