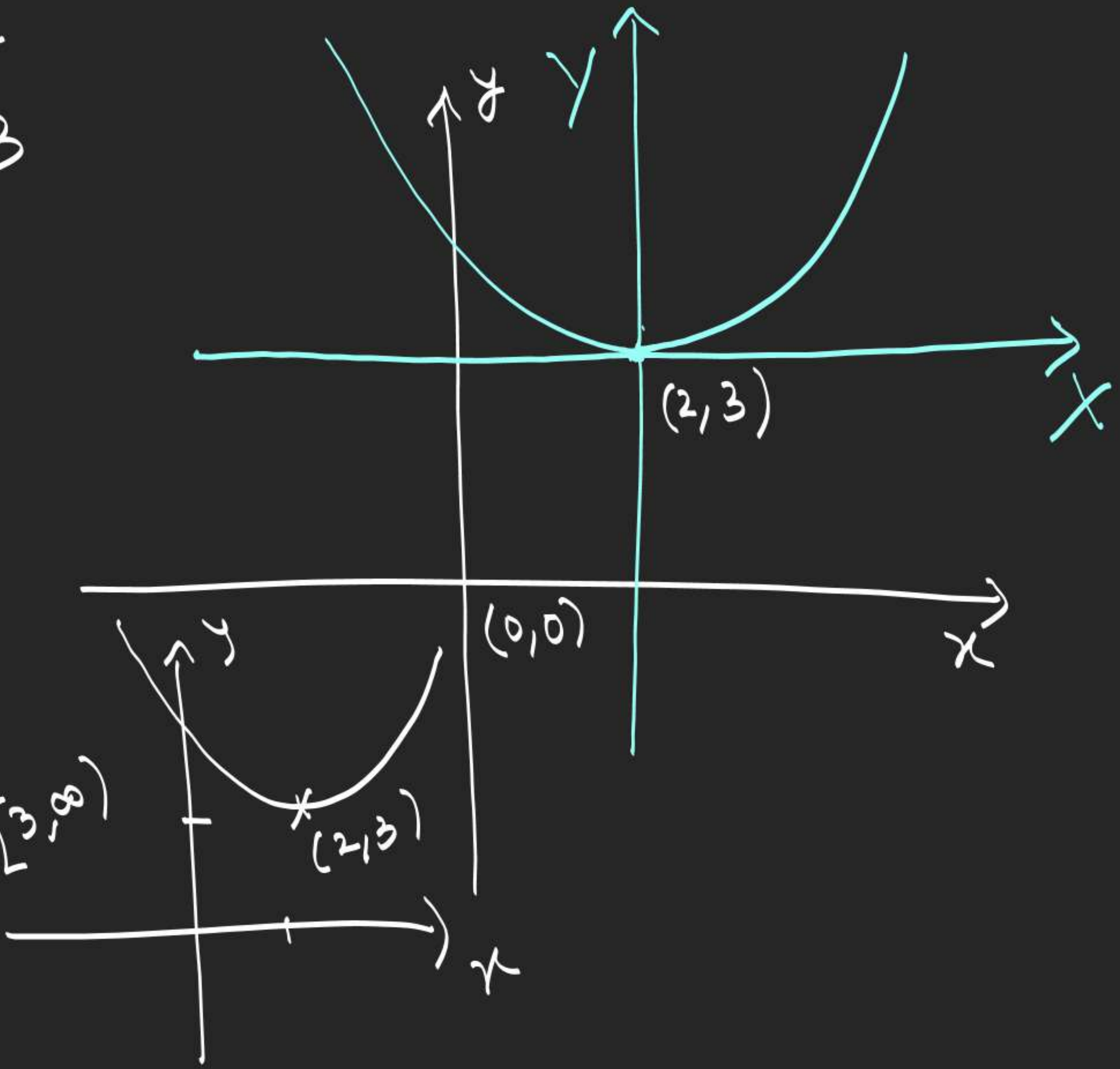
$$y = (x-2)^2 + 3$$

$$y - 3 = (x-2)^2$$

$$\boxed{\begin{aligned} x-2 &= X \\ y-3 &= Y \end{aligned}}$$

$$\boxed{Y = X^2}$$

$$R_f = [3, \infty)$$



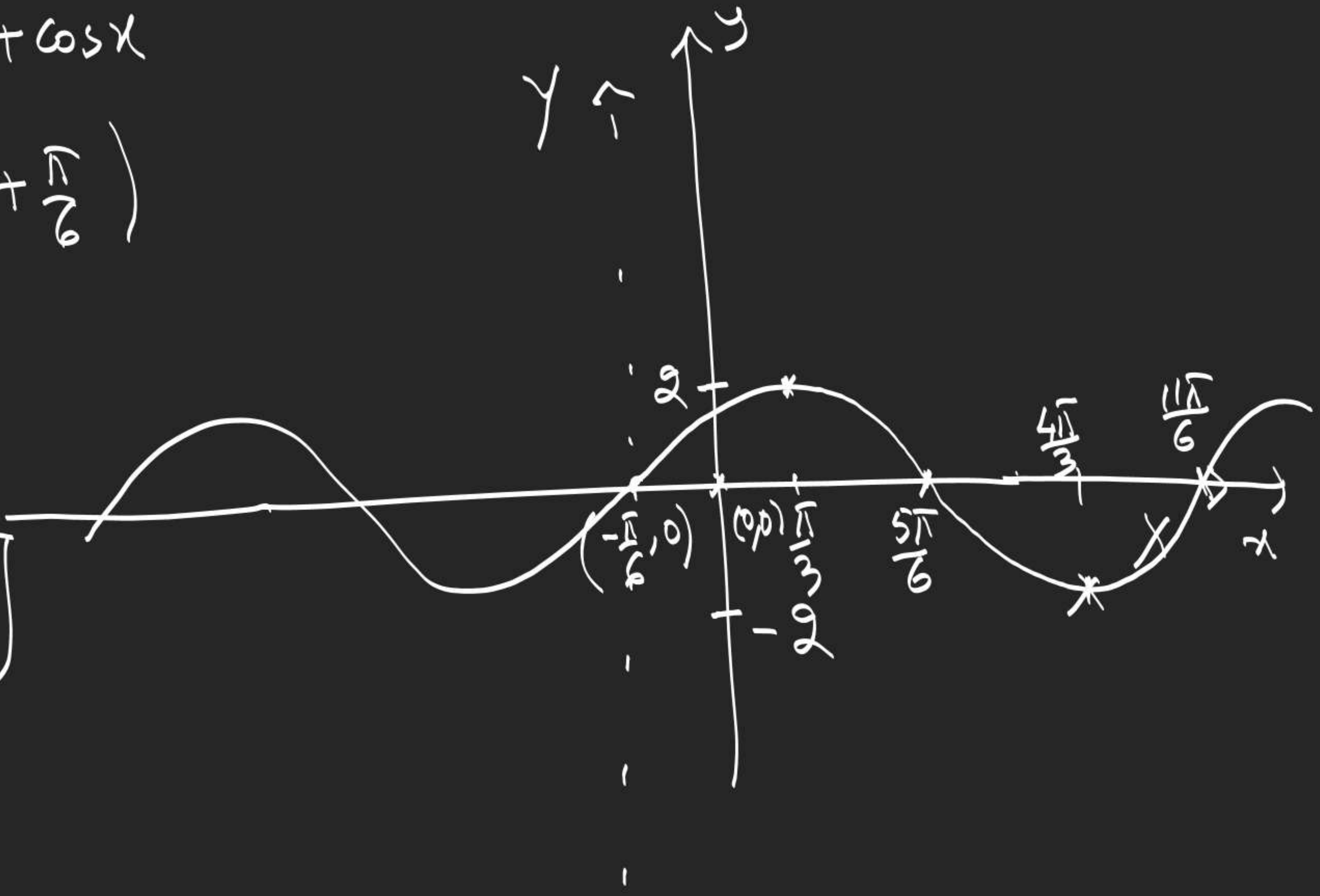
$$y = \sqrt{3}\sin x + \cos x$$

$$y = 2\sin\left(x + \frac{\pi}{6}\right)$$

$$x + \frac{\pi}{6} = X$$

$$y = Y$$

$$\boxed{Y = 2\sin X}$$



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3.

$$y = \boxed{\frac{1}{x-3} - 2} = f(x)$$

$$D_f = (-\infty, 3) \cup (3, \infty)$$

$$R_f = (-\infty, -2) \cup (-2, \infty)$$

$$R - \{-2\}$$

$$y + 2 = \frac{1}{x-3}$$

$$\boxed{Y = \frac{1}{X}}$$

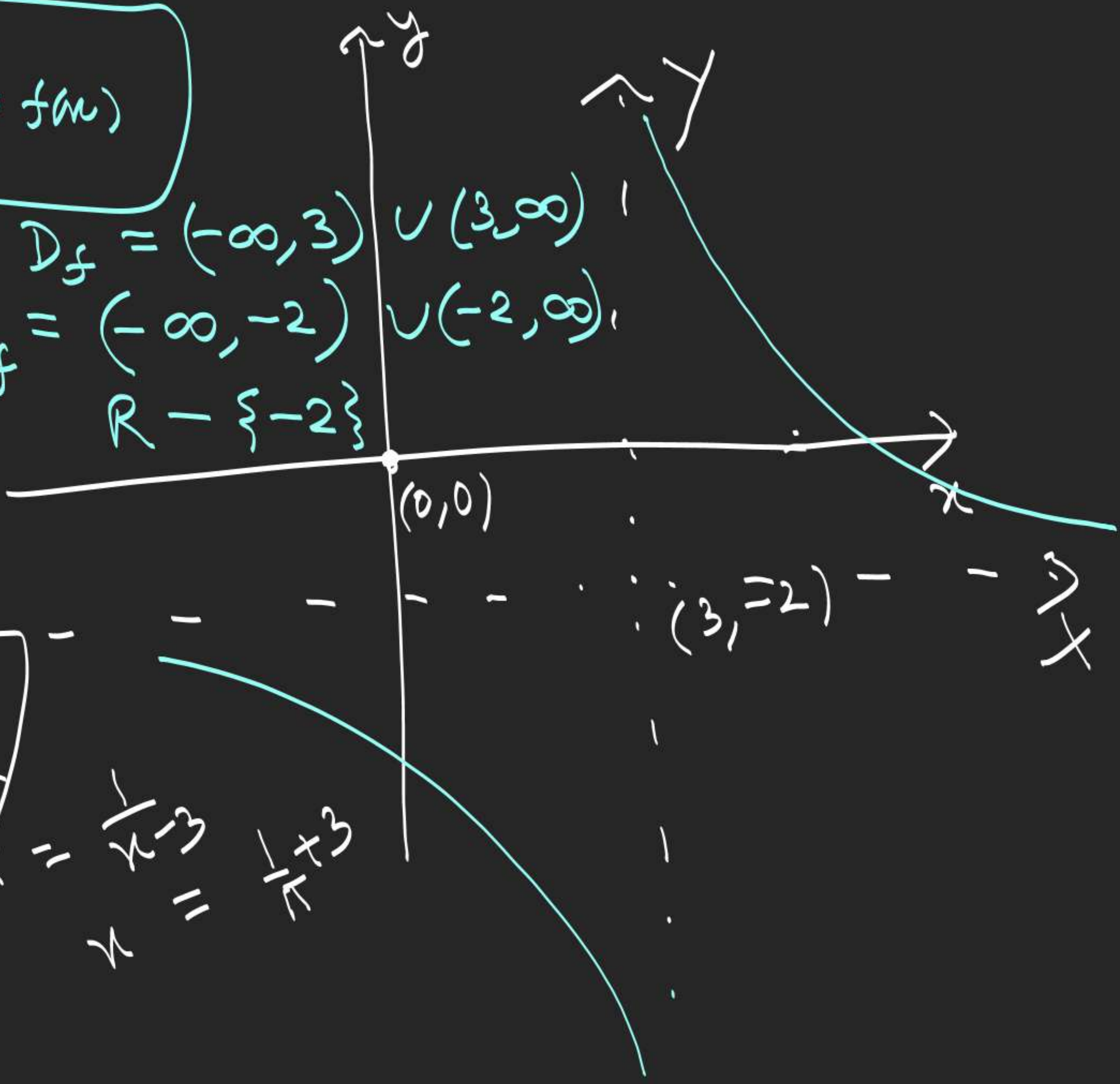
$y \neq -2$

$$y = \boxed{\frac{1}{x-3} - 2}$$

$$\frac{1}{x-3} \neq 0$$

$$X = \frac{1}{x-3}$$

$$x = \frac{1}{X} + 3$$



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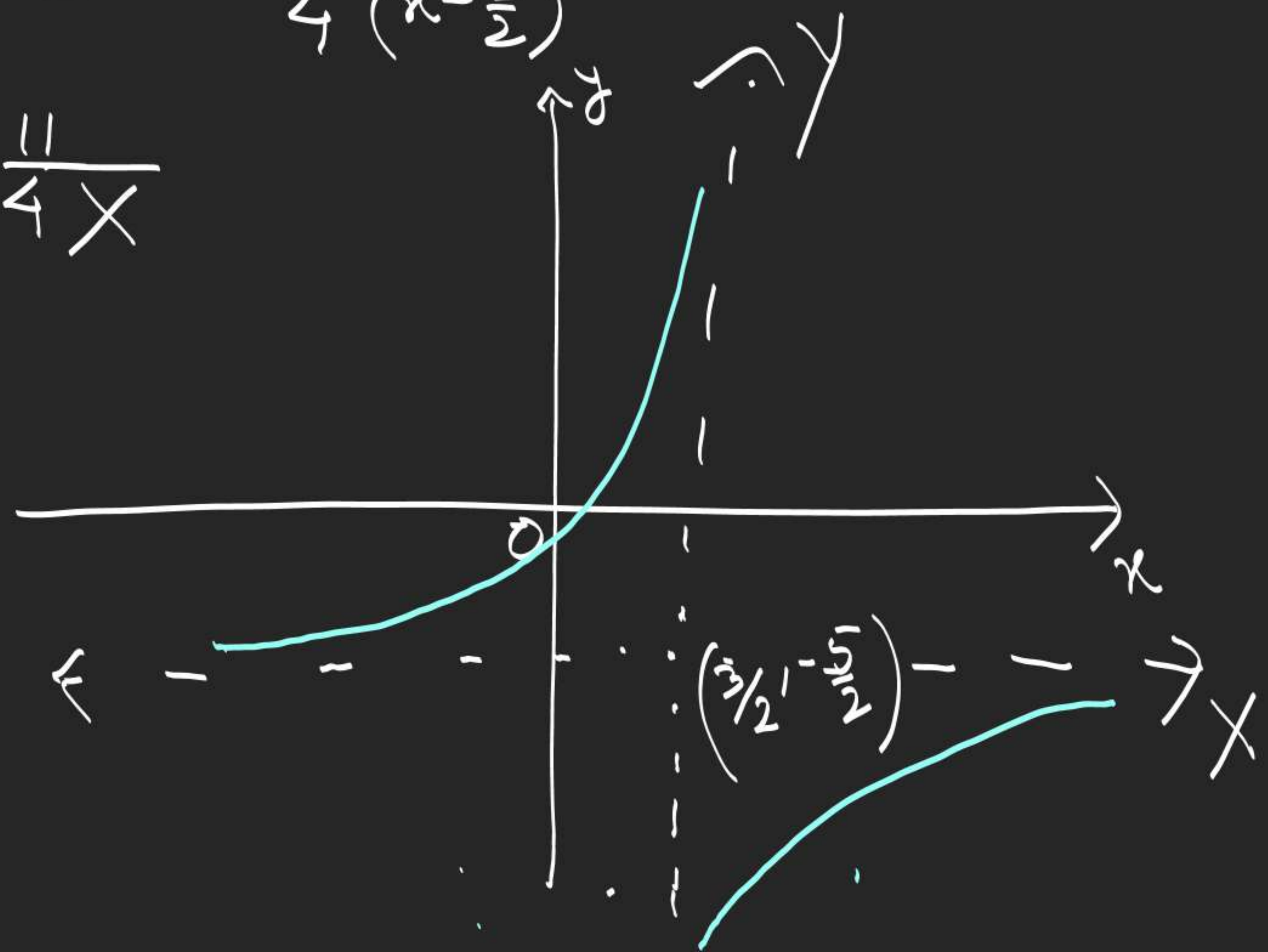
4.

$$y = \frac{2-5x}{2x-3} = \frac{-\frac{5}{2}(2x-3) - \frac{11}{2}}{2x-3} = -\frac{5}{2} - \frac{11}{2(2x-3)}$$

$$y + \frac{5}{2} = \frac{-11}{4\left(x-\frac{3}{2}\right)}$$

$$Y = -\frac{11}{4X}$$



5.

$$y = 2x^3 - 6x^2 + 6x - 7$$

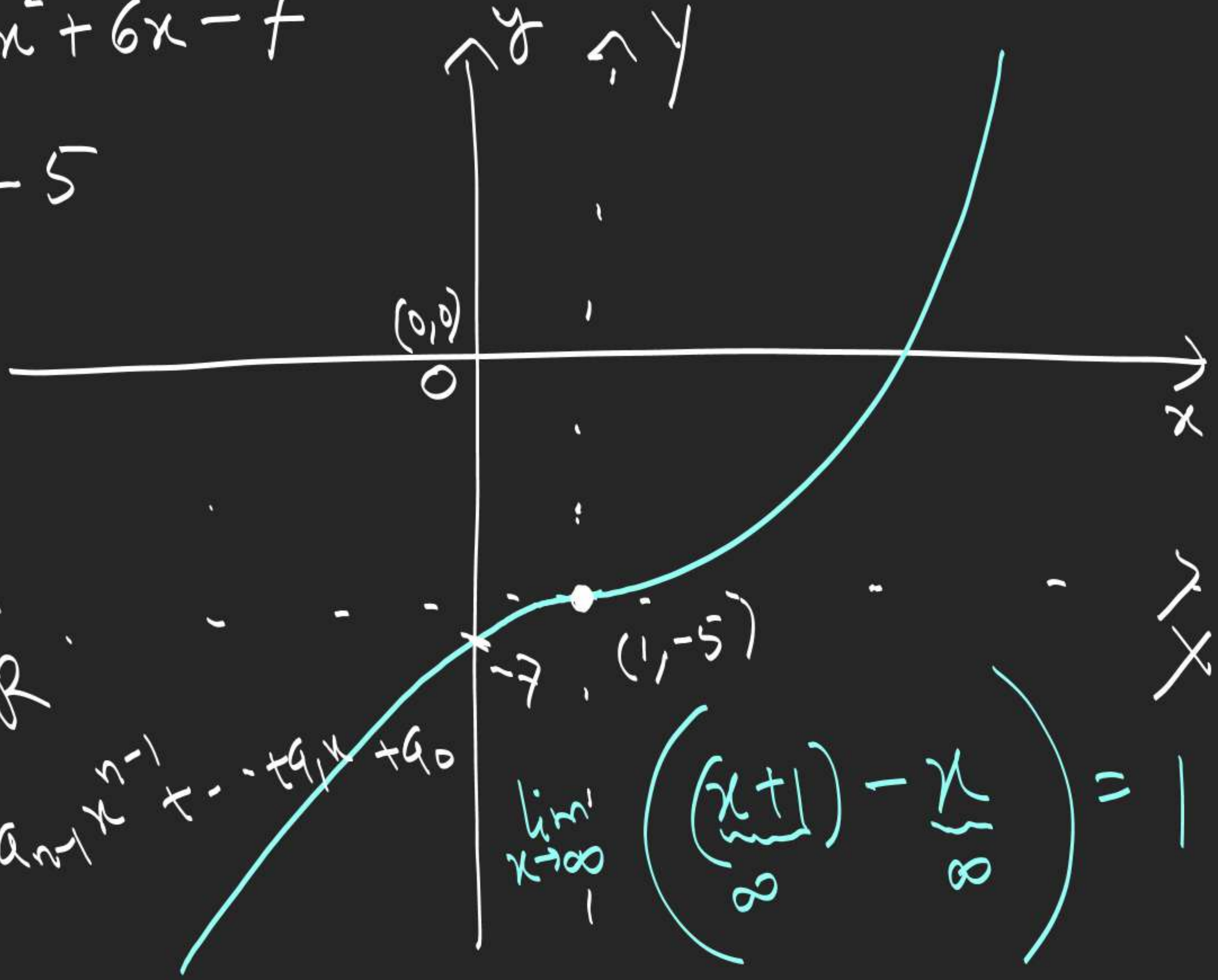
$$y = 2(x-1)^3 - 5$$

$$y + 5 = 2(x-1)^3$$

$$Y = 2X^3$$

$D_f = R$

$R_f = R$



$x \to -\infty$

$\infty + \infty \to \infty$

$\infty - \infty$

$$a_n x^n + a_{n-1} x^{n-1} + \dots + a_1 x + a_0$$

$$\lim_{x \to \infty} \left(\underbrace{(x+1)}_{\infty} - \underbrace{x}_{\infty} \right) = 1$$

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$2x^3 - 6x^2 + 6x - 7$

$-\infty - \infty - \infty - 7 \to -\infty$

$x \to -\infty$, y

$\frac{1}{\infty} \to 0$

$\boxed{R_f = (-\infty, \infty)}$ continuous

$f(x) = \boxed{y = x^3 + 5x^2 - 6x + 7}$

$-\infty + \infty + \infty + 7$

$x \to -\infty$

$-\infty + \infty + 7$

$\boxed{x \to -\infty, y \to -\infty}$ ✓

$y = x^3\left(1 + \frac{5}{x} - \frac{6}{x^2} + \frac{7}{x^3}\right)$

$x^3 \to -\infty$, $\frac{5}{x} \to 0$, $\frac{6}{x^2} \to 0$, $\frac{7}{x^3} \to 0$

$x \to \infty, y \to \infty$ ✓

$x \to -\infty$

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x^3

x^2

x

$x + x^2$

cont. cont.

$h(x) = f(x) + g(x)$

cont. cont. cont.

$h(x) = f(x) - g(x)$

$h(x) = f(x)g(x)$

C C C

$h(x) = \frac{f(x)}{g(x)}$

C C

$g(x) \neq 0$

cont.

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$x \to \infty,\ y \to 1$ $\qquad$ $x = -1,\ y = 3$

$$f(x) = y = \frac{x^2 - x + 1}{x^2 + x + 1}$$

$x \to -\infty,\ y \to 1$

$$y = \frac{\cancel{x^2}\left(1 - \frac{1}{x} + \frac{1}{x^2}\right)}{\cancel{x^2}\left(1 + \frac{1}{x} + \frac{1}{x^2}\right)}$$

$$y = 1 - \frac{2x}{x^2 + x + 1}$$

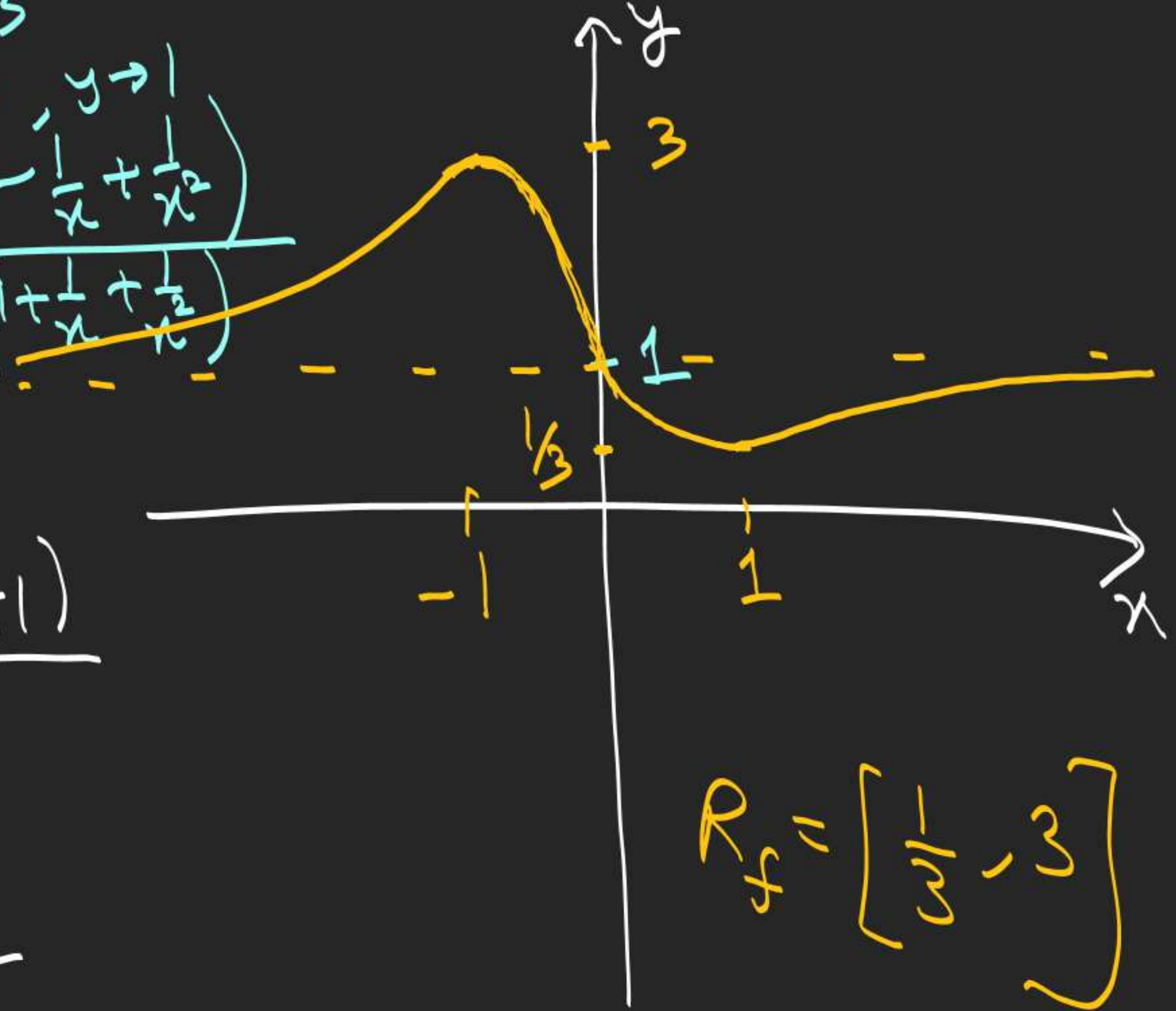
① $D_f = R$

② $$f'(x) = \frac{(x^2+x+1)(2x-1) - (x^2-x+1)(2x+1)}{(x^2+x+1)^2}$$

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

$f(x) \uparrow$ $\quad (-\infty, -1) \cup (1, \infty)$

$f(x) \downarrow \quad x \in (-1, 1)$



$R_f = \left[\frac{1}{3}, 3\right]$

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6. $f(x) = \dfrac{x^2+2x-11}{2(x-3)}$

$x \to 2.99\ldots,\ y \to -\infty$

$x \to 3.000\ldots,\ y \to$

① $D_f = R - \{3\}$

$y = \dfrac{x\left(1+\frac{2}{x}-\frac{11}{x^2}\right)}{2\left(1-\frac{3}{x}\right)}$

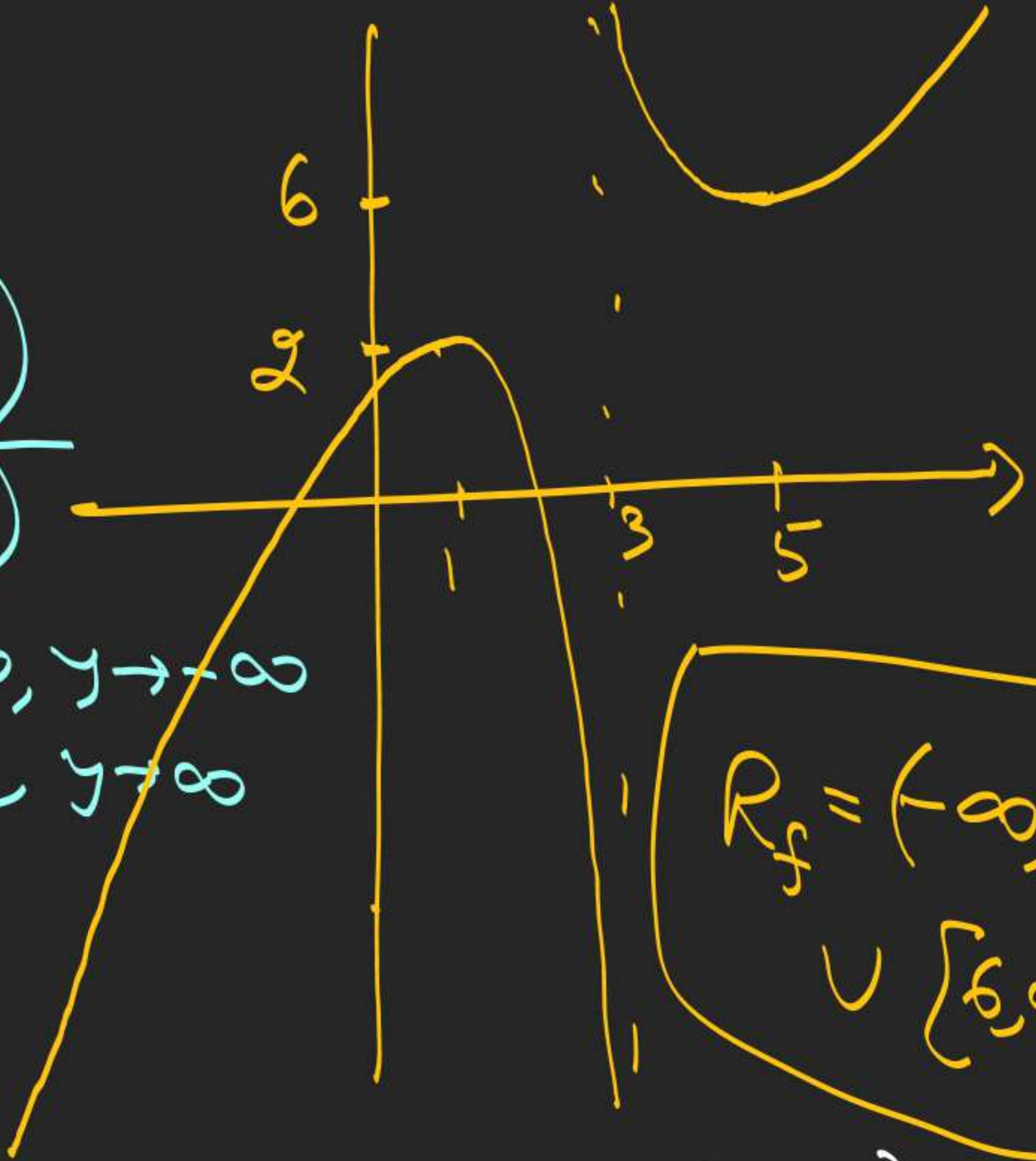
② $f(x) = \dfrac{(x-3)(x+5)+4}{2(x-3)}$

$x \to -\infty,\ y \to -\infty$

$x \to \infty,\ y \to \infty$

$= \dfrac{1}{2}\left(x+5+\dfrac{4}{x-3}\right)$

$f'(x) = \dfrac{1}{2}\left(1-\dfrac{4}{(x-3)^2}\right) = \dfrac{(x-5)(x-1)}{2(x-3)^2}$



$R_f = (-\infty, 2] \cup [6, \infty)$

$f \uparrow (-\infty, 1) \cup (5, \infty)$

$f \downarrow (1, 3) \cup (3, 5)$