Section 3.3 really tests your chops in hard-core college-algebra skills.

SIGN PATTERNS

Test 2 Solutions are Posted. I'm going to use the bonus question on the rational function graph.

$$f(x) = \frac{30x^2 + 27x - 21}{x+2}$$

Factoring $30x^2 + 27x - 21$

$= 3(10x^2 + 9x - 7)$

$= 3(10x^2 + 14x - 5x - 7)$

$= 3(2x(5x+7) - 1(5x+7))$ $\qquad \frac{2x(\cancel{5x+7})}{5x+7} = 2x \qquad \frac{-1(\cancel{5x+7})}{5x+7} = -1$

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

SLEDGEHAMMER:

$a = 10,\ b = 9,\ c = -7$

$b^2 - 4ac = 9^2 - 4(10)(-7)$

$= 81 + 280 = 361 \rightsquigarrow \sqrt{361} = 19$

$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a} = \frac{-9 \pm 19}{2(10)} = \begin{cases} \frac{10}{20} = \frac{1}{2} \\ \frac{-28}{20} = \frac{-7}{5} \end{cases}$

So $3(10(x - \frac{1}{2})(x + \frac{7}{5}))$

$= 3(2(x - \frac{1}{2})(5)(x + \frac{7}{5}))$

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

$$\frac{3(2x-1)(5x+7)\cancel{(x+2)}}{\cancel{x+2}}$$

$\mathcal{D} = \mathbb{R} \setminus \{-2\}$

$\boxed{\text{V.A. } x = -2}$

x-int: $x = \frac{1}{2}, -\frac{7}{5} \rightsquigarrow (\frac{1}{2}, 0), (-\frac{7}{5}, 0)$

Degree of num > Degree of denom $\Rightarrow$

Oblique Asymptote (O.A.)

Long Division (Synthetic if Denom is degree 1)

Divide by $x+2$:

$$\begin{array}{r|rrr} -2 & 30 & 27 & -21 \\ & & -60 & 66 \\ \hline & 30 & -33 & 45 \end{array}$$

$y = 30x - 33$

This says $f(x) = \boxed{30x - 33 + \frac{45}{x+2}}$

away from $x=-2$ close to $x=-2$

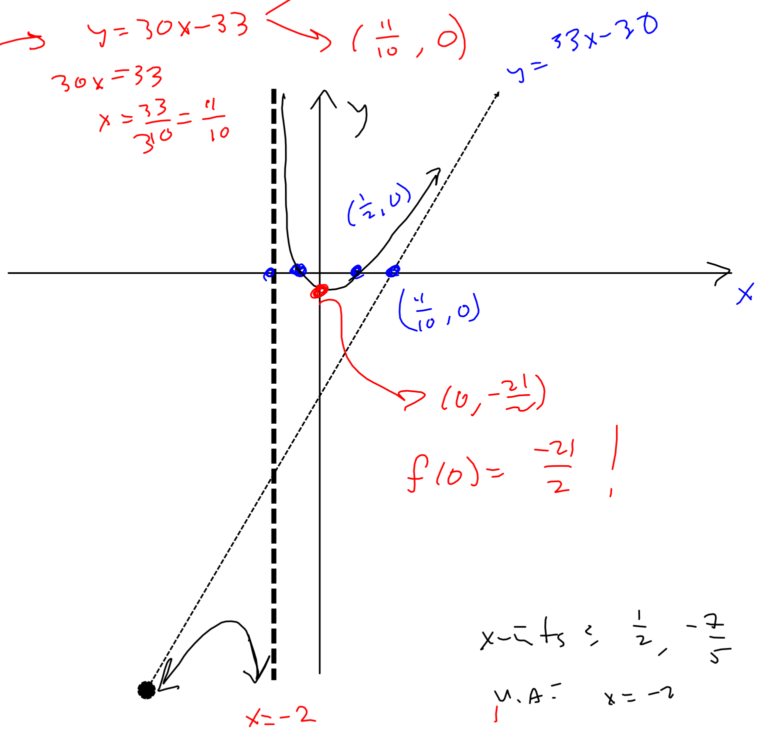
$28 = 3(9) + 1$

$\frac{28}{3} = 9 + \frac{1}{3}$

$y = 30x - 33 \to (0,-33),\ \left(\frac{11}{10}, 0\right)$

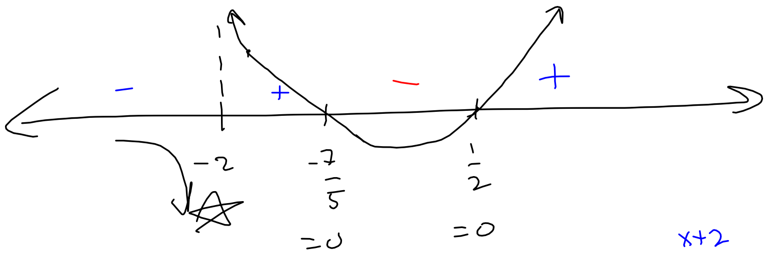
$30x = 33$

$x = \frac{33}{30} = \frac{11}{10}$



x-ints: $\frac{1}{2}, -\frac{7}{5} = x$

V.A.: $x = -2$



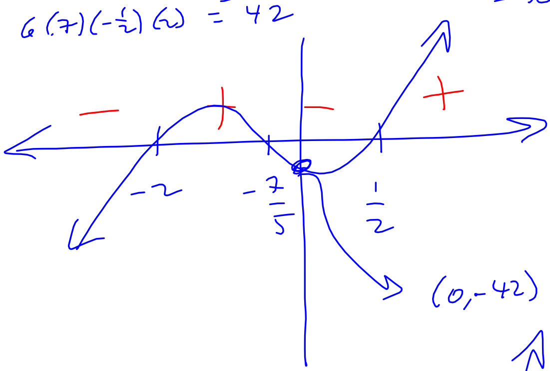
$x+2$

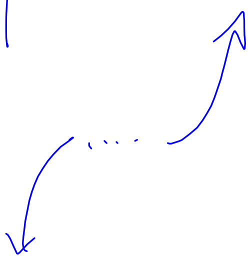
$$\frac{30\left(x-\frac{1}{2}\right)\left(x+\frac{7}{5}\right)}{x+2}$$

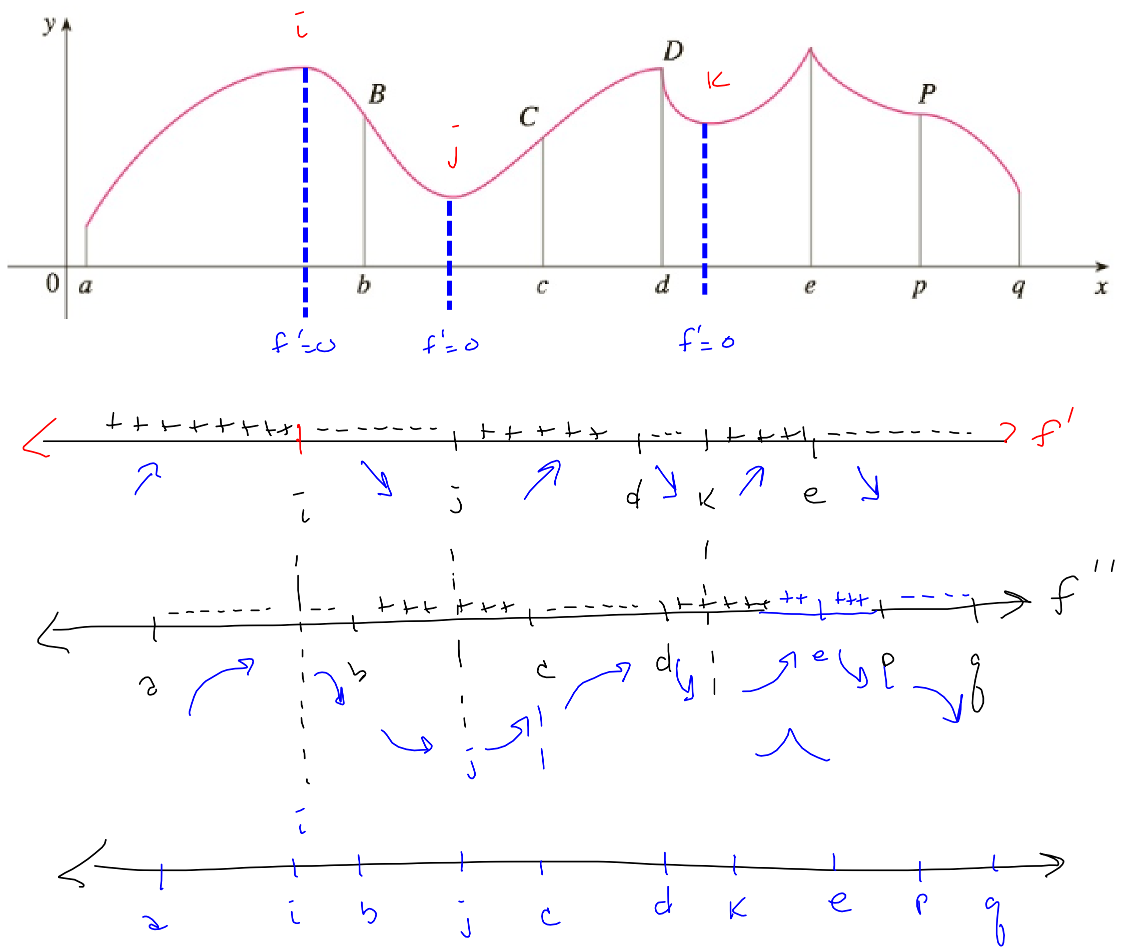
$6(5x+7)(x-1/2)(x+2) = 6(5x)(x)(x)$

$= 30x^3$

$6(7)(-\frac{1}{2})(2) = -42$







$f'(x) = 0 \qquad f'(x)\ \nexists$

$f''(x) = 0 \qquad f''(x)\ \nexists$