

$$\oplus x^4 - 2x^3 - 13x^2 + 10x + 40$$

$$x^4 + 2x^3 - 13x^2 - 10x + 40$$

poss solutions:  $\boxed{4}$   
 $\oplus$  solutions:  $\boxed{2, 0}$   
 $\ominus$  solutions:  $2, 0$

$x^4 - 2x^3 - 13x^2 + 10x + 40$

Find all zeros

$$x^2 - 5$$

$$(x) = (\sqrt{5})^2$$

$$x^2 = 5$$

$$x^4 - 2x^3 - 13x^2 + 10x + 40 \div x^2 - 5 = 5 \quad -5$$

one zero  $\sqrt{5}$   
 $-\sqrt{5}$   
 $x^2 - 5 = 0$   
 $(x^2 - 5)$

$$x^2 + 0x - 5 \overline{) x^4 - 2x^3 - 13x^2 + 10x + 40}$$

$$-x^4 + 0x^3 + 5x^2$$


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$$-2x^3 - 8x^2 + 10x$$

$$+2x^3 + 0x^2 + 10x$$


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$$-8x^2 + 0x + 40$$

$$+8x^2 + 0x + 40$$


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$$0 \quad 0 \quad 0$$

Solution  $5i$   
 $-5i$   
 $(x^2 + 25)$   
 $x^2 + 25 = 0$   
 $-25 \quad -25$   
 $\sqrt{x^2} = \sqrt{-25}$   
 $x = \pm 5i$

$$(x^2 - 5)(x^2 - 2x - 8)$$

$$\boxed{(x^2 - 5)(x - 4)(x + 2)}$$

$$-4 * 2 = -8$$

$$-4 + 2 = -2$$

$$\frac{x^2 - 5x + 6}{2x^2 + 6x}$$

Factor top and bottom

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

$$\begin{aligned} -3 \cdot -2 &= 6 \\ -3 + -2 &= -5 \end{aligned}$$

Evaluate denominator

$$(2x)(x+3) \neq 0$$

$$\frac{2x \neq 0}{2} \Rightarrow \boxed{x \neq 0}$$

$$\begin{aligned} x+3 &\neq 0 \\ -3 &\quad -3 \end{aligned} \Rightarrow \boxed{x \neq -3}$$

Asymptote don't cancel

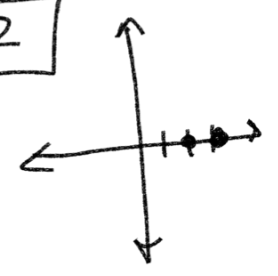
~~Ho to cancel~~

$$(x-3)(x-2) = 0$$

$$\boxed{3} \quad \boxed{2}$$



$$\frac{x^2 - 5x + 6}{2x^2 + 6x} \xrightarrow{x \rightarrow \infty} \frac{1}{2} = \frac{1}{\infty} = 0$$



$$\frac{2x^3}{x^2}$$

TOP HEAVY

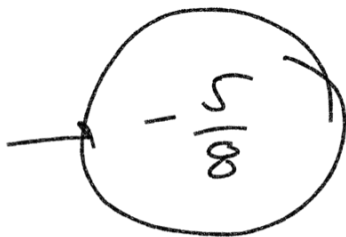
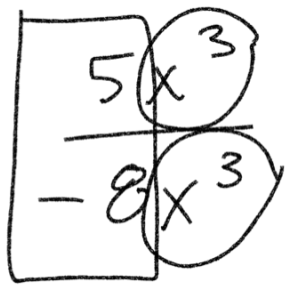
$$\rightarrow \infty$$

Bottom Heavy

$$\rightarrow 0$$

Behave  $\frac{1}{\infty} = 0$

$$\frac{2x^3}{3x^4}$$



$$f(x) = \frac{x^2 - x - 12}{4x + 12}$$

Top

zero/roots

asymptotes/holes

(end behavior horizontal asymptotes)

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

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

Behave

Top heavy

goes to  $\infty$

$x = -3$  hole

$$\frac{4(x+3) \neq 0}{4} \quad \frac{0}{4}$$

zeros/roots:  $4, -3$

$$(x-4)(x+3)$$

$$\frac{x+3 \neq 0}{-3 \quad -3}$$

$$x \neq -3$$

$$\begin{array}{r} x-4=0 \\ +4 \quad +4 \\ \hline x=4 \end{array} \quad \begin{array}{r} x+3=0 \\ -3 \quad -3 \\ \hline x=-3 \end{array}$$

$$x=4 \quad x=-3$$