① What are the missing math symbols here?

$a! = a(a-1)(a-2)\ldots 1$

$5! = 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1$

$3! = 3 \cdot 2 \cdot 1$

$(1 + 1 + 1)! = 6$ ✓

$2 + 2 + 2 = 6$ ✓

$(3 \cdot 3) - 3 = 6$

$4 + 4 - \sqrt{4} = 6$

$5 + (5 \div 5) = 6$

$6 \times 6 \div 6 = 6$

$7 - (7 \div 7) = 6$

$\sqrt[3]{8} + \sqrt[3]{8} + \sqrt[3]{8} = 6$

$(\sqrt{9} \cdot \sqrt{9}) - \sqrt{9} = 6$

② What is the Horizontal and Vertical Asymptote of:

$$f(x) = \frac{3x^2 - 5}{1x^2 - 9}$$

HA @ $y = \frac{3}{1}$ $\boxed{y = 3}$

VA @ $x^2 - 9 = 0$

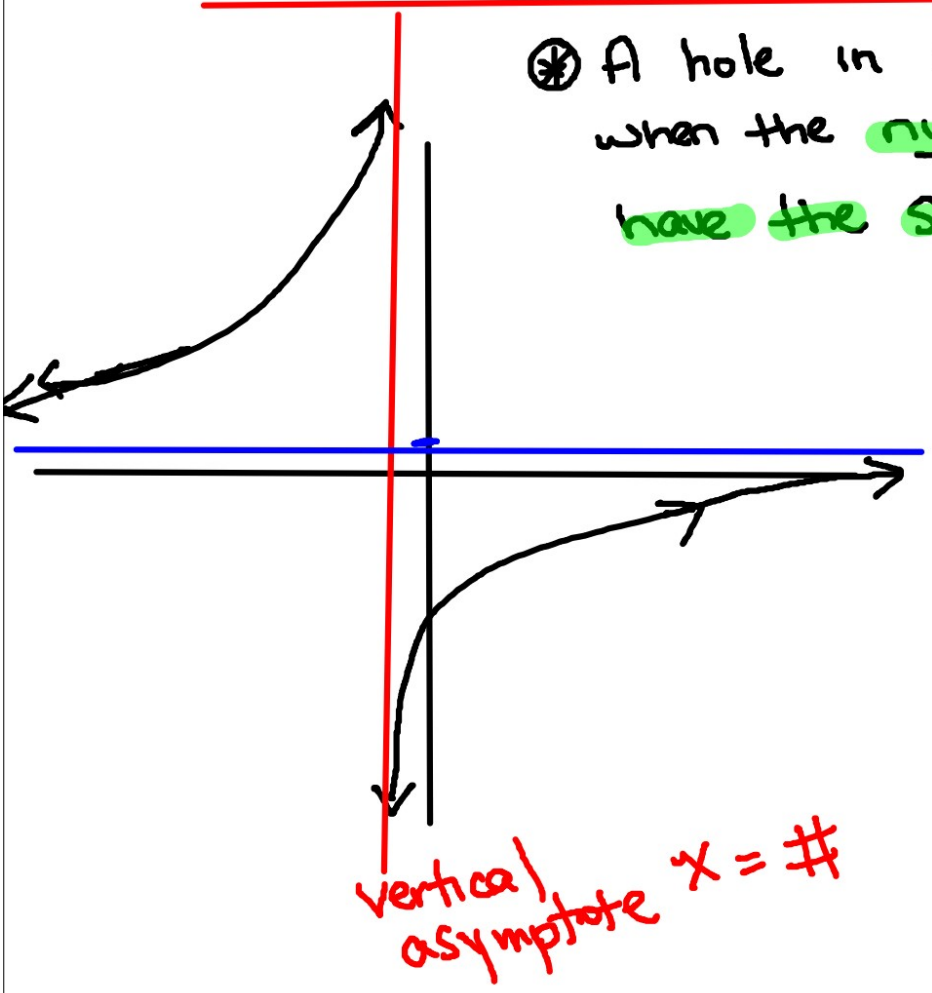
$(x + 3)(x - 3) = 0$

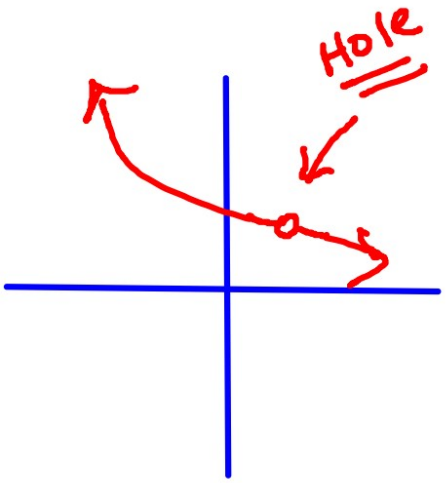
$x + 3 = 0$ $\boxed{x = -3}$

$x - 3 = 0$ $\boxed{x = 3}$

Holes in Rational Functions

⊛ A hole in a function occurs when the numerator & denominator have the same factor(s).





Ex: $f(x) = \dfrac{(x+3)}{(x+4)(x+3)} =$

* They share $(x+3)$ so we set the common factor equal to zero and solve.

$(x+3) = 0$

$x + \cancel{3} = 0$

$\quad -\cancel{3} \quad -3$

$\boxed{x = -3}$

Has a hole @ $x = -3$

D: 1

$$f(x) = \frac{x^1 - 2}{x^2 - 7x + 10} = \frac{\cancel{(x-2)}\ 1}{\cancel{(x-2)}(x-5)}$$

D: 2

ADD MULT

Hole: $x - 2 = 0$

$+2 \quad +2$

$\boxed{x = 2}$

Hole @

VA @ $x - 5 = 0$

$\boxed{x = 5}$

HA @ $y = 0$

$$f(x) = \frac{1x^2 + 3x - 18}{1x^2 + 7x + 6} = \frac{(x+6)(x-3)}{(x+6)(x+1)}$$

ADD MULT

ADD MULT

Hole @ $x = -6$

$x + 6 = 0$

$-6 \quad -6$

$x = -6$

VA @ $x + 1 = 0$

$-1 \quad -1$

$\boxed{x = -1}$

HA @ $y = \frac{1}{1}$

$\boxed{y = 1}$

Find all holes & asymptotes

① $f(x) = \dfrac{3x^2 - 12}{1x^2 + 4x + 4}$

GCF is 3

ADD MULT

$= \dfrac{3(x^2 - \boxed{4})}{(x+2)(x+2)}$

$= \dfrac{3\cancel{(x+2)}(x-2)}{(x+2)\cancel{(x+2)}}$

HA @ $y = \frac{3}{1}$

$\boxed{\text{HA @ } y = 3}$

Hole @ $x + 2 = 0$
$-2 \quad -2$
$\boxed{x = -2}$

VA @ $x + 2 = 0$
$-2 \quad -2$
$\boxed{x = -2}$

②

$f(x) = \dfrac{2x^2 + 3x + 1}{2x + 1}$

$= \dfrac{\cancel{(2x+1)}(x+1)}{\cancel{2x+1}}$?

Hole: $2x + 1 = 0$

$\dfrac{2x}{2} = \dfrac{-1}{2}$

$x = -\frac{1}{2}$

NO V.A

HA: NO HA

Diff of squares

$$f(x) = \frac{x^2 - 9}{(x-3)} = \frac{(x+3)\cancel{(x-3)}}{\cancel{(x-3)}}$$

$$= (x+3)$$

$$3 + 3 = 6$$

(*) Hole:

$$x - 3 = 0$$
$$+3 \quad +3$$

Hole @ $x = 3$

Coordinates of the Hole: $(3, 6)$

$$f(x) = \frac{x^2 + 4x - 5}{x^2 + 1x - 2} = \frac{(x+5)\cancel{(x-1)}}{(x+2)\cancel{(x-1)}}$$

ADD MULT

ADD MULT

$$= \frac{x+5}{x+2} = \frac{1+5}{1+2} = \frac{6}{3} =$$

Hole @ $x = 1$

$$\begin{aligned} x - 1 &= 0 \\ +1 \quad &+1 \\ \hline x &= 1 \end{aligned}$$

Coordinates of Hole

$(1, 2)$