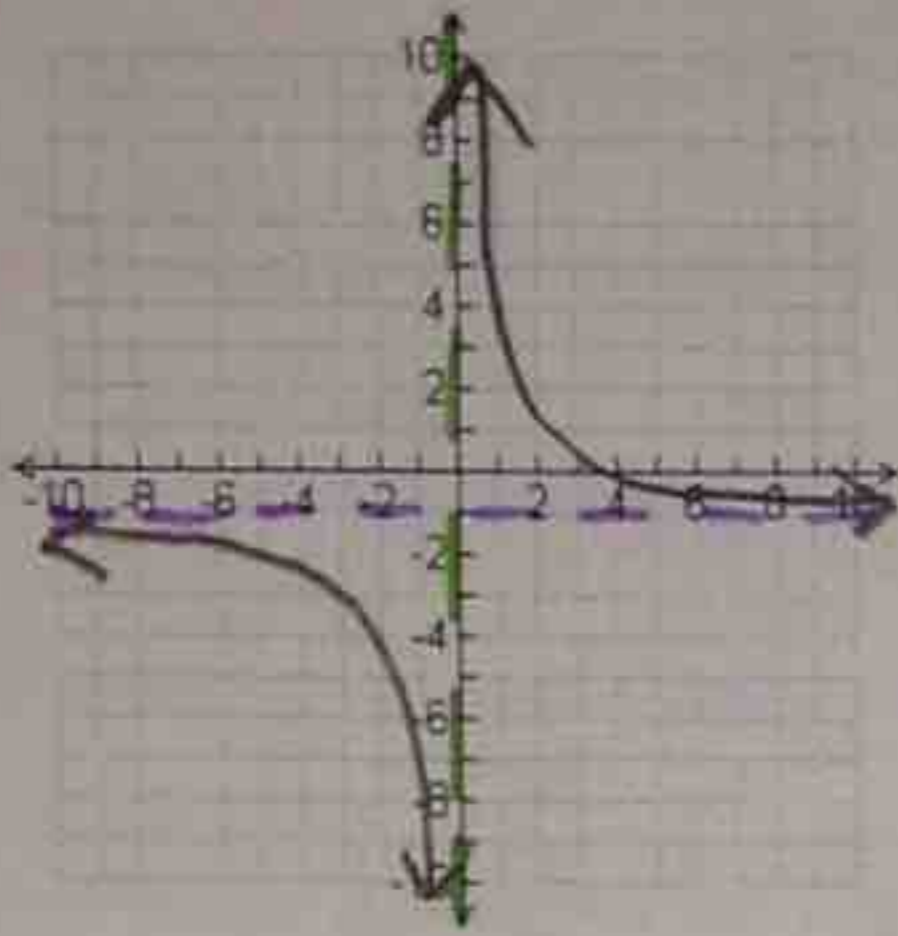


Directions: Sketch the asymptotes and the graph of each function. Identify the domain.

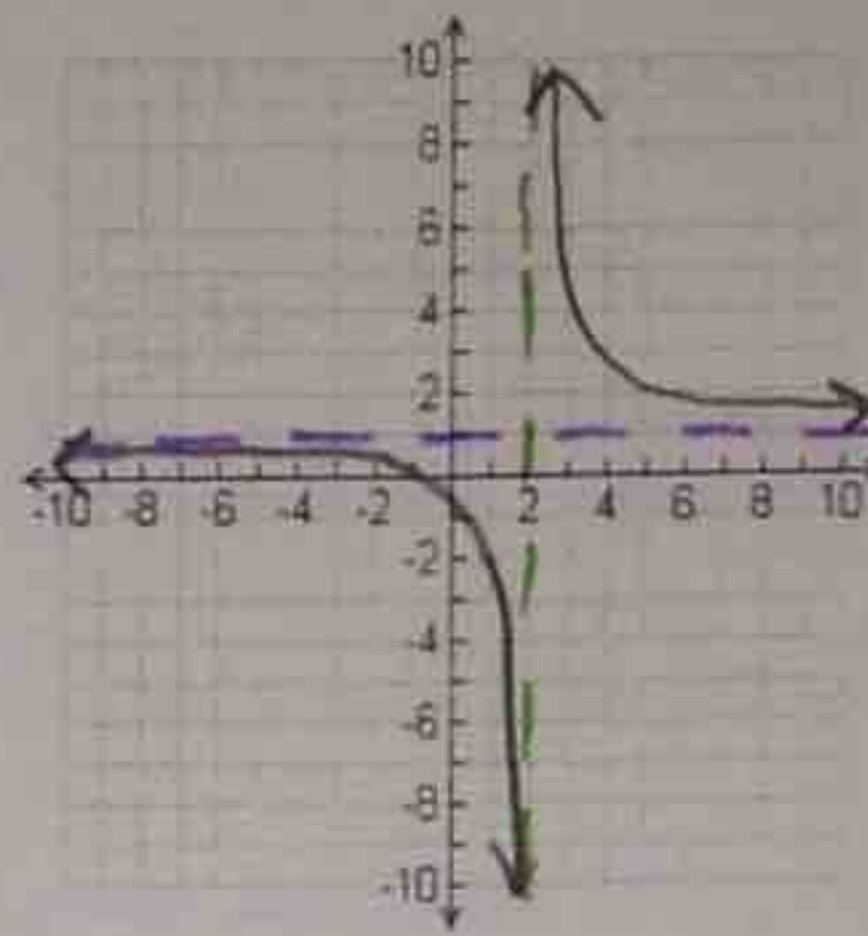
1. $y = \frac{8}{x} - 1$



VA: $x=0$
HA: $y=-1$

Domain: $(-\infty, 0) \cup (0, \infty)$

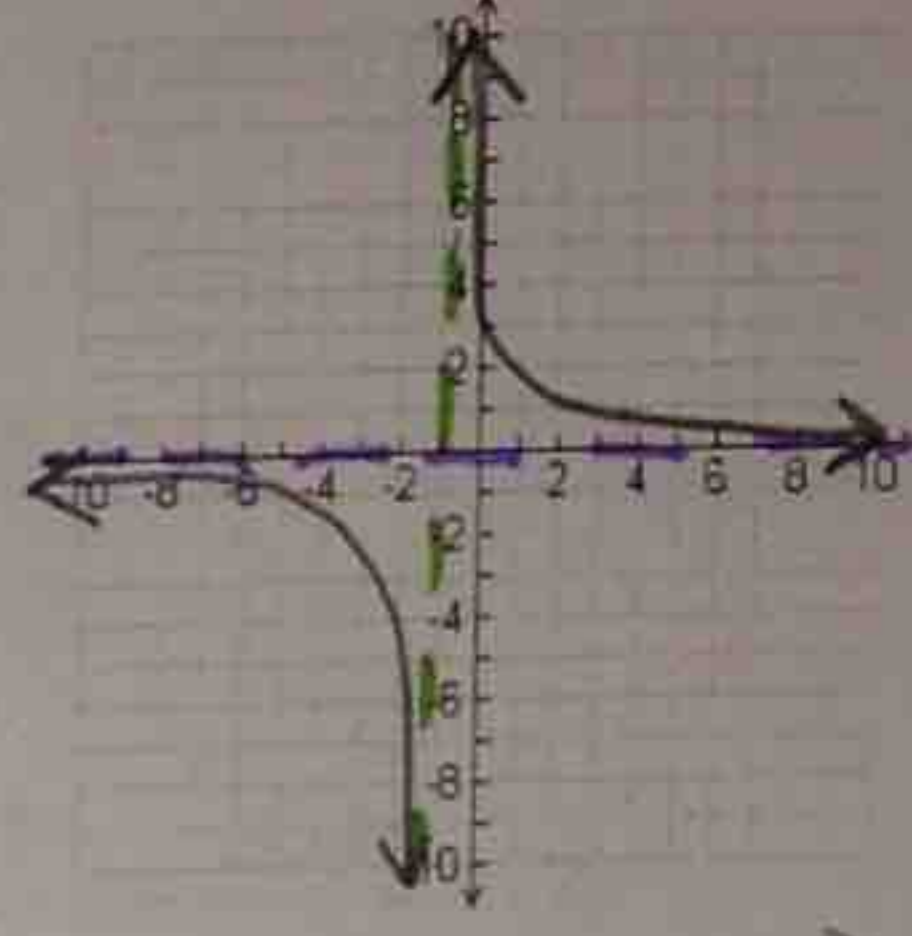
2. $y = \frac{1}{x-2} + 1$



VA: $x=2$
HA: $y=1$

Domain: $(-\infty, 2) \cup (2, \infty)$

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

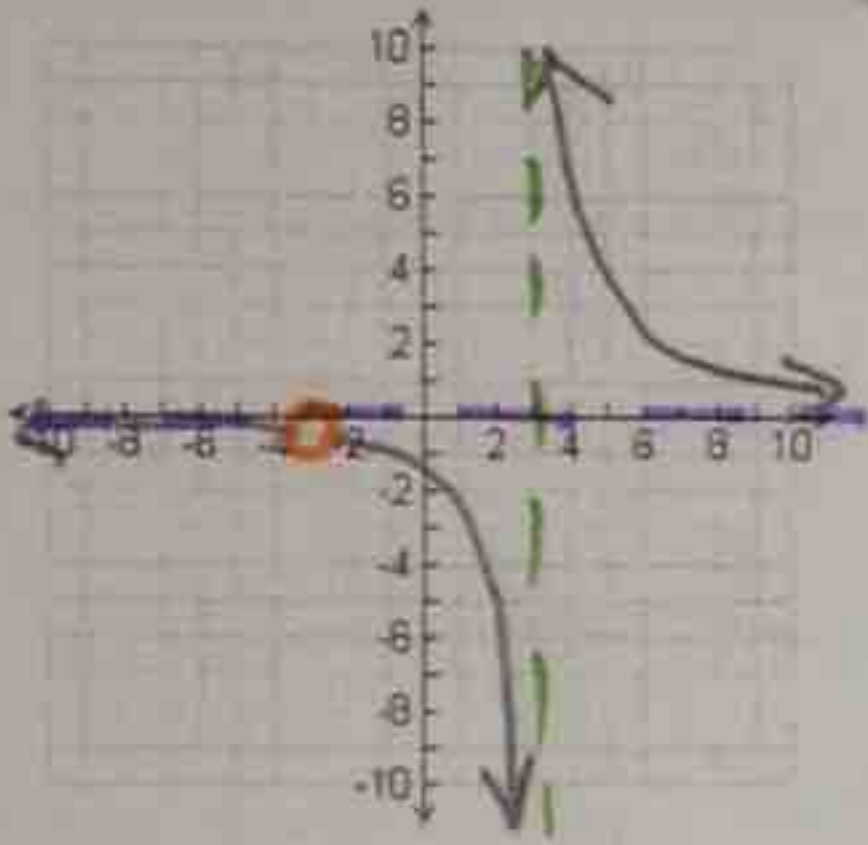


VA: $x=-1$
HA: $y=0$

Domain: $(-\infty, -1) \cup (-1, \infty)$

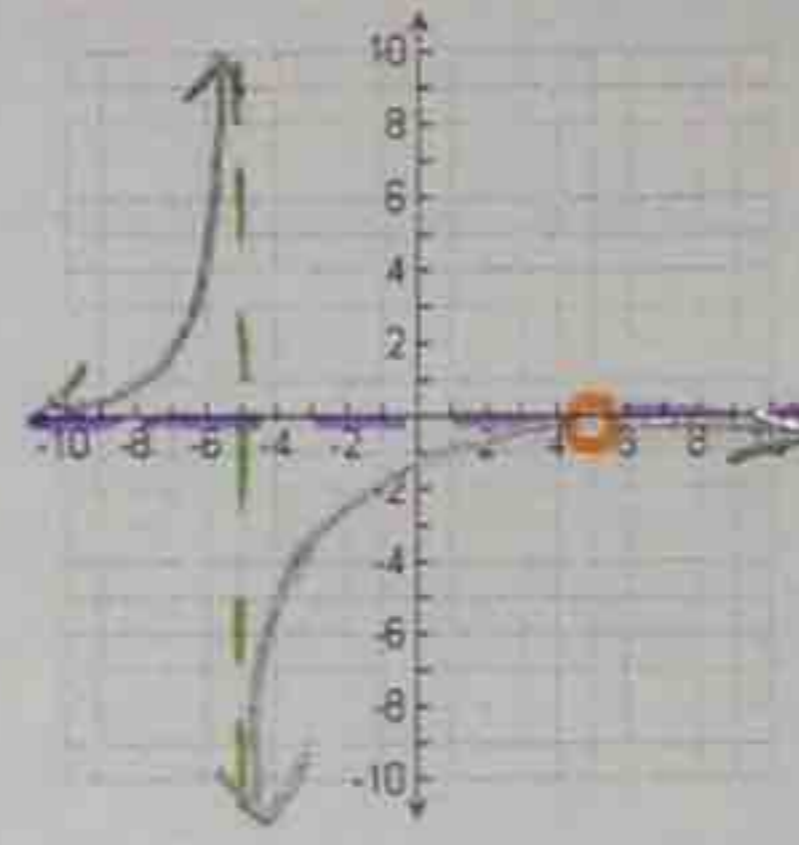
Directions: Find points of discontinuity, the domain, horizontal and vertical asymptotes, and x-intercepts.

4. $y = \frac{x+3}{x^2-9} = \frac{x+3}{(x+3)(x-3)} = \frac{1}{x-3}$



POD: $x=-3$
VA: $x=3$
HA: $y=0$
X-int: NONE
D: $(-\infty, -3) \cup (-3, 3) \cup (3, \infty)$

5. $y = \frac{5-x}{x^2-25} = \frac{-x+5}{x^2-25} = \frac{-1(x-5)}{(x-5)(x+5)} = \frac{-1}{x+5}$



POD: $x=5$
VA: $x=-5$
HA: $y=0$
X-int: NONE
D: $(-\infty, -5) \cup (-5, 5) \cup (5, \infty)$

Simplify. State any restrictions on the variables.

6. $\frac{5x^2y}{10xy^4}$

$\frac{x}{2y^3}$ $x \neq 0$
 $y \neq 0$

7. $\frac{4d^2+8d}{2d}$

$\frac{4d(d+2)}{2d} = 2(d+2)$ $d \neq 0$

8. $\frac{x^2+9x+18}{x+6} = \frac{(x+6)(x+3)}{(x+6)}$

$x+3$ $x \neq -6$

9. $\frac{x^2-2x-8}{x+3} + \frac{x-4}{x+3}$

$\frac{(x-4)(x+2)}{(x+3)} + \frac{(x+3)}{(x+3)} = x+2$ $x \neq -3, 4$

10. $\frac{3x+1}{x^2-x-6} \div \frac{6x^2+11x+3}{x^2+4x+4}$

$\frac{x+2}{(x-3)(2x+3)}$
 $x \neq -2, -3/2, -1/3, 3$

11. $\frac{3x^4-x^3-2x^2}{6x^2-2x-4}$

$\frac{x^2}{2}$ $x \neq -2/3, 1$

12. $\frac{2x^2+5x-3}{x^2-4x} \cdot \frac{2x^3-8x^2}{x^2+6x+9}$

$\frac{2x(2x-1)}{x+3}$ $x \neq 0, 4, -3$

13. $\frac{x^2+3x+2}{x-1} \cdot \frac{1-x}{x+2}$

$-1(x+1)$ $x \neq 1, -2$

$$\begin{aligned}
 10. \quad & \frac{3x+1}{x^2-x-6} \cdot \frac{x^2+4x+4}{6x^2+11x+3} \rightarrow \frac{(6x^2+9x)(2x+3)}{3x(2x+3)1(2x+3)} \\
 & \frac{(3x+1)(2x+3)}{(3x+1)(2x+3)} \\
 & = \frac{(3x+1) \cdot (x+2)(x+2)}{(x-3)(x+2) \cdot (3x+1)(2x+3)} \\
 & = \frac{x+2}{(x-3)(2x+3)}
 \end{aligned}$$

$$\begin{aligned}
 11. \quad & \frac{3x^4 - x^3 - 2x^2}{6x^4 - 2x - 4} \quad \frac{(3x^4 - 3x^3)(2x^3 - 2x^2)}{3x^3(x-1)2x^2(x-1)} \quad \frac{(6x^2 - 6x)(4x - 4)}{16x(x-1)4(x-1)} \\
 & \frac{x^2(3x+2)(x-1)}{2(3x+2)(x-1)} \quad \frac{x^2(3x+2)(x-1)}{2(3x+2)(x-1)} \\
 & = \frac{x^2}{2}
 \end{aligned}$$

$$\begin{aligned}
 12. \quad & \frac{2x^2+5x-3}{x^2-4x} \cdot \frac{2x^3-8x^2}{x^2+6x+9} \quad \frac{(2x^2+6x)(-1x-3)}{2x(x+3)-1(x+3)} \\
 & \frac{(2x-1)(x+3)2x^2(x-4)}{x(x-4)(x+3)(x+3)} \\
 & = \frac{2x(2x-1)}{x+3}
 \end{aligned}$$

$$13. \quad \frac{(x+2)(x+1)}{(x-1)} \cdot \frac{-x+1}{x+2} = \frac{(x+2)(x+1)(-1)(x-1)}{(x-1)(x+2)} = -1(x+1)$$

Simplify each sum or difference. State any restrictions on the variables.

14. $\frac{6x+1}{x+2} + \frac{2x-5}{2x+4}$ CD: $2(x+2)$

$$\frac{2(6x+1)}{2(x+2)} + \frac{(2x-5)}{2(x+2)} = \frac{12x+2+2x-5}{2(x+2)}$$

$$= \frac{14x-3}{2(x+2)} \quad x \neq -2$$

15. $\frac{8}{x^2-25} + \frac{9}{x-5}$ CD: $(x-5)(x+5)$

$$\frac{8}{(x-5)(x+5)} + \frac{9(x+5)}{(x-5)(x+5)} = \frac{8+9x+45}{(x-5)(x+5)}$$

$$\frac{9x+53}{(x-5)(x+5)} \quad x \neq \pm 5$$

16. $\frac{x-3}{x^2+3x} + \frac{7}{x+3}$ CD: $x(x+3)$

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

$$= \frac{8x-3}{x(x+3)} \quad x \neq 0, -3$$

17. $\frac{3x}{x^2+5x+6} - \frac{2x}{x^2+8x+16}$ CD: $(x+2)(x+3)(x+4)^2$

$$\frac{3x(x^2+8x+16)}{(x+2)(x+3)} - \frac{2x(x^2+5x+6)}{(x+4)(x+4)}$$

$$= 3x^3+24x^2+48x - 2x^3-10x^2-12x$$

$$= \frac{x^3+14x^2+36x}{(x+2)(x+3)(x+4)^2} = \frac{x(x^2+14x+36)}{(x+2)(x+3)(x+4)^2} \quad x \neq -2, -3, -4$$

18. $\frac{2}{x^2-1} - 3$ CD: (x^2-1)

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

$$x \neq \pm 1$$

19. $\frac{2x}{x-5} - \frac{x}{x+7}$

$$\frac{2x(x+7) - x(x-5)}{(x-5)(x+7)} = \frac{2x^2+14x - x^2+5x}{(x-5)(x+7)}$$

$$\frac{x^2+19x}{(x-5)(x+7)} = \frac{x(x+19)}{(x-5)(x+7)} \quad x \neq 5, -7$$

Solve each equation. Check each solution.

20. $\frac{x}{4} = \frac{x+1}{3}$

$$3x = 4x + 4$$

$$-x = 4$$

$$x = -4$$

21. $\frac{2}{x^2-1} = \frac{4}{x+1}$

$$\frac{2}{(x-1)(x+1)} = \frac{4}{x+1}$$

$$\frac{2}{x-1} = 4 \quad 6 = 4x$$

$$2 = 4x - 4 \quad x = \frac{3}{2}$$

22. $\frac{3x}{5} + \frac{4}{x} = \frac{4x+1}{5}$

$$\frac{3x(x) + 4(5)}{5x} = \frac{(4x+1)(x)}{5x}$$

$$3x^2 + 20 = 4x^2 + x$$

$$0 = x^2 + x - 20$$

$$0 = (x+5)(x-4)$$

$$x = -5 \quad x = 4$$

23. $\frac{3x}{x-2} = 4 + \frac{x}{5}$

$$\frac{3x}{x-2} = \frac{20+x}{5}$$

$$15x = (x-2)(x+20)$$

$$15x = x^2 + 18x - 40$$

$$0 = x^2 + 3x - 40$$

$$0 = (x+8)(x-5)$$

$$x = -8 \quad x = 5$$

24. $x + \frac{x}{4} - \frac{x}{5} = 21$

$$\frac{20x + 5x - 4x}{20} = 21$$

$$\frac{21x}{20} = 21$$

$$21x = 420$$

$$x = 20$$

25. $\frac{3}{x+4} + \frac{5}{4} = \frac{18}{x+4}$

$$\frac{3(4) + 5(x+4)}{4(x+4)} = \frac{18(4)}{4(x+4)}$$

$$12 + 5x + 20 = 72$$

$$5x + 32 = 72$$

$$5x = 40$$

$$x = 8$$