

Name _____ Date _____ Period _____

Key

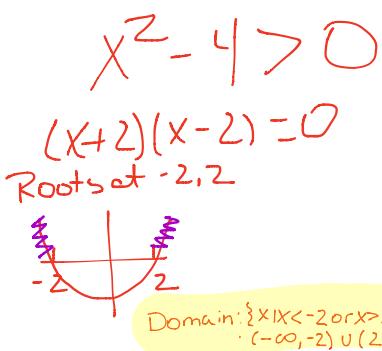
Worksheet 2.1—Algebraic Domains of FunctionsGive simplified, exact values for all answers. **No Calculator is Permitted.****I. Multiple Choice**

- C 1. If $f(x) = \frac{\sqrt{x-1}}{x^2 - 9}$, then the domain of f is given by the interval
 (A) $(1, \infty)$ (B) $(-3, 3)$ (C) $[1, 3) \cup (3, \infty)$ (D) $(-3, 3) \cup (3, \infty)$ (E) $[1, 3]$
 $x-1 \geq 0$ $x^2 - 9 \neq 0$
 $x \geq 1$ $x^2 \neq 9$
 $x \neq \pm 3$
- D 2. Which of the following functions has no vertical asymptote(s)?
 (A) $f(x) = \frac{x-7}{(x-7)(x-5)}$ ~~$x=7$ hole~~ (B) $f(x) = \frac{x}{x^2 - x - 1}$ ~~$x=1 \pm \sqrt{2}$ hole~~ (C) $f(x) = \frac{1}{x-2}$ $x=2$ hole
 (D) $f(x) = \frac{x^2 - 9x + 20}{(x-4)(x-5)}$ (E) None, they all have at least one VA
 $= \frac{(x-5)(x-4)}{(x-4)(x-5)}$
 ~~$x=5$ hole~~
 ~~$x=4$ hole~~
- D 3. Which of the following functions has a hole at $(1, 4)$?
 (A) $f(x) = \frac{x-1}{(x-1)(x-5)}$ ~~$x=1$ hole @ $x=1$~~ (B) $f(x) = \frac{x-1}{(x+1)^2}$ ~~$x=-1$ hole~~ (C) $f(x) = \frac{4}{x-1}$ $x=1$ hole
 (D) $\frac{(x-1)(11x+1)}{(x-1)(x+2)}$ (E) $f(x) = \begin{cases} x^2 + 3, & x \leq 1 \\ x+4, & x > 1 \end{cases}$
 $\text{hole @ } x=1$
 $= \frac{11(1)+1}{1+2} = \frac{12}{3} = 4$
- A 4. Which of the following equations represents y as a function of x ?
 (A) $x^2 + 3y = 5$ (B) $y = x^2 - 7x + y^2$ (C) $x^2 - y^3 - 9 = y^{3/4}$ (D) $|x| - |y| = 0$ (E) None of these
- A+E 5. Which set of ordered pairs represents a function? (There may be more than one correct answer.)
 (A) $\{(a, 3), (b, 5), (c, 9), (d,)\}$ (B) $\{(a, -3), (b, 6), (c, 1), (b, 9)\}$ (C) $\{(a, 3), (b, 3), (c, 3), (b, -3)\}$
 (D) $\{(a, 5), (a, -9), (a, 0), (a, 12)\}$ (E) $\{(a, 3), (b, 5), (c, 9), (d, 9)\}$

II. Short Answer

6. Find the domains of the following functions. Use correct notation.

a) $f(x) = \frac{1}{\sqrt{x^2 - 4}}$



b) $g(x) = \frac{3x}{x^2 + 4x + 3}$

$$x^2 + 4x + 3 \neq 0$$

$$(x+3)(x+1) = 0$$

$$x = -3 \quad x = -1$$

D: $\{x | x \neq -3, -1\}$

D: $(-\infty, -3) \cup (-3, -1) \cup (-1, \infty)$

c) $h(x) = \sqrt{x^2 + 5x - 6}$

$$x^2 + 5x - 6 \geq 0$$

$$(x+6)(x-1) \geq 0$$

$$x = -6 \quad x = 1$$

D: $\{x | x \leq -6 \text{ or } x \geq 1\}$

D: $(-\infty, -6] \cup [1, \infty)$

d) $k(x) = \frac{2}{\sqrt{(x-2)^2}}$

$$(x-2)^2 \geq 0$$

All Reals

$$\begin{cases} \sqrt{(x-2)^2} \neq 0 \\ (x-2)^2 \neq 0 \\ x-2 \neq 0 \\ x \neq 2 \end{cases}$$

D: $\{x | x \neq 2\}$

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

e) $j(x) = \frac{-1}{1 - \sqrt{x+2}}$

$$x+2 \geq 0 \quad 1 - \sqrt{x+2} \neq 0$$

$$x \geq -2 \quad (1) \neq (\sqrt{x+2})^2$$

$$1 \neq x+2$$

$$-1 \neq x$$

D: $\{x | x \geq -2, x \neq -1\}$

D: $[-2, -1) \cup (-1, \infty)$

f) $k(x) = \frac{4x-1}{(x^2 + 3)^{1/3}}$

D: \mathbb{R}

g) $m(x) = \frac{\frac{2}{x} - \frac{x}{3}}{\frac{x-5}{x}}$

$$x \neq 0$$

$$x-5 \neq 0$$

$$x-5 \neq 0$$

$$x = 5$$

$$\{x | x \neq 0, 5\}$$

$(-\infty, 0) \cup (0, 5) \cup (5, \infty)$

7. Find all the discontinuities (if any) of the following functions, then classify them as Holes, VA's, or Jumps.

$$\begin{aligned} \text{a) } f(x) &= \frac{x-1}{x^3 - x} \\ &= \frac{x-1}{x(x^2-1)} \\ &= \frac{x-1}{x(x+1)(x-1)} \end{aligned}$$

$$\begin{aligned} x(x+1)(x-1) &\neq 0 \\ x \neq 0, x \neq -1, x \neq 1 \end{aligned}$$

$$D_f: \{x | x \neq 0, -1, 1\}$$

$x = 1$ hole

$x = 0$ VA

$x = -1$ VA

Hole at $(1, \frac{1}{2})$

$$\text{b) } f(x) = \frac{x-5}{x^2 + 25}$$

$$x^2 + 25 \neq 0$$

$$D_f: \mathbb{R}$$

no discontinuities

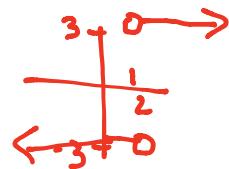
$$\text{c) } f(x) = \frac{3x-6}{|x-2|}$$

$$x-2 \neq 0$$

$$x \neq 2$$

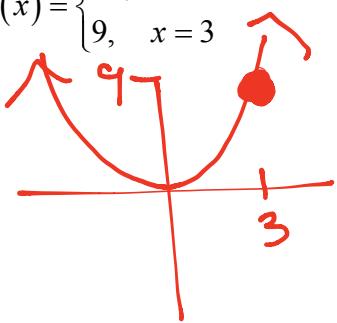
$$D_f: \{x | x \neq 2\}$$

$x = 2$ jump



$$\text{d) } f(x) = \frac{3x^2 - 3x - 18}{4x^2 - 36}$$

$$\text{e) } f(x) = \begin{cases} x^2, & x \neq 3 \\ 9, & x = 3 \end{cases}$$



$$f(x) = \frac{3(x^2 - x - 6)}{4(x^2 - 9)}$$

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

$$4(x+3)(x-3) \neq 0$$

$$x \neq -3, x \neq 3$$

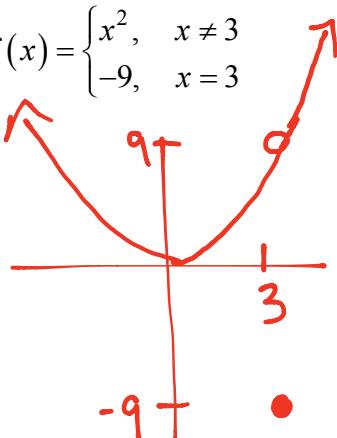
$$D_f: \{x | x \neq -3, 3\}$$

$x = -3$ VA

$x = 3$ hole

Hole at $(3, \frac{15}{24})$

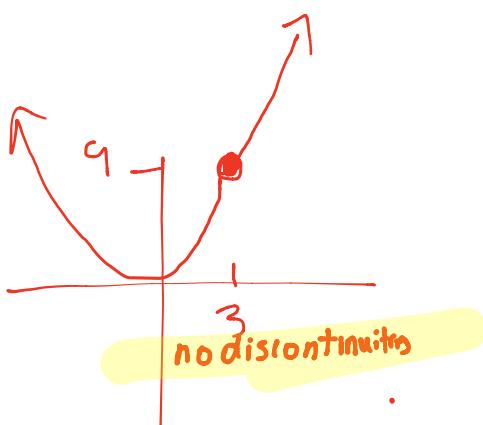
$$\text{f) } f(x) = \begin{cases} x^2, & x \neq 3 \\ -9, & x = 3 \end{cases}$$



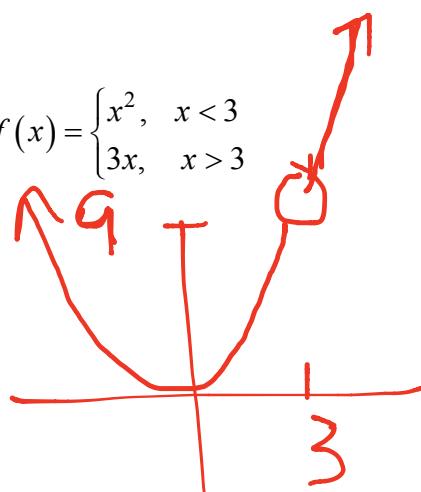
$$D_f: \mathbb{R}$$

Hole at $(3, -9)$

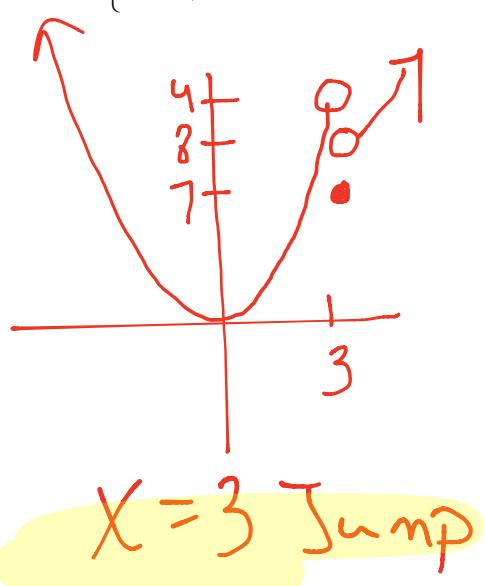
g) $f(x) = \begin{cases} x^2, & x < 3 \\ 5x - 6, & x \geq 3 \end{cases}$



h) $f(x) = \begin{cases} x^2, & x < 3 \\ 3x, & x > 3 \end{cases}$



WS 2.1: Alg Domains of Funcs
i) $f(x) = \begin{cases} x^2, & x < 3 \\ 7, & x = 3 \\ 3x - 1, & x > 3 \end{cases}$

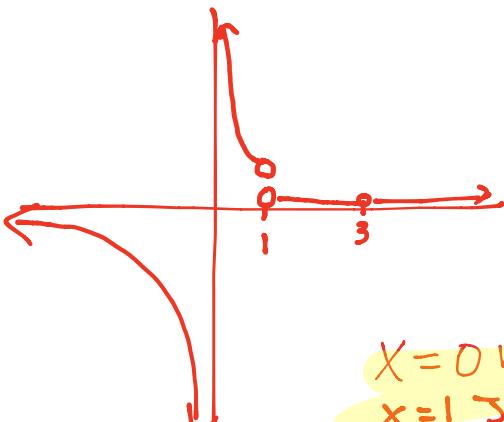


$X=3$ Jump

j) $f(x) = \begin{cases} \frac{1}{x}, & x < 1 \\ \frac{x-3}{x^2+x-12}, & x > 1 \end{cases}$

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

$$= \frac{1}{x+4}, x \neq 3$$



$X=0$ VA
 $X=1$ Jump
 $X=3$ hole
Hole at $(3, \frac{1}{4})$