

3.1 Practice – Discontinuity & Domain

Name: _____

Pre-Calculus

For 1 – 9, find and classify each discontinuity.

1. $f(x) = \frac{x}{x-3}$

Denom $\neq 0$

cancel (hole) stays (VA)
 $x-3 \neq 0$
 $x \neq 3$

\therefore VA @ $x=3$

2. $g(x) = \sqrt{9+4x}$

Continuous on its domain

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

$h(x) = \frac{1}{x+1}$

Denom $\neq 0$

cancel (hole) stays (VA)
 $x-5 \neq 0$ $x+1 \neq 0$
 $x \neq 5$ $x \neq -1$

\therefore Hole @ $x=5$, \therefore VA @ $x=-1$

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

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

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

Denom $\neq 0$

cancel (hole) stays (VA)
 $2x-1 \neq 0$ } $x+3 \neq 0$
 $2x \neq 1$ } $x \neq -3$
 $x \neq \frac{1}{2}$

\therefore VA @ $x=-3, \frac{1}{2}$

5. $w(x) = \frac{5x+15}{3}$

CONTINUOUS ON ITS DOMAIN

6. $f(x) = \frac{3x+4}{9x^2-16} = \frac{\cancel{3x+4}}{(3x-4)(3x+4)}$

$f(x) = \frac{1}{3x-4}$

Denom $\neq 0$

cancel (hole) stays (VA)
 $3x+4 \neq 0$ $3x-4 \neq 0$
 $3x \neq -4$ $3x \neq 4$
 $x \neq -\frac{4}{3}$ $x \neq \frac{4}{3}$

\therefore Hole @ $x=-\frac{4}{3}$ \therefore VA @ $x=\frac{4}{3}$

7.
$$h(t) = \frac{3t^2 + t}{t^3 + 3t^2 - 28t}$$

$$= \frac{t(3t+1)}{t(t^2+3t-28)} = \frac{t(3t+1)}{t(t+7)(t-4)}$$

$$h(t) = \frac{3t+1}{(t+7)(t-4)}$$

Denom $\neq 0$
 Cancel (hole) $t \neq 0$
 Stays (VA) $t+7 \neq 0 \Rightarrow t \neq -7$
 $t-4 \neq 0 \Rightarrow t \neq 4$
 \therefore Hole @ $t=0$
 \therefore VA @ $t = -7, 4$

8.
$$a(x) = \frac{6x^2 + 19x - 7}{10x^2 + 37x + 7}$$

$$= \frac{(6x^2+21x) + (-2x-7)}{(10x^2+35x) + (2x+7)} = \frac{3x(2x+7) - 1(2x+7)}{5x(2x+7) + 1(2x+7)}$$

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

Denom $\neq 0$
 Cancel (hole) $2x+7 \neq 0$
 $2x \neq -7$
 $x \neq -\frac{7}{2}$
 \therefore Hole @ $x = -\frac{7}{2}$
 Stays (VA) $5x+1 \neq 0$
 $5x \neq -1$
 $x \neq -\frac{1}{5}$
 \therefore Hole @ $x = -\frac{1}{5}$

9.
$$f(x) = \frac{2}{x^2 + 4}$$

Denom $\neq 0$
 Cancel (hole) $x \neq 0$
 Stays (VA) $x^2+4 \neq 0$
 $x^2 \neq -4$
 $x \neq \pm 2i$

CONTINUOUS ON ITS DOMAIN

For 10 – 21, identify the domain of each function. (use inequality notation)

10.
$$w(x) = \frac{\sqrt{2x-5}}{3}$$

RADICAND ≥ 0
 $2x-5 \geq 0$
 $2x \geq 5$
 $x \geq \frac{5}{2}$
 $D: x \geq \frac{5}{2}$

11.
$$s(t) = \frac{5}{\sqrt{4t-8}}$$

RADICAND ≥ 0 Denom $\neq 0$
 $4t-8 \geq 0$ $\sqrt{4t-8} \neq 0$
 $4t \geq 8$ $4t-8 \neq 0$
 $t \geq 2$ $4t \neq 8$
 $t \neq 2$
 $D: t > 2$

12.
$$f(x) = \frac{x}{\sqrt{36-6x}}$$

RADICAND ≥ 0 Denom $\neq 0$
 $36-6x \geq 0$ $\sqrt{36-6x} \neq 0$
 $36 \geq 6x$ $36-6x \neq 0$
 $6 \geq x$ $36 \neq 6x$
 $6 \neq x$
 $D: x < 6$

13.
$$g(x) = \frac{x+7}{x^2-2x-15}$$

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

Denom $\neq 0$
 $x-5 \neq 0 \Rightarrow x \neq 5$
 $x+3 \neq 0 \Rightarrow x \neq -3$
 $D: \mathbb{R}, x \neq -3, 5$

14.
$$v(t) = \frac{2t}{t\sqrt{t+6}}$$

RADICAND ≥ 0 Denom $\neq 0$
 $t+6 \geq 0$ $t \neq 0$ } $\sqrt{t+6} \neq 0$
 $t \geq -6$ $t \neq 0$ } $t+6 \neq 0$
 $t \neq -6$
 $D: t > -6, t \neq 0$

15.
$$g(w) = \frac{7}{5-\sqrt{w}}$$

RADICAND ≥ 0 Denom $\neq 0$
 $w \geq 0$ $5-\sqrt{w} \neq 0$
 $5 \neq \sqrt{w}$
 $25 \neq w$
 $D: w \geq 0, w \neq 25$

16.
$$s(t) = \sqrt[3]{3t-9}$$

 No restrictions on ODD root.

$D: \mathbb{R}$

17.
$$g(x) = \frac{x}{|x|-3}$$

Denom $\neq 0$
 $|x|-3 \neq 0$
 $|x| \neq 3$
 $x \neq 3$ $x \neq -3$
 $D: \mathbb{R}, x \neq \pm 3$

18.
$$h(t) = \frac{\sqrt{1-t}}{t-3}$$

RADICAND ≥ 0 Denom $\neq 0$
 $1-t \geq 0$ $t-3 \neq 0$
 $-t \geq -1$ $t \neq 3$
 $t \leq 1$
 $D: t \leq 1$

19.
$$a(t) = (t-4)(\sqrt{t})$$

RADICAND ≥ 0
 $t \geq 0$

$D: t \geq 0$

20.
$$g(x) = x^3 + 7x^2 + 12x$$

$D: \mathbb{R}$

21.
$$h(t) = \frac{t^2-t}{5t^3-7t^2+2t}$$

Denom $\neq 0$
 $t(5t^2-7t+2) \neq 0$
 $t(5t^2-7t+2) \neq 0$
 $t[(5t^2-5t)+(2t+2)] \neq 0$
 $t[5t(t-1)+2(t+1)] \neq 0$
 $t(t-1)(5t+2) \neq 0$
 $t \neq 0$ $t-1 \neq 0 \Rightarrow t \neq 1$ $5t+2 \neq 0 \Rightarrow t \neq -\frac{2}{5}$
 $D: \mathbb{R}, x \neq 0, \frac{2}{5}, 1$

For 22 – 27, identify the domain of each function AND classify each discontinuity.

22. $w(x) = \frac{8x + 12}{4}$

D: \mathbb{R}

CONTINUOUS ON ITS DOMAIN

23. $f(x) = \frac{8x - 5}{64x^2 - 25}$
 $f(x) = \frac{8x - 5}{(8x - 5)(8x + 5)}$
 $f(x) = \frac{1}{8x + 5}$

Denom $\neq 0$
 Cancel (Hole) $8x - 5 \neq 0$
 $8x \neq 5$
 $x \neq 5/8$
 stays (VA) $8x + 5 \neq 0$
 $8x \neq -5$
 $x \neq -5/8$

DOMAIN: $\mathbb{R}, x \neq \pm 5/8$
 Disc: Hole @ $x = 5/8$, VA @ $x = -5/8$

24. $h(x) = \frac{x + 1}{x^2 - 5x - 6} = \frac{x + 1}{(x + 1)(x - 6)}$
 $h(x) = \frac{1}{x - 6}$

Denom $\neq 0$
 Cancel (Hole) $x + 1 \neq 0$
 $x \neq -1$
 stays (VA) $x - 6 \neq 0$
 $x \neq 6$

DOMAIN: $\mathbb{R}, x \neq -1, 6$
 Disc: Hole @ $x = -1$, VA @ $x = 6$

25. $v(x) = \frac{3x}{x\sqrt{x+9}}$

$v(x) = \frac{3}{\sqrt{x+9}}$

Denom $\neq 0$
 Cancel (Hole) $x \neq 0$
 stays (VA) $\sqrt{x+9} \neq 0$
 $x + 9 \neq 0$
 $x \neq -9$
 RADICAND ≥ 0
 $x \geq -9$

DOMAIN: $x > -9, x \neq 0$
 Disc: Hole @ $x = 0$

26. $g(x) = \frac{\sqrt{5-x}}{x-8}$
 Denom $\neq 0$
 RADICAND ≥ 0 (Hole) Cancel stays (VA)
 $5-x \geq 0$
 $-x \geq -5$
 $x \leq 5$
 $x-8 \neq 0$
 $x \neq 8$

DOMAIN: $x \leq 5$
 Disc: CONTINUOUS ON ITS DOMAIN

27. $f(x) = \frac{1}{x^2 + 1}$
 Denom $\neq 0$
 (Hole) Cancel stays (VA)
 $x^2 + 1 \neq 0$
 $x^2 \neq -1$
 $x \neq \pm i$

DOMAIN: \mathbb{R}
 Disc: CONTINUOUS ON ITS DOMAIN

Skillz Review: Solve or evaluate.

1. $\sqrt{-32}$
 $= \sqrt{16 \cdot (-1) \cdot 2}$
 $= \sqrt{16} \sqrt{-1} \sqrt{2}$
 $= 4i\sqrt{2}$

2. $x^2 = -75$
 $x = \pm\sqrt{-75}$
 $x = \pm\sqrt{25 \cdot (-1) \cdot 3}$
 $x = \pm\sqrt{25} \sqrt{-1} \sqrt{3}$
 $x = \pm 5i\sqrt{3}$

3. $(x - 3)^2 = 25$
 $x - 3 = \pm 5$
 $x = 3 \pm 5$
 $x = -2, 8$

4. $(x - 5)^2 = -17$
 $x - 5 = \pm\sqrt{-17}$
 $x = 5 \pm i\sqrt{17}$