# AM: Domain & range, functions

**1.** Find the domain and range: $y = \sqrt{x-6} + 8$

[A] domain: $\{x \mid x \geq 6\}$, range: $\{y \mid y \geq 8\}$ [B] domain: $\{x \mid x \geq 0\}$, range: $\{y \mid y \geq 8\}$

[C] domain: $\{x \mid x \geq -6\}$, range: $\{y \mid y \geq -8\}$

[D] domain: $\{x \mid x \geq 0\}$, range: $\{y \mid y \geq 0\}$

$x - 6 \geq 0$

$+6 \quad +6$

$x \geq 6$

LO: The domain is the set of numbers {____________}, because those are the __________, or x values of the relation.
The range is the set of numbers {____________}, because those are the __________, or y values of the relation.

5

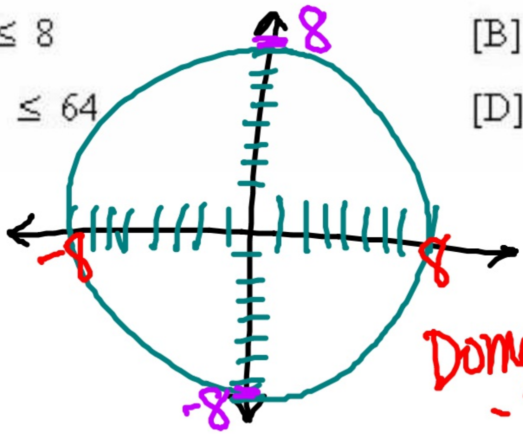
$\boxed{x^2+y^2=r^2}$

## AM: Domain & range, functions

**2.** Find the range of the relation $A=\{(x,y)\mid x^2+y^2=64\}$. $r=8$

[A] $-8 \le y \le 8$ [B] $-64 \le y \le 64$

[C] $-64 \le x \le 64$ [D] $-8 \le x \le 8$




$x^2+y^2=25$

$r=5$

Domain:
$-8 \le x \le 8$

LO: The range is the set of numbers {_____________}, because those are the __________, or ___ values of the relation.

# AM: Domain & range, functions

**3.** Find the domain and range of the relation $\{(x, y) \mid 2x < 12\}$.

[A] domain = **R**; range = $\{y \mid y < 12\}$

[B] domain = $\{x \mid x < 6\}$ ; range = **R**

[C] domain = $\{x \mid x < 12\}$ ; range = $\{y \mid y < 6\}$

[D] domain = **R**; range = $\{y \mid y < 6\}$

$\frac{2x}{2} < \frac{12}{2}$

$x < 6$

The set of x and y such that

$\mathbb{R}$

LO: The domain is the set of numbers {____________}, because those are the __________, or x values of the relation.

The range is the set of numbers {____________}, because those are the __________, or y values of the relation.

## AM: Domain & range, functions

**4.** Determine the domain: $h(x) = \dfrac{2x}{x(x^2 - 16)}$

[A] $\{x \mid x \neq \pm 4, x \neq 0\}$

[B] $\{x \mid x \neq \pm 4\}$

[C] $\{x \mid x \neq \pm 16, x \neq 0\}$

[D] $\{x \mid x \neq 4\}$

$a \cdot b = 0$

$a = 0 \quad b = 0$

$x(x^2 - 16) \neq 0$

$x \neq 0 \qquad x^2 - 16 \neq 0$

$+16 \quad +16$

$\sqrt{x^2} \neq \sqrt{16}$

$x \neq \pm 4$

LO: The domain is the set of numbers {____________}, because those are the __________, or x values of the relation.

## Today's Objectives

- Orally describe and **evaluate intervals of continuity in functions** and relate to **asymptotes** using key words in small groups.
- Success Criteria
  - Identify different kinds of continuity
  - Define asymptotes and their key features
  - Use graphical representations to justify solutions
- **Vocabulary**: asymptote, continuity, discontinuity

dis = not

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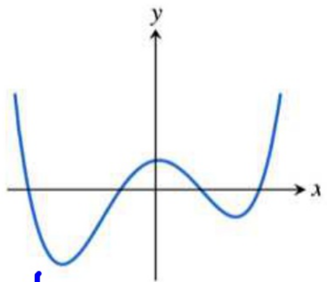
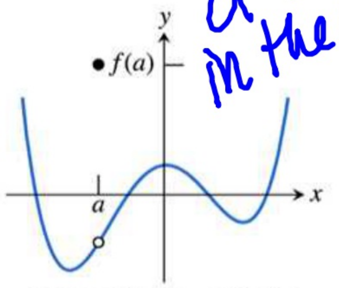
# Continuity

a is
in the domain

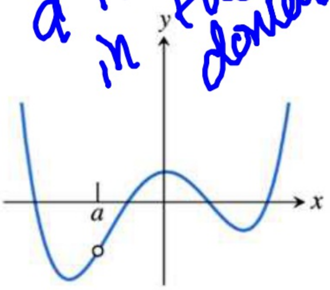



Continuous at all $x$

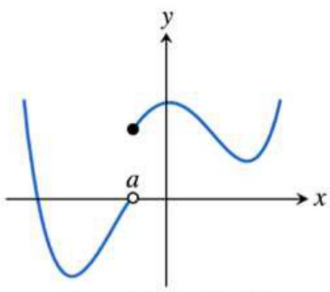



Removable discontinuity

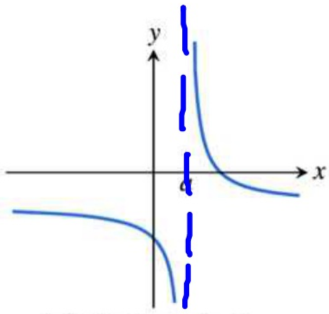
a is not
in the
domain.




Removable discontinuity




Jump discontinuity




Infinite discontinuity

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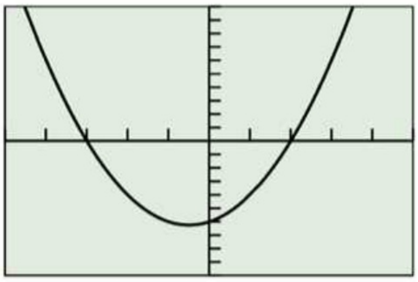
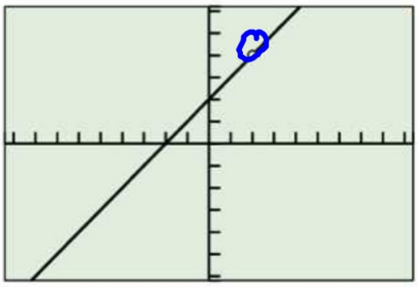
## Example Identifying Points of Discontinuity

Which of the following figures shows functions that are discontinuous at x = 2?



[–5, 5] by [–10, 10]



[–9.4, 9.4] by [–6.2, 6.2]

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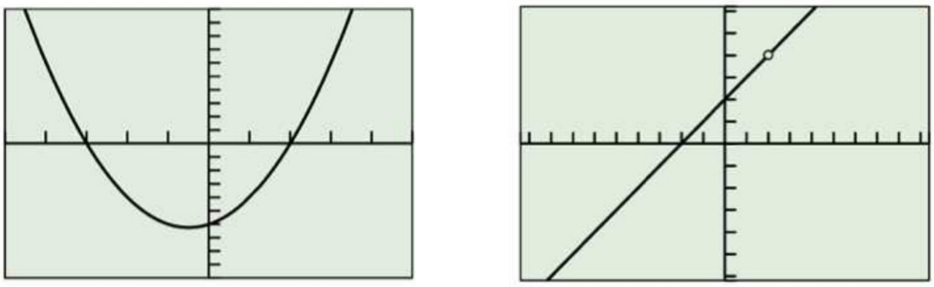
# Example Identifying Points of Discontinuity

Which of the following figures shows functions that are discontinuous at x = 2?



[–5, 5] by [–10, 10]    [–9.4, 9.4] by [–6.2, 6.2]

The function on the right is not defined at x = 2 and can not be continuous there. This is a removable discontinuity.

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## Vertical Asymptotes

The line $x = a$ is a vertical asymptote of the graph of a function $y = f(x)$ if $f(x)$ approaches a limit of $+\infty$ or $-\infty$ as $x$ approaches $a$ from either direction.

Vertical Asymptotes appear when we have Infinite discontinuity

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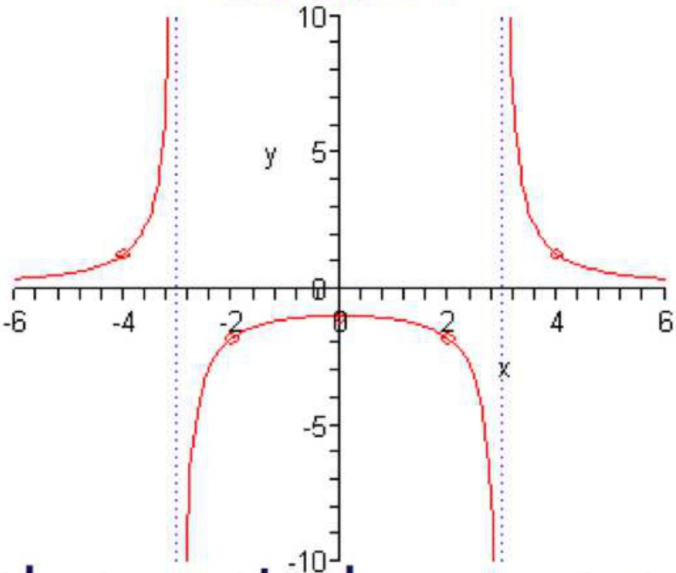
## Example 1




*Notice that vertical asymptotes are examples of infinite discontinuities and are **NOT in the domain.**

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## Horizontal Asymptotes

The line $y = b$ is a horizontal asymptote of the graph of a function $y = f(x)$ if $f(x)$ approaches a limit of $b$ as $x$ approaches $+\infty$ or $-\infty$.

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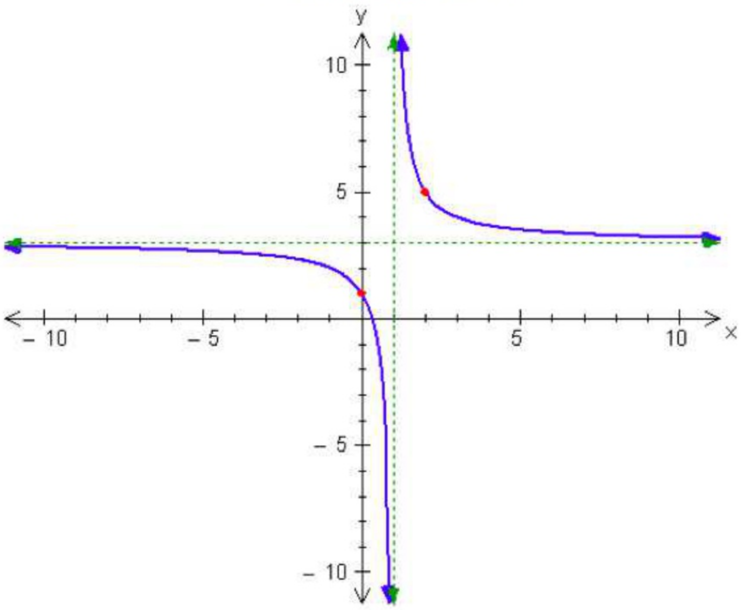
# Example 2




*Notice that horizontal asymptotes are **NOT in the range**

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# Math Joke

- What is an asymptote's favorite song?

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# Answer

- Can’t touch this!

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## Today's Objectives

- **Determine intervals of increase and decrease for various functions** and write in interval or inequality notation using sentence frames.
- Success Criteria
  - Define increasing, decreasing, and constant
  - Graph functions using graphing utility
  - Use graph characteristics to draw conclusions
- **Vocabulary:** increasing, decreasing, constant

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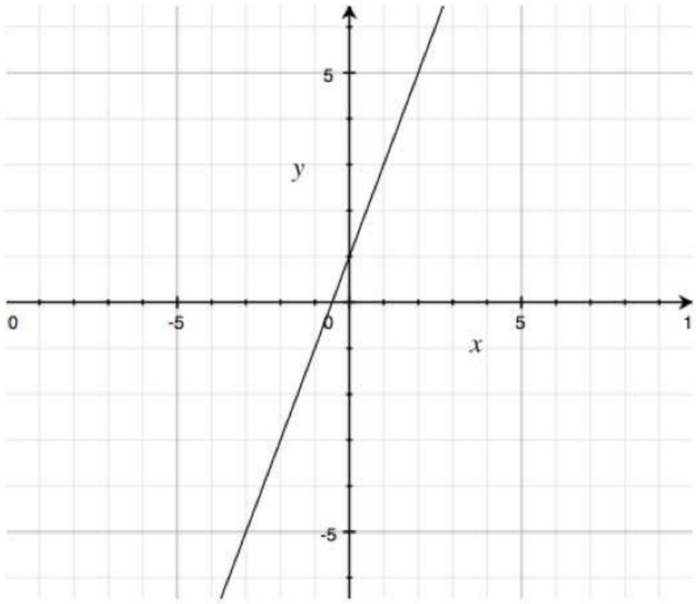
# Increasing Function on an Interval

A function f is increasing on an interval if, for any two points in the interval, a positive change in x results in a positive change in f(x).

(As x increases, y increases).

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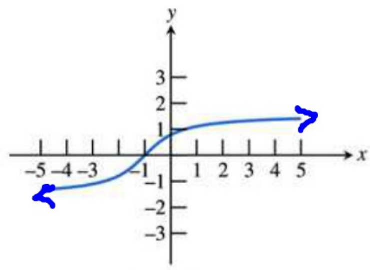
# Constant, Increasing and Decreasing Functions

LO: The function is an increasing function because as the input $x$ increases from $-\infty$ to $\infty$ the functions corresponding output value , $y$, is getting bigger, going up, increasing all the time.




Increasing

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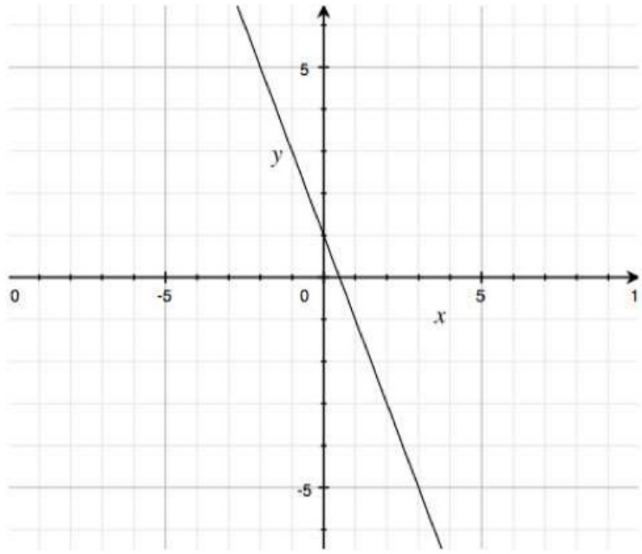
# Decreasing Function on an Interval

A function f is decreasing on an interval if, for any two points in the interval, a positive change in x results in a negative change in f(x).

(As x increases, y decreases).

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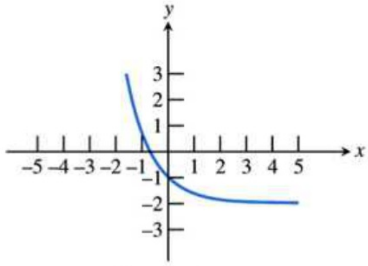
# Constant, Increasing and Decreasing Functions

LO: The function $g(x)$ is a decreasing function because as the input $x$ increases from $-\infty$ to $+\infty$ the functions output value, $y$, is getting smaller, going down in values, decreasing all the time.



Decreasing

$f(x)$ $\phi(x)$

$g(x)$

$h(x)$

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