



# Calculus 1 Workbook

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Continuity

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MATH

## POINT DISCONTINUITIES

- 1. Redefine the function as a continuous piecewise function.

$$f(x) = \frac{x^2 - 6x - 27}{x + 3}$$

- 2. Identify the non-removable discontinuities of the function.

$$k(x) = \frac{x^3 + 3x^2 - 25x - 75}{x^2 + x - 12}$$

- 3. What is the set of removable discontinuities of the function?

$$j(\theta) = \frac{\cos^2\theta \cdot \sin^2\theta}{\tan^2\theta}$$

- 4. Examine whether or not the function is continuous at  $x = 0$ .

$$g(x) = \begin{cases} 2 - x^2 & x \leq 0 \\ x - 2 & x > 0 \end{cases}$$

- 5. Where is the removable discontinuity in the graph of the function?



$$f(x) = \frac{x^3 + 27}{x + 3}$$

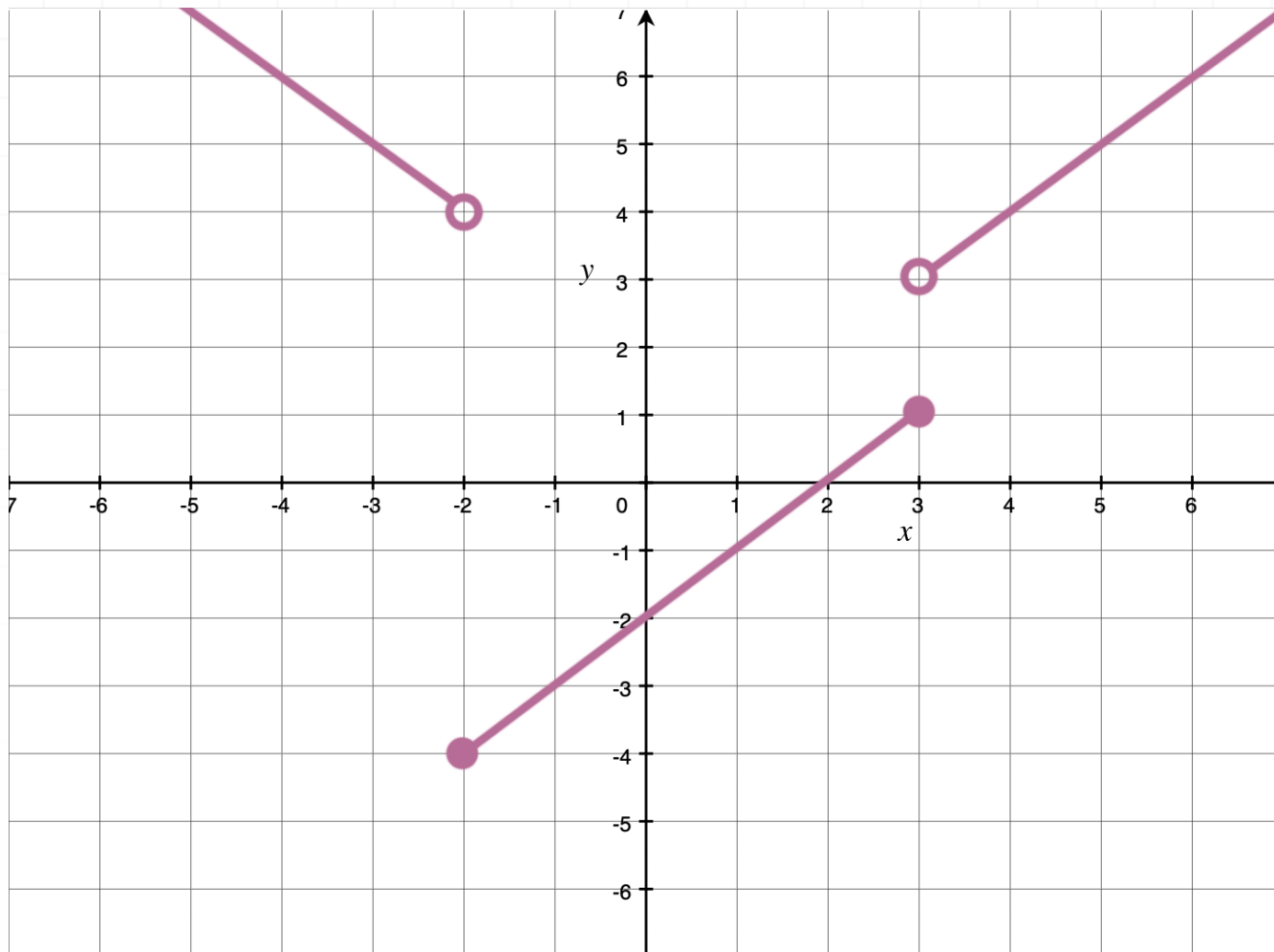
- 6. Identify the removable discontinuities in the function.

$$k(x) = \frac{x^4 - 2x^3 - 16x^2 + 2x + 15}{x^2 - 2x - 15}$$



## JUMP DISCONTINUITIES

- 1. What are the  $x$ -values where the graph of  $f(x)$ , shown below, has jump discontinuities?

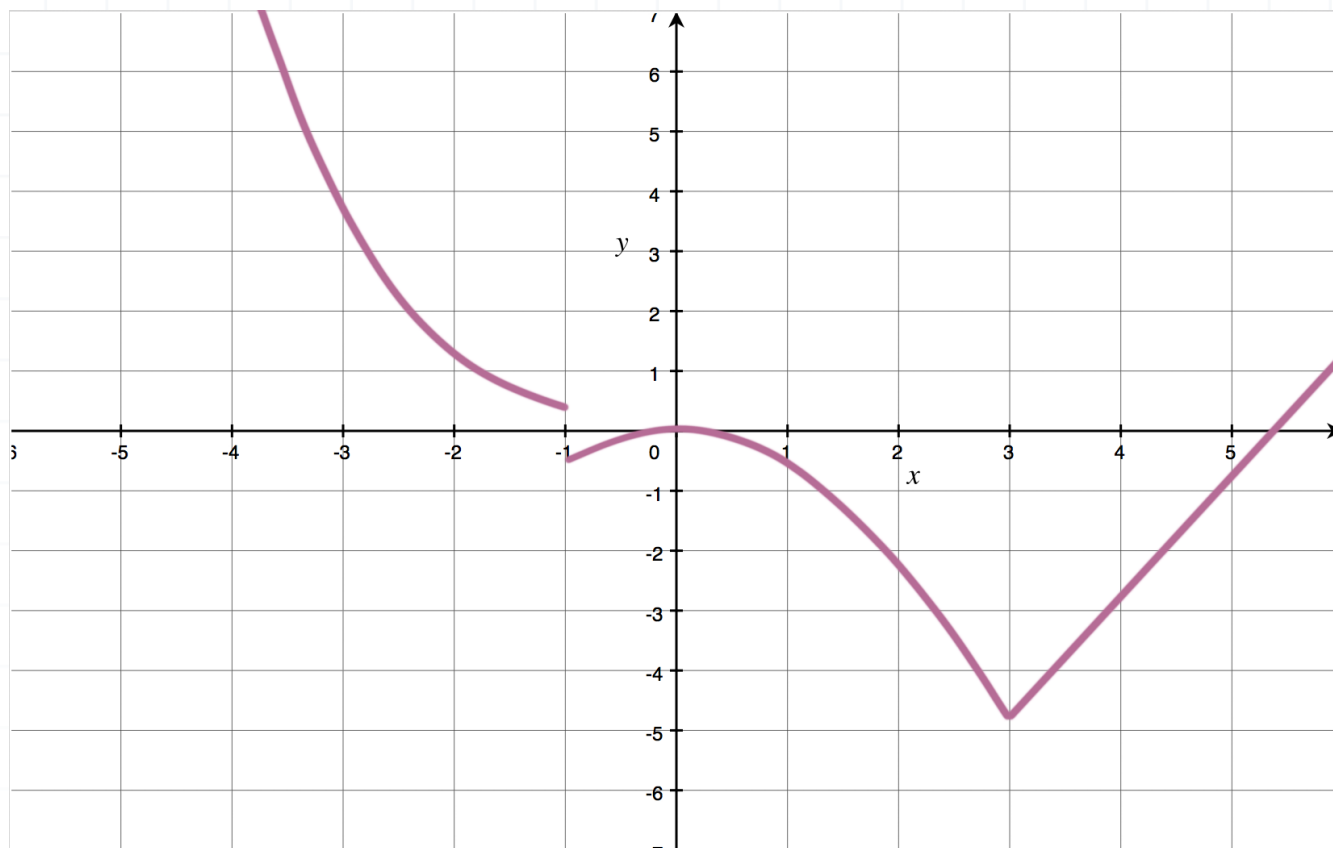


- 2. Where are the jump discontinuities in the graph of the function?

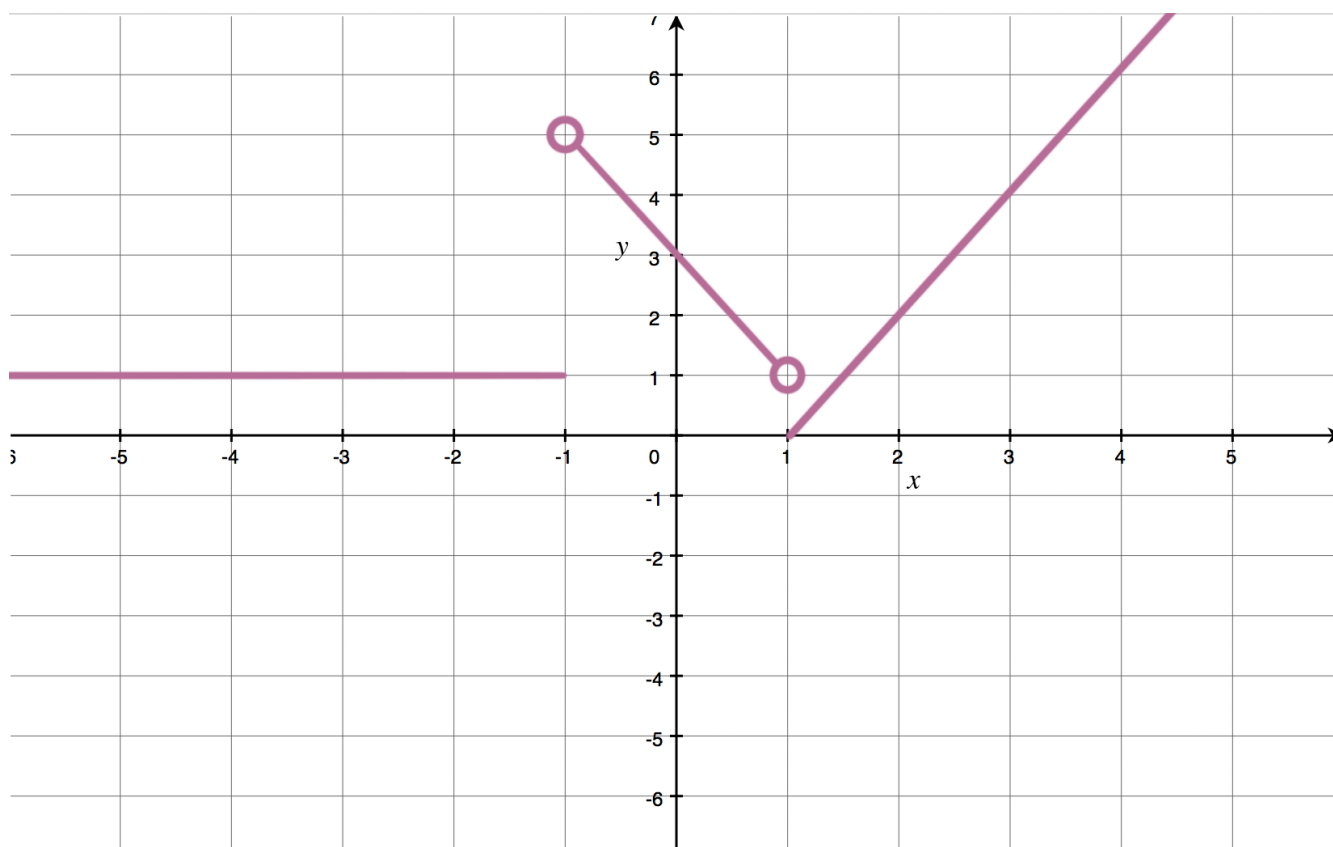
$$h(x) = \begin{cases} -\frac{1}{3}x^2 + 2 & x < 0 \\ 3 & 0 \leq x \leq 1 \\ \frac{1}{3}x^2 + 4 & x > 1 \end{cases}$$



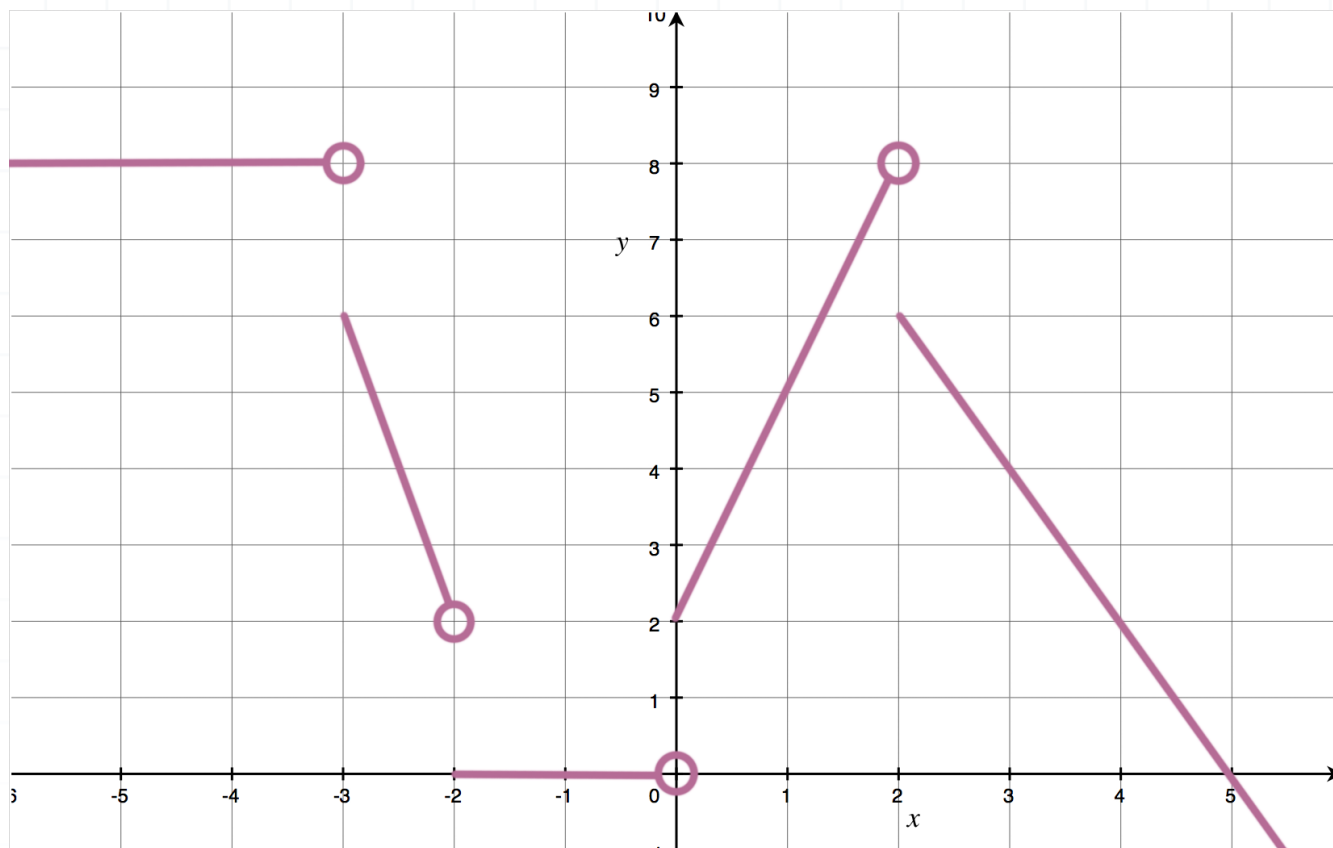
■ 3. What are the  $x$ -values where the graph of  $g(x)$  has jump discontinuities?



■ 4. Show that  $f(x)$  has jump discontinuity at  $x = -1$  and  $x = 1$ .

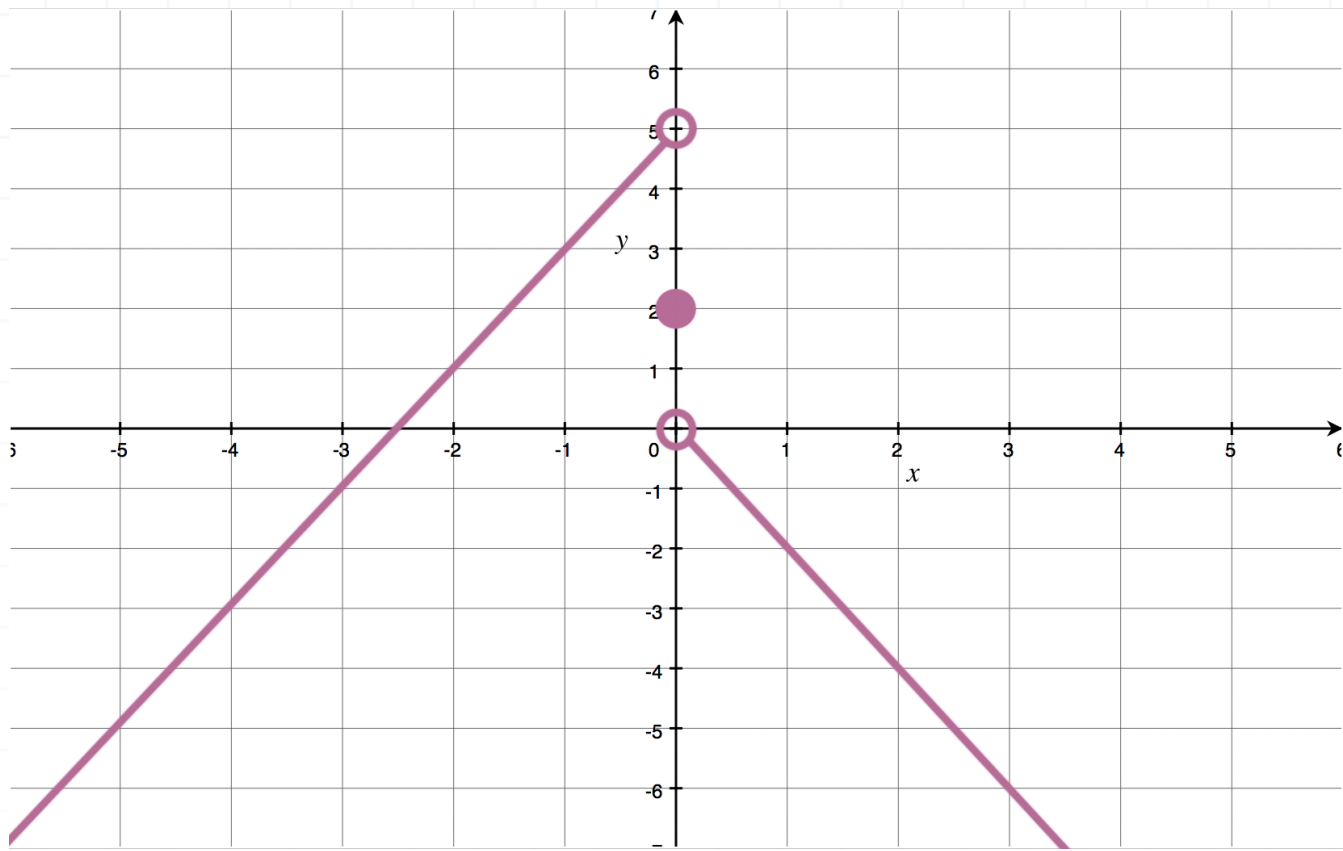


■ 5. Where are the jump discontinuities in the graph of the function shown below?



■ 6. What are the  $x$ -values where the graph of  $h(x)$ , shown below, has jump discontinuities?





## INFINITE DISCONTINUITIES

- 1. At what  $x$ -values does the function have infinite discontinuities?

$$f(x) = \frac{x^2 + x - 12}{x^2 + x - 2}$$

- 2. Where are the infinite discontinuities of the function?

$$h(x) = \frac{x^4 + 3x^3 - 8x - 24}{x^2 + 3x - 4}$$

- 3. At what  $x$ -values does the function have infinite discontinuities?

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

- 4. Where are the infinite discontinuities of the function?

$$h(x) = \frac{x^2 - 6x + 9}{x^2 - 4}$$

- 5. At what  $x$ -values does the function have infinite discontinuities?





$$h(x) = \frac{x^2 - 6x + 9}{x^2 + x - 12}$$

- 6. Classify the discontinuities of  $f(x) = \cot x$  on the interval  $[0, 2\pi]$ .



## ENDPOINT DISCONTINUITIES

- 1. What is the value of the limit on the interval  $[0,3]$ ?

$$\lim_{x \rightarrow 3} -\sqrt{x+5}$$

- 2. What is the value of the limit on the interval  $[\pi, 2\pi]$ ?

$$\lim_{x \rightarrow \pi} \sin x$$

- 3. What is the value of the limit on the interval  $[4, \infty)$ ?

$$\lim_{x \rightarrow 4} -\frac{x+7}{x^2-6x+15}$$

- 4. What is the value of the limit on the interval  $[-9/2, 5/2]$ ?

$$\lim_{x \rightarrow \frac{5}{2}} \frac{x+3}{x^2+x+1}$$

- 5. What is the value of the limit on the interval  $(-2, 2]$ ?

$$\lim_{x \rightarrow -2} \sqrt{2x+4}$$



■ 6. What is the value of the limit on the interval  $[-\pi, \pi]$ ?

$$\lim_{x \rightarrow \pi} -\frac{5 \cos x}{2}$$



