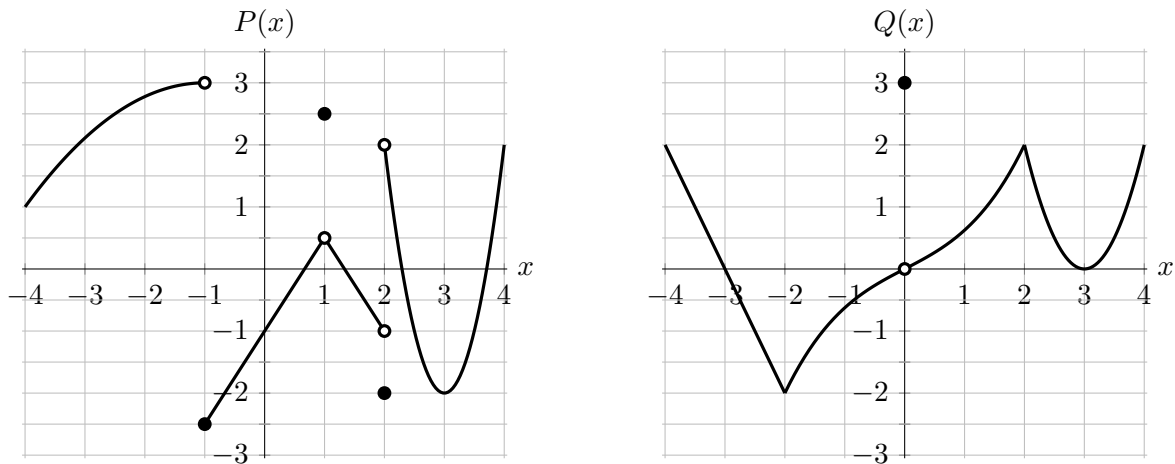


1. [10 points] Given below are the graphs of two functions, $P(x)$ and $Q(x)$, both defined on the interval $(-4, 4)$. Use these graphs to answer the questions below about $P(x)$ and $Q(x)$. *You do not need to show work.*



- a. [1 point] Circle all of the x values below at which the function $P(x)$ is *not* continuous.

$x = -3$ $x = -1$ $x = 1$ $x = 3$ NONE OF THESE

- b. [6 points] Find the **exact** numerical value of each expression below, if possible. For any values that do not exist, including if they are limits that diverge to $\pm\infty$, write DNE.

i. $\lim_{x \rightarrow 1} P(x) = \underline{\hspace{2cm}}$

iv. $\lim_{x \rightarrow 1} Q(3x) = \underline{\hspace{2cm}}$

ii. $\lim_{x \rightarrow 2^-} P(x) = \underline{\hspace{2cm}}$

v. $\lim_{x \rightarrow 2} (P(x)Q(x)) = \underline{\hspace{2cm}}$

iii. $\lim_{x \rightarrow Q(0)} P(x) = \underline{\hspace{2cm}}$

vi. $\lim_{x \rightarrow 0} \frac{P(x) - P(0)}{x} = \underline{\hspace{2cm}}$

- c. [2 points] Circle all x -values given below where the function $\frac{1}{Q(x)}$ has a vertical asymptote.

$x = -3$ $x = -2$ $x = 0$ $x = 2$ $x = 3$ NONE OF THESE

- d. [1 point] Circle all the x -values given below where the function $\frac{1}{Q(x)}$ is undefined.

$x = -3$ $x = -2$ $x = 0$ $x = 2$ $x = 3$ NONE OF THESE