Name:

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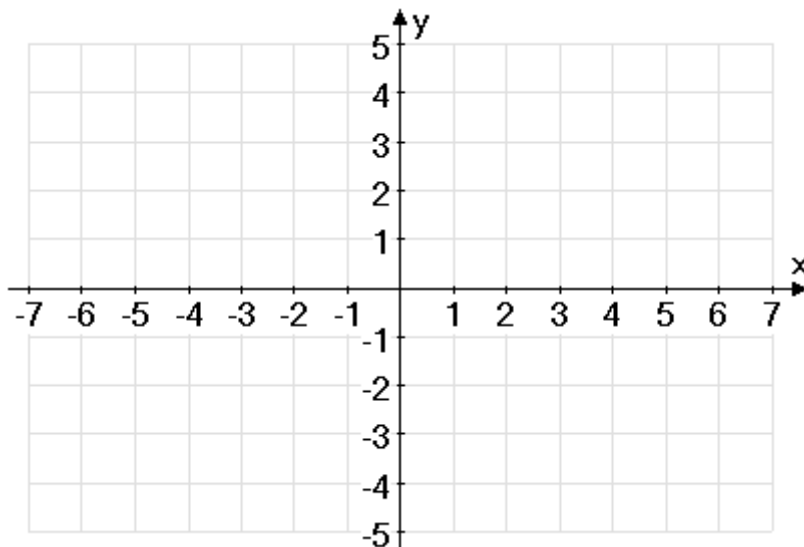--

1- Sketch a graph of a function f that satisfies all of the following conditions:

$$\lim_{x \to -2^-} f(x) = -\infty; \quad \lim_{x \to -2^+} f(x) = \infty; \quad \lim_{x \to -\infty} f(x) = 2; \quad \lim_{x \to -1} f(x) = 1; \quad f(x) \text{ is undefined at } x = 2;$$

and $f(x)$ has a jump discontinuity at $x=3$

2- Let $f(x) = \begin{cases} \dfrac{4a}{x+1} & \text{if } x > 1 \\ 4 & \text{if } x = 1 \\ a^2 & \text{if } x < 1 \end{cases}$, Find the value(s) of a such that $f(x)$ is continuous everywhere.

3- Use the Intermediate Value Theorem to show that the equation $\cos x = \sqrt{x}$ has a root in $\left(0, \frac{\pi}{2}\right)$.

4- Use the graph of $f(x) = \frac{1}{x}$ to find a number δ such that If $|x - 3| < \delta$ then $\left|\frac{1}{x} - \frac{1}{3}\right| < \frac{1}{5}$.

5- The position function of a particle moving in a straight line is given by the equation of motion $s(t) = t^3 - 2t$, where t is measured in seconds and s in meters.
   a. Find the average velocity of the particle over the time interval $[1,3]$.

   b. Use limits to find the instantaneous velocity of the particle when $t = 2$.