Calculus 1 Unit 1 worksheet: Discontinuities and how to remove them

Name _____ Date _____ Period _____

1. Find every discontinuity of each function and classify it as removable, jump, infinite or oscillating. Give the size of every jump.

(a) $\dfrac{x^2+2x-8}{x^3-4x}$

(b) $\dfrac{1-\cos x}{x|x|}$

(c) $\dfrac{1}{x}\cos\dfrac{1}{x}$

2. Let $g(x)=\dfrac{x^3+64}{x^2+6x+8}$.

(a) Find and classify every discontinuity of g. At an infinite discontinuity, give both one-sided limits.

(b) Write the continuous extension of g at its removable discontinuity as one formula, and give its domain.

3. Let

$$f(x)=\begin{cases}\dfrac{1}{x+1}, & x<0\\ 3, & x=0\\ \cos x, & 0<x<\pi\\ x-4, & x\geq\pi\end{cases}$$

(a) Find and classify every discontinuity of f. For a jump, give its size and say from which side, if any, f is continuous.

(b) Which discontinuity can be removed, and how? Why can the others not be removed?

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4. Let $f(x) = 7 - x$ for $x < 2$ and $f(x) = x^2 - 3$ for $x \geq 2$. Classify each function below at 2. For a jump, give its size.

(a) $f(x) + x^3$ (b) $(x^2 - 2x)f(x)$ (c) $(x^2 - 7)f(x)$

5. Decide whether each statement is true for every function f and every number a. Prove a true one; give a counterexample to a false one.

(a) If $\lim_{x \to a^-} f(x) = 2$ and $\lim_{x \to a^+} f(x) = \infty$, then f has a jump at a.

(b) If f has a removable discontinuity at a, then $3f + 1$ has a removable discontinuity at a.

(c) If f has a jump at a, then f^2 has a jump at a.

6. Let $f(x) = \dfrac{\tan x}{x}$ on the interval $(-\pi, \pi)$. Find and classify every discontinuity of f in this interval. Give the one-sided limits at each infinite discontinuity, and the value that removes any removable one.

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