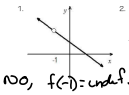
Differentiability and Continuity Homework Name _____

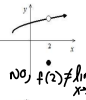
Determine if the function $f(x)$ is continuous at the value c. If not continuous, state which rule of continuity the function fails.

1. 

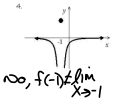
no, $f(-1)=$ undef.

2. 

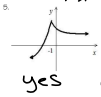
no, $\lim_{x\to 1}$ dne

3. 

no, $f(2)\neq\lim_{x\to 2}$

4. 

no, $f(-1)\neq\lim_{x\to -1}$

5. 

yes

6. 

no, $f(3)=$ undef.

State the value(s) of x where the function is discontinuous.

7. $f(x)=\frac{x^2+5x-24}{x^2-64}$ 8. $g(x)=\tan x$ 9. $h(x)=2^x+x^2$ 10. $f(x)=\frac{x^3-27}{x-3}$

Determine whether the function is continuous at the "transition value" where the function rules change.

11. $f(x)=\begin{cases} x^2-3, & x<1 \\ 2-x, & x\geq 1\end{cases}$ 12. $g(x)=\begin{cases} 2(x+2), & x\leq -1 \\ \sqrt{x+1}+2, & x>-1\end{cases}$

13. $h(x)=\begin{cases} (x-2)^2+1, & x\geq 1 \\ x+1, & x<1\end{cases}$ 14. $f(x)=\begin{cases} x+3, & x<-1 \\ 2^{-x}, & x\geq -1\end{cases}$

 Jean Adams

$$f'(x)=\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$$

a) $f(x)=x$

$$f'(x)=\lim_{h\to 0}\frac{\cancel{x}+h-\cancel{x}}{h}\to\frac{h}{h}\to 1$$

b) $g(x)=x^2$

$$g'(x)=\lim_{h\to 0}\frac{(x+h)^2-x^2}{h}\to\frac{\cancel{x^2}+2xh+h^2-\cancel{x^2}}{h}$$

$$\frac{\cancel{h}(2x+h)}{\cancel{h}}\to 2x$$

c) $h(x)=x^3$

$$h'(x)=\lim\frac{\cancel{x^3}+3x^2h+3xh^2+h^3-\cancel{x^3}}{h}$$

$$\frac{\cancel{h}(3x^2+3xh+h^2)}{\cancel{h}}\to 3x^2$$

d) $k(x)=x^4$

$k'(x)=4x^3$

$g(x)=x^{15}$

$g'(x)=15x^{14}$

$f(x)=10$

$f(x)=10x^0$

$f'(x)=0$

$f(x)=x^2$

$f'(x)=2x$

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$f(x)=\sqrt{x}$

$f(x)=x^{\frac{1}{2}}$

$f'(x)=\frac{1}{2}x^{\frac{1}{2}-1}$

$=\frac{1}{2}x^{-\frac{1}{2}}=\frac{1}{2\sqrt{x}}$

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$g(x)=\frac{1}{x}\to x^{-1}$

$g'(x)=-1x^{-2}\to\frac{-1}{x^2}$

$h(x)=\frac{1}{x^2}\to x^{-2}$

$h'(x)=-2x^{-3}\to\frac{-2}{x^3}$

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$f(x)=5x^2$

$f'(x)=10x$

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Basic Differentiation Rules

$\frac{d}{dx}[c]=0$

$\frac{d}{dx}[x]=1$

$\frac{d}{dx}[x^n]=n\cdot x^{n-1}$

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a) $f(x) = 6x^{\frac{1}{2}}$

$f'(x) = 3x^{-\frac{1}{2}}$

b) $g(x) = 4x^2 + 7x$

$g'(x) = 8x + 7$

c) $h(x) = x^{3/4}$

$h'(x) = \frac{3}{4}x^{-1/4}$

d) $p(x) = 9x - \frac{1}{4}x^8 + \sqrt[3]{x} + 8$

$= 9x - \frac{1}{4}x^8 + x^{\frac{1}{3}} + 8$

$p'(x) = 9 - 2x^7 + \frac{1}{3}x^{-2/3}$

Oct 10-10:01 AM