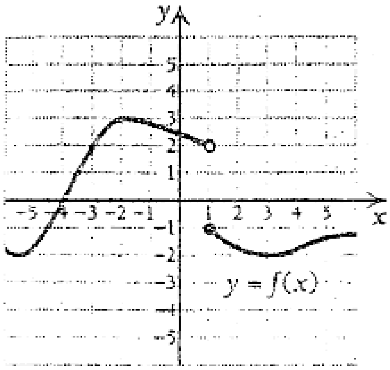
Honors Brief Calculus Group Work Unit 10 Name__________________________________

1. Determine whether the following is continuous. Use the graph.



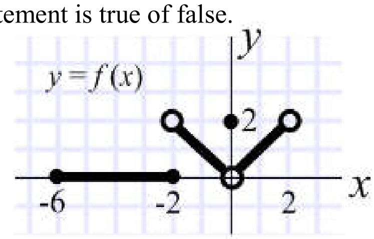
a) Find $\lim_{x\to 1^+} f(x) =$ $\lim_{x\to 1^-} f(x) =$ $\lim_{x\to 1} f(x) =$

b) Find $f(1) =$ c) Is *f* continuous at $x = 1$?

d) Find $\lim_{x\to -2} f(x) =$ e) Find $f(-2) =$

f) Is *f* continuous at $x = -2$?

2. Refer to the graph of *f* below to determine whether each statement is true of false.



a) $\lim_{x\to -2^+} f(x) = 1$

b) $\lim_{x\to -2^-} f(x) = 0$

c) $\lim_{x\to -2^+} f(x) = \lim_{x\to -2^-} f(x)$

d) $\lim_{x\to -2} f(x)$ exists.

e) $\lim_{x\to -2} f(x) = 2$

f) $\lim_{x\to 0} f(x) = 0$

g) $f(0) = 2$

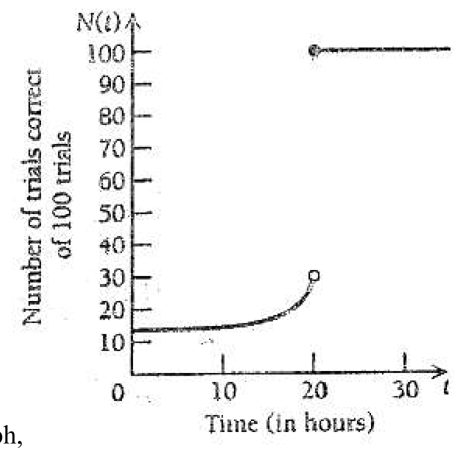
h) *f* is continuous at $x = -2$.

i) *f* is continuous at $x = 0$.

j) *f* is continuous at $x = -1$.

3. *A learning curve.* In psychology one often takes a certain amount of time *t* to learn a task. Suppose that the goal is to do a task perfectly and that you are practicing the ability to master it. After a certain time period, what is known to psychologists as an "I've got it!" experience occurs, and you are able to perform the task perfectly.

Where do you think this happens on the learning curve below?



Using the graph,

find each of the following limits, if it exists.

a) $\lim_{x\to 20^+} N(t) =$ $\lim_{x\to 20^-} N(t) =$ $\lim_{x\to 20} N(t) =$

b) $\lim_{x\to 30^+} N(t) =$ $\lim_{x\to 30^-} N(t) =$ $\lim_{x\to 30} N(t) =$

c) Is *N* continuous at 20? At 30?

d) Is *N* continuous at 10? At 26?

4. Consider $f(x) = \begin{cases} 1 & \text{for } x \neq 2 \\ -1 & \text{for } x = 2 \end{cases}$ Find each of the following:

a) $\lim_{x\to 0} f(x) =$ b) $\lim_{x\to 2^-} f(x) =$ c) $\lim_{x\to 2^+} f(x) =$ d) $\lim_{x\to 2} f(x) =$

e) Is *f* continuous at 0? At 2?

Find the limit (algebraically), if it exists.

6. $\lim_{x\to 2}\dfrac{x^2+x-6}{x^2-4}$

7. $\lim_{x\to 1}\dfrac{x^3-1}{x^2-1}$

8. $\lim_{x\to 0}\dfrac{|x|}{x}$

9. $\lim_{x\to 0}\dfrac{\sqrt{3-x}-\sqrt{3}}{x}$

10. $\lim_{x\to -1} f(x)$ given $f(x)=\begin{cases}\dfrac{x^4-1}{x^2+x} & \text{if } x\neq -1\\ 0 & \text{if } x=-1\end{cases}$

11. $\lim_{x\to -\infty}\dfrac{2x^3-x+1}{3x^3+4}$

12. $\lim_{x\to 3^+}\dfrac{x^2+x-6}{x-3}$

13. $\lim_{x\to 3^-}\dfrac{x^2+x-6}{x-3}$

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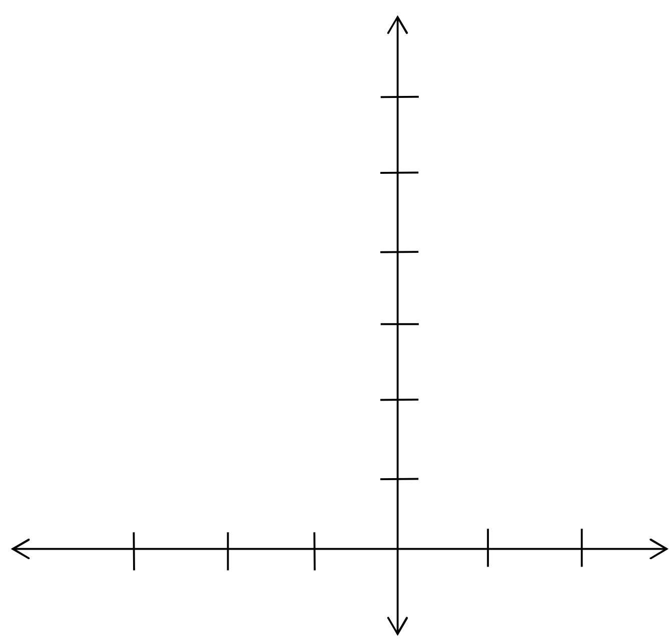
14. Find the derivative of a linear function
$f(x) = mx + b$

15. Find an equation of the tangent line to the graph of $y = x^2 + 3x$ at the point $(-1, -2)$.

16. Given $f(x) = x^2 + x$

a) Graph the function
b) Draw tangent lines to the graph at points whose x-coordinates are $-2,\ 0,$ and 1.
c) Find $f'(x)$



d) Find $f'(-2)$, $f'(0)$, and $f'(1)$.

e) How do these slopes compare with those of the lines you drew in part (b)?

17. Determine whether the function *f* is continuous at *c*.

$$f(x)=\begin{cases}\dfrac{x^2+x}{x} & \text{if } x\neq 0\\ 1 & \text{if } x=0\end{cases}\qquad c=0$$

18. Use the graph of the function *f* below to determine the points at which the derivative does not exist.