Sample Quiz 1/Study Guide: AP Calc AB (last revised 8-26-19)

Topic 1: Average rate of change versus instantaneous rate of change (ROC vs. IROC)

1. Average rate of change between two distinct elements of the domain of the given function
2. Using average rate of change to approximate instantaneous rate of change
3. Using difference quotient and limit as x approaches a particular value of the domain to find the instantaneous rate of change.
4. Understand the difference between approximating instantaneous rate of change at a specific value of the domain and actually calculating the instantaneous rate of change.
5. Use approximations of ROC to approximate IROC
6. Use limit of a difference quotient to find IROC

Topic 2: Slope of secant line between two points on a function versus slope of a tangent line at a point of a function

1. Find slope between two points
2. Find slope between two points as these points become increasingly closer to each other
3. Use approximations of secant line slope to approximate slope of tangent line
4. Use limit of a difference quotient to find tangent line slope

Topic 3: Finding limits through a variety of means

1. Finding a limit's approximation through a table of coordinates that approach a specific value of x
2. Finding a limit through direct substitution
3. Finding a limit through a graph of a related function
4. Understanding what the indeterminate form tells us about a function at the point that causes $\frac{0}{0}$
5. Understanding what $\frac{n}{0}$ for some real non-zero n means in context of a limit at a specific value of x

Sample Questions

1. Use $f(x) = 2x^2 - 4x - 6$ and the following values of x to determine the average rate of change as x approaches x = 2 from the right side (Keep at least 6 decimal places)

P occurs at x = 2 Q occurs at x = 3 Average rate of change from x = 2 to x = 3	P occurs at x = 2 R occurs at x = 2.1 Average rate of change from x = 2 to x = 2.1	P occurs at x = 2 S occurs at x = 2.01 Average rate of change from x = 2 to x = 2.01	P occurs at x = 2 T occurs at x = 2.001 Average rate of change from x = 2 to x = 2.001

2. According to the information in the table from #1, select the most appropriate limit that this table supports
   a. $\lim\limits_{x \to 2} \frac{f(x) - f(2)}{x - 2}$
   b. $\lim\limits_{x \to 2^-} \frac{f(x) - f(2)}{x - 2}$
   c. $\lim\limits_{x \to 2^+} \frac{f(x) - f(2)}{x - 2}$
   d. None of these

3. Use $f(x) = 2x^2 - 4x - 6$ and the following values of x to determine the average rate of change as x approaches x = 2 from the left side (Keep at least 6 decimal places)

P occurs at x = 2 N occurs at x = 1 Average rate of change from x = 2 to x = 1	P occurs at x = 2 L occurs at x = 1.9 Average rate of change from x = 2 to x = 1.9	P occurs at x = 2 K occurs at x = 1.99 Average rate of change from x = 2 to x = 1.99	P occurs at x = 2 J occurs at x = 1.999 Average rate of change from x = 2 to x = 1.999

4. According to the information in the table from #3, select the most appropriate limit that this table supports

a. $\lim_{x \to 2} \frac{f(x) - f(2)}{x - 2}$

b. $\lim_{x \to 2^-} \frac{f(x) - f(2)}{x - 2}$

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

d. None of these

Use $f(x) = 2x^2 - 4x - 6$

5. Refer to #1-4, as both x values get closer to each other, what appears to happen to the average rate of change between these two x values?

BE SPECIFIC and include a specific comment regarding a particular value of the domain

Use $f(x) = 2x^2 - 4x - 6$ to answer the following questions

6. Explain what $\lim_{x \to 2} \frac{f(x) - f(2)}{x - 2}$ tells us about the instantaneous rate of change at x = 2 or IROC at x = 2

Use $f(x) = 2x^2 - 4x - 6$ to answer the following questions

7. If you attempt to replace x = 2 into $\lim_{x \to 2} \frac{f(x) - f(2)}{x - 2}$ it will lead to ______________________ form, explain specifically which fraction occurs (prior to any "algebra" tricks)

8. Find $\lim_{x \to 2} \frac{f(x) - f(2)}{x - 2}$ SHOW WORK or NECESSARY Justifications

9. Explain the difference between a secant line through points determined by f(x) at x = a and at x = b and a tangent line to f(x) at x = c, use $f(x) = 2x^2 - 4x - 6$ and questions 1-8 to support your answer

10. Write the equation of the tangent line at x = 2 (the slope of the tangent should be obvious from tables in questions 1 and 3, but you actually found this slope in question 8.

Equation of the tangent line to f(x) at x = 2 in point slope form____

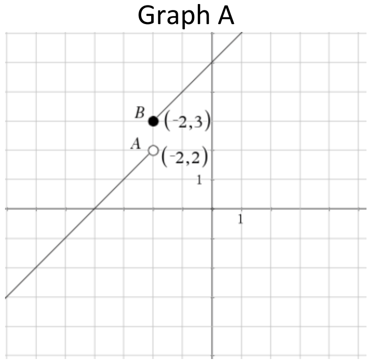
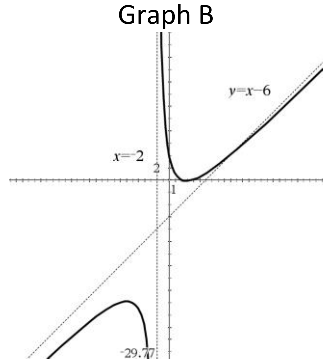
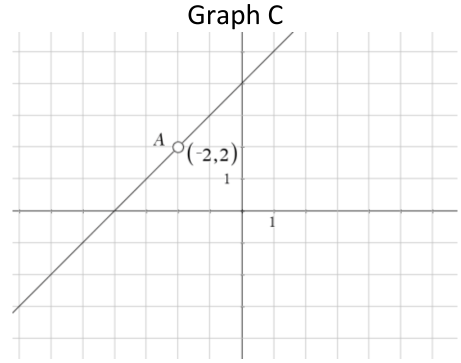
Equation of the tangent line to f(x) at x = 2 in slope intercept form____

11. Explain the difference between results of $\frac{n}{0}$ and $\frac{0}{0}$ for a limit of a function at a particular value of x for some non-zero "n" in the set of all reals in the context of finding a limit.

Use $g(x)=\dfrac{2x^2+4x}{x+2}$ and $h(x)=\dfrac{2x^2+4x}{x+3}$ as example functions to support your answer.

Use proper limit notation and support your answer with a graph

Use the function names f(x), g(x), and h(x) and graphs, and graph names A, B, and C to answer the following questions

Graph A	Graph B	Graph C
		
f(x)	g(x)	h(x)

12. Determine each of the following if possible, if NOT possible state why not

a. $\lim\limits_{x\to -2^+} f(x)$

d. $\lim\limits_{x\to -2^+} g(x)$

g. $\lim\limits_{x\to -2^+} h(x)$

b. $\lim\limits_{x\to -2^-} f(x)$

e. $\lim\limits_{x\to -2^-} g(x)$

h. $\lim\limits_{x\to -2^-} h(x)$

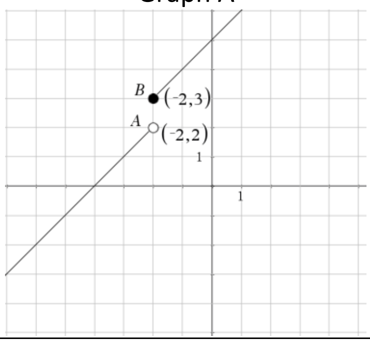
c. $\lim\limits_{x\to -2} f(x)$

f. $\lim\limits_{x\to -2} g(x)$

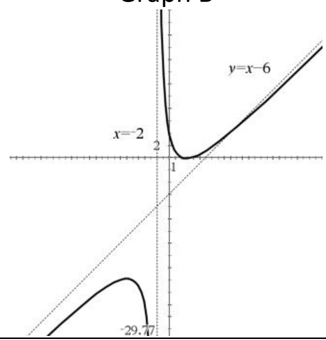
i. $\lim\limits_{x\to -2} h(x)$

Use the function names f(x), g(x), and h(x) and graphs, and graph names A, B, and C to answer the following questions

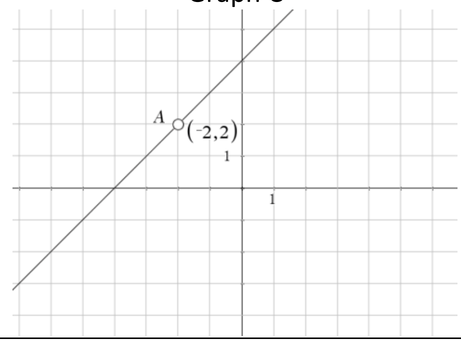
Graph A



Graph B



Graph C



13. Which functions have a limit that does not exist on the interval x in (-5, 5)? At which values do these functions fail to have a limit?

14. Which functions have a pair of one sided limits that do NOT agree? Where do they fail to agree?

15. Match the graphs and functions above to the equations below?

a. $y = \dfrac{x^2 - 6x + 8}{x + 2}$

b. $y = \begin{cases} x + 4, & \text{x} < \text{-2} \\ x + 5, & \text{x} \geq \text{-2} \end{cases}$

c. $y = \dfrac{x^2 + 6x + 8}{x + 2}$

____________________ ____________________ ____________________

Use $g(x)=\dfrac{2x^2+4x}{x+2}$ and $h(x)=\dfrac{2x^2+4x}{x+3}$ to answer the questions below

16. State which of the following limits would require more than direct substitution to evaluate

a. $\lim\limits_{x\to -2} g(x)$

b. $\lim\limits_{x\to 2} g(x)$

c. $\lim\limits_{x\to 3} g(x)$

d. $\lim\limits_{x\to -3} g(x)$

e. $\lim\limits_{x\to -2} h(x)$

f. $\lim\limits_{x\to 2} h(x)$

g. $\lim\limits_{x\to 3} h(x)$

h. $\lim\limits_{x\to -3} h(x)$

17. What does a graph on a graphing calculator or a graphing program fail to directly show for the user of the graph?(mark all that apply)

a. Holes
b. Vertical asymptotes
c. Horizontal asymptotes
d. Slant asymptotes
e. Oblique Asymptotes
f. All of the above

TRUE or FALSE

18. ________99.9% of the time instead of making a table of values to find a specific limit at x = c, you should try f(c-0.0001) and f(c+0.0001) for any real c and any function f(x) to find this limit at x = c

19. ________ A function must be defined at a value of x to have a limit at a value of x

20. ________ limit of f(x) at x = c is ALWAYS f(c)

21. ________ $\frac{0}{0}$ is one of the example of a mathematic occurrence called the determinate form

22. _________ A function can have a left side limit at x = c and a right side limit at x = c, but not have a limit at x = c

23. _________ if a function's left hand limit at x =c and right hand limit at x = c are equal, then we can say that the function itself has a limit at x = c