Calculus
MID TERM
Review

Name: _____

Directions: For # 1-21, fill in the blank with the best possible answer. *The answers may have more than one word.*

1. The difference quotient is a formula to find the _____.
2. The y value that a function approaches as x approaches a given value is called the _____.
3. A function is non-differentiable at $x = a$ when:
   a. _____ c. _____
   b. _____ d. _____
4. A _____ is an equation that gives the slope of the graph at any point.
5. If the limit as x approaches a point of discontinuity is equal to a constant (a number), then the graph of the function has a _____ at that x value.
6. Taking the limit as x approaches infinity is a way to find the _____of a function.
7. $\frac{f(x+h)-f(x)}{h}$ is a formula to find the _____.
8. Graphically, the instantaneous rate of change is the _____.
9. When evaluating a limit, the form $\frac{0}{0}$ is called _____.
10. The function $f(x) = |x - 1|$ is non-differentiable at $x =$_____.
11. If the limit as x approaches a point of discontinuity is equal to $\pm\infty$, then the graph of the function has a _____ at that x value.
12. Graphically, the average rate of change is the _____.
13. The function $f(x) = 2\sqrt[3]{x-3} + 2$ is non-differentiable at $x =$_____.
14. What is the formula for $f'(x)$. Explain the formula.
15. When using direct substitution to evaluate a limit, what does it mean if the result is $\frac{5}{0}$?
16. What is a point of discontinuity? (write a brief definition)
17. Find the average rate of change between $x = -1$ and $x = 3$ for the function $f(x) = 2x - 3x^2$
18. Find the instantaneous rate of change between at $x = -1$ for the function $f(x) = 2x - 3x^2$

19. Make a graph that meets the following conditions.

a. $\lim_{x\to-\infty} f(x) = -1$

b. $\lim_{x\to\infty} f(x) = -1$

c. $\lim_{x\to 3} f(x) = \infty$

d. $\lim_{x\to 0} f(x) = 1$

e. $f(0) = 0$

20. Make a graph that meets the following conditions.

a. $\lim_{x\to-\infty} f(x) = -3$

b. $\lim_{x\to\infty} f(x) = -3$

c. $\lim_{x\to 1^-} f(x) = \infty$

d. $\lim_{x\to 1^+} f(x) = -\infty$

e. $\lim_{x\to -2} f(x) = -1$

f. $f(-2) = 3$

21. Evaluate:

$$\lim_{x\to -2^-}\left(\frac{1}{x+2}\right)$$

22. Evaluate:

$$\lim_{x\to\infty}\left(\frac{3x^2+2x+1}{2-x^2}\right)$$

23. Evaluate:

$$\lim_{x\to 3}\left(\frac{4x^2-21x+27}{9+x^2}\right)$$

24. Evaluate:

$$\lim_{x\to 2}\left(\frac{x-2}{x^3-8}\right)$$

25. Evaluate:

$$\lim_{x\to-\infty}(e^{x-1}+2)$$

26. Evaluate:

$$\lim_{x\to\infty}\left(\frac{2x+1}{3-5x+x^2}\right)$$

27. Evaluate:

$$\lim_{x\to 2}(4x^2-3x+1)$$

28. Evaluate:

$$\lim_{x\to\infty}\left(\frac{3x^2+2x+1}{2-x^2}\right)$$

29. Evaluate:

$$\lim_{x\to 1}\left(\frac{3x^2-2x-1}{1-x^4}\right)$$

30. Evaluate:

$$\lim_{x\to-\infty}\left(\frac{5x^3+x}{7-2x}\right)$$

31. Evaluate:

$$\lim_{x\to\infty}(2^{x+1}-3)$$

32. Evaluate:

$$\lim_{x\to 13}\left(\frac{\sqrt{x-4}-3}{x-13}\right)$$

33. Evaluate:

$$\lim_{x\to 2}\frac{x+1}{(x-2)^2}$$

34. Evaluate:

$$\lim_{x\to 2}\left(\frac{\frac{x-2}{x+3}}{x^3-2x^2+4x-8}\right)$$

35. Evaluate:

$$\lim_{h\to 0}\frac{\frac{1}{2+h}-\frac{1}{4}}{x}$$

36. Evaluate:

$$\lim_{x\to -\infty}(3x^2-3x^5)$$

37. Evaluate:

$$\lim_{x\to \infty}(3x^2-3x^5)$$

38. Evaluate:

$$\lim_{x\to \infty}\left(\frac{x^2-4x+4}{x^2-4}\right)$$

39. Evaluate:

$$\lim_{x\to 2}\left(\frac{x^2-4x+4}{x^2-4}\right)$$

40. Evaluate:

$$\lim_{x\to -2}\left(\frac{x^2-4x+4}{x^2-4}\right)$$

41. What does the limit in # 35 represent?

Directions: Complete each derivative rule in the space provided

42. $\frac{d}{dx}\,K =$ _____

43. $\frac{d}{dx}\,x^n =$ _____

44. $\frac{d}{dx}\,Kf(x) =$ _____

45. $\frac{d}{dx}f(x)\pm g(x) =$ _____

46. $\frac{d}{dx}f(x)g(x) =$ _____

47. $\frac{d}{dx}\,\frac{T(x)}{B(x)} =$ _____

48. $\frac{d}{dx}\,[f(x)]^n =$ _____

49. $\frac{d}{dx}\ln x =$ _____

50. $\frac{d}{dx}e^x =$ _____

51. $\frac{d}{dx}[\ln f(x)] =$ _____

52. $\frac{d}{dx}e^{f(x)} =$ _____

53. $\frac{d}{dx}\log_b f(x) =$ _____

54. $\frac{d}{dx}b^{f(x)} =$ _____

55. Find $g'(x)$ if $g(x)=7e^2+\pi-3$. What is the slope of the tangent line at $x=1$?

56. Find $h'(x)$ if $h(x)=(3x-5)^2$. What is the instantaneous rate of change at $x=-2$?

57. Find $h'(x)$ if $h(x)=\sqrt{11x}$. What is the slope of the graph at $x=11$?

58. Find $d'(x)$ if $d(x)=\frac{3x^3-2x+7}{x^2}$ What is the slope of the graph at $x=-1$?

59. Find $r'(x)$ if $r(x)=\sqrt[3]{\left(\frac{2}{x}-\frac{\sqrt[4]{x}}{2}\right)}$

60. Find $f'(x)$ if $f(x)=\frac{3}{(6x^7+5x^3+7x)^4}$

61. Find $f'(x)$ if $f(x)=\left(\frac{3}{2x}+\frac{x}{3}\right)\sqrt{x^3+5x}$

62. Find $f'(x)$ if $f(x)=\frac{3}{5x}+\frac{2x^2}{7}+e^3+x^e$

63. Find $f'(x)$ if $f(x) = \left(\frac{1-3x}{2x^2+7x}\right)\left(\frac{x+5}{2x}\right)$

64. Find $p'(x)$ if $p(x) = \sqrt{5-5x^2}\left(\frac{6+x^2}{2x-6x^3}\right)$

65. Find $h'(x)$ if $h(x) = \frac{\frac{1}{2x}+5\sqrt[3]{x}}{8x-7}$

66. Find $r'(x)$ if $r(x) = \left(\frac{1-\sqrt{x}}{x^2+\frac{x^2}{3}}\right)\left(\frac{2e+3}{\pi x}\right)$

67. Find $h'(x)$ if $h(x) = \left(\frac{6ex+x^2-x}{\sqrt[3]{x^2}-3x^3}\right)^4$

68. Find $f'(x)$ if $f(x) = \left[\left(\frac{1}{2x}+3x^4\right)\left(\sqrt[5]{x^3}+x^5-x^{-4}\right)\right]^5$

69. Find $g'(x)$ if $g(x) = \sqrt[3]{\ln(2x^2+3)^5}$

70. Find $r'(x)$ if $r(x) = \log\frac{x^3-7}{10^{2x}}$

71. Find $v'(x)$ if $v(x) = \sqrt{\ln\left(\frac{\frac{x}{5}+\frac{2}{x}}{3xe^x}\right)}$

72. Find $d'(x)$ if $d(x) = \log_2\left(7^{\sqrt[3]{x}-x\ln x}\right)$

73. Find $f'(x)$ if $f(x) = \frac{\log_4(x^2-7x)}{\log_4(e^{3x}+\sqrt{e})}$

74. Find $g'(x)$ if $g(x) = \frac{3}{\ln\left(\frac{3}{2x}-3^x\right)^3}$

75. Find $k'(x)$ if $k(x) = \log 3 - 2\ln\frac{3}{\sqrt{x}} + (\ln x)^5$

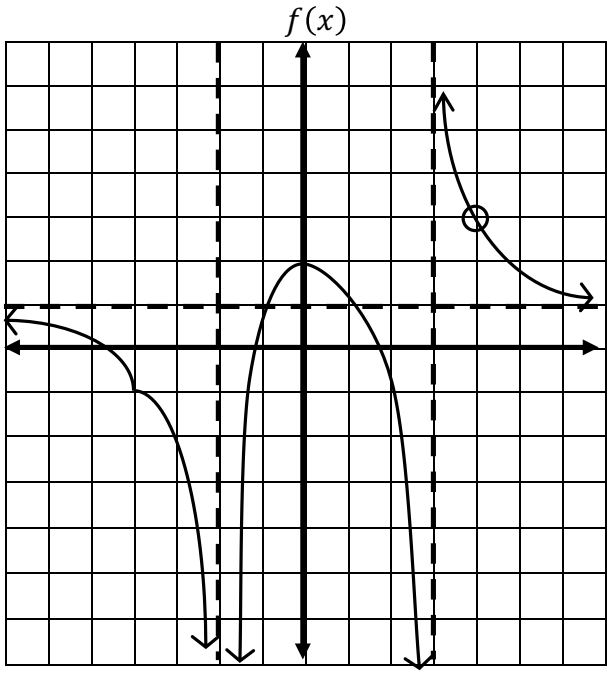
76. Find $h'(x)$ if $h(x) = \log\sqrt{\ln(4x^{-5}+5^{2x})^3}$

77. Find $f'(x)$ if $f(x) = \sqrt[3]{\frac{x}{(5x-3)^2}}$

78. Find $g'(x)$ if $g(x) = \frac{x\left(2^{x^2-4x}\right)}{\log(3xe^x)}$

79. Find $f'(x)$ if $f(x) = 2x(10-3x)^4(\ln 3x^2 - e^{2-x})$

Directions: Use the graph of $f(x)$ to the right to answer #80-100.



80. $f'(0) =$ _____

81. $f'(-4) =$ _____

82. $f(4) =$ _____

83. $f'(3) =$ _____

84. $f'(4) =$ _____

85. $\lim_{x\to-\infty} f(x) =$ _____

86. $\lim_{x\to\infty} f(x) =$ _____

87. $\lim_{x\to3^+} f(x) =$ _____

88. $\lim_{x\to-2} f(x) =$ _____

89. $\lim_{x\to4} f(x) =$ _____

90. $\lim_{x\to-4} f(x) =$ _____

91. $\lim_{x\to0} f(x) =$ _____

92. Where is $f(x)$ discontinuous (list the x-values)? _____

93. Where is $f(x)$ non-differentiable (list the x-values)? _____

94. Use the definition of a derivative **(DO IT THE LONG WAY!)** to find $f'(x)$ given $f(x) = \sqrt{x} - 1$

95. Use the definition of a derivative **(DO IT THE LONG WAY!)** to find $f'(x)$ given $f(x) = 2x - x^2$

96. Use the definition of a derivative **(DO IT THE LONG WAY!)** to find $f'(x)$ given $f(x) = 3x + 5$

97. Use the definition of a derivative **(DO IT THE LONG WAY!)** to find $f'(x)$ given $f(x) = 2x^2$

98. Use the definition of a derivative **(DO IT THE LONG WAY!)** to find $f'(x)$ given $f(x) = 18$

99. Use the definition of a derivative **(DO IT THE LONG WAY!)** to find $f'(x)$ given $f(x) = \frac{2x}{x+5}$

100. Use the definition of a derivative **(DO IT THE LONG WAY!)** to find $f'(x)$ given $f(x) = x^3 - x^2 + 5x - 8$

101. Evaluate:
$$\lim_{x\to -\frac{3\pi}{4}}[(\csc x)(\tan x)]$$

102. Evaluate:
$$\lim_{x\to 0}\left(\frac{\tan^2 x}{x}\right)$$

103. Evaluate:
$$\lim_{x\to 0}\left(\frac{x^2}{\sin^2 x}\right)$$

104. Evaluate:
$$\lim_{x\to \frac{\pi}{4}}\left(\frac{\sec^2 x-\csc^2 x}{\tan x-1}\right)$$

105. Evaluate:
$$\lim_{x\to \frac{\pi}{4}^+}\left(\frac{\sin^2 x}{\cos(2x)}\right)$$

106. Evaluate:
$$\lim_{x\to \frac{\pi}{2}}\left(\frac{\cos(2x)+\sin^2 x}{\csc^2 x-1}\right)$$

107. Evaluate:
$$\lim_{x\to 2}\left(\frac{\sin(x-2)}{x^2+2x-8}\right)$$

108. Evaluate:
$$\lim_{x\to \pi}(\sec x)$$

109. Evaluate:
$$\lim_{x\to \pi}[(\cos^2 x-1)(\csc^2 x)]$$

110. Evaluate:
$$\lim_{x\to \pi}\left(\frac{\tan\frac{x}{2}}{\cot(-x)}\right)$$

111. Evaluate:
$$\lim_{x\to 0}\left(\frac{\csc 8x}{\csc 4x}\right)$$

112. Evaluate:
$$\lim_{x\to \frac{\pi}{2}^-}(\tan x-\sec x)$$

113. Evaluate:
$$\lim_{x\to \frac{\pi}{16}}\left[(\csc 4x)\left(\cot\left(\frac{8x}{3}-\frac{\pi}{3}\right)\right)\right]$$

114. Evaluate:
$$\lim_{x\to 0}\left(\frac{\sin^2 x}{1-\sec^2 x}\right)$$

115. Evaluate:
$$\lim_{x\to 0}\left(\frac{\sin^2 x+\cos x-1}{x}\right)$$

116. Evaluate:
$$\lim_{x\to 0}\left(\frac{1-\cos^2 x}{x}\right)$$

117. Evaluate:
$$\lim_{x\to 0}\left(\frac{\sin x+\cos x}{x^2}\right)$$

118. Evaluate:
$$\lim_{x\to \frac{\pi}{4}}\left(\frac{\sin^2 x-\cos^2 x}{\tan^2 x-1}\right)$$