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**Part B: Multiple Choice**

**INSTRUCTIONS:** Choose the best answer to each of the following questions. Fill in the appropriate circle on the scantron sheet with a pencil **AND** circle your answer in the booklet. You may keep this booklet when the exam concludes. There are 13 multiple choice problems.

1. Evaluate the following limit:

$$\lim_{x \rightarrow 7} \frac{x + 7}{(x - 7)^2}.$$

(a)  $\infty$  \*\*\*

(b)  $\frac{1}{14}$

(c) 14

(d)  $-\infty$

(e) 0

2. For which value(s) of the constant  $k$  will the function  $f(x) = \frac{(x + 8)(x - k)}{(x - 9)^2(x + 2)}$  have **exactly one** vertical asymptote (i.e., infinite discontinuity)?

(a) There are no such values of  $k$ .

(b)  $k = -8$  only

(c)  $k = -2$  only \*\*\*

(d)  $k = 9$  or  $k = -2$

(e)  $k = 9$  only

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3. Evaluate the following limit:

$$\lim_{x \rightarrow -2} \frac{|4x + 3| - 5}{x + 2}.$$

(a) 0

(b)  $-4^{***}$

(c) 2

(d)  $\frac{3}{2}$

(e)  $\infty$

4. Which of the following statements is **FALSE**?

(a)  $\lim_{x \rightarrow \infty} \frac{1}{x^2} = 0$

(b)  $\lim_{x \rightarrow -\infty} \frac{1}{(x - 4)^3} = 0$

(c)  $\lim_{x \rightarrow \infty} \frac{1}{(x - 4)^6} = 0$

(d)  $\lim_{x \rightarrow -\infty} \frac{x}{\sqrt{9x^2 + 4}} = \frac{1}{3}^{***}$

(e)  $\lim_{x \rightarrow \infty} \frac{x}{\sqrt{9x^2 + 4}} = \frac{1}{3}$

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5. Consider  $h(x) = \sin(x^2) + \frac{2}{x}$ . Which of the following is equal to  $h'(x)$ ?

(a)  $\cos(x^2) - 2$

(b)  $2x \cos(x^2) - \frac{2}{x^2}$  \*\*\*

(c)  $2 \cos(x^2) + \frac{2-x}{x^2}$

(d)  $2x \cos(x) + 2 \ln(x)$

(e)  $\cos(2x) - \frac{2}{x^2}$

6. Let

$$f(x) = \frac{e^x}{\ln(x)}.$$

Which of the following equals  $f'(x)$ ?

(a)  $e^x \ln(x) + \frac{e^x}{x}$

(b)  $xe^x$

(c)  $\frac{e^x \ln(x) - \frac{e^x}{x}}{(\ln(x))^2}$  \*\*\*

(d)  $xe^{x-1} \ln(x) + \frac{e^x}{x}$

(e)  $\frac{xe^{x-1} \ln(x) - \frac{e^x}{x}}{\ln(x)}$

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7. Let  $f(x)$  be a function that is differentiable for all values of  $x$ . The equation of the tangent line of  $f$  at the point  $x = 2$  is  $y = 4x - 1$ . Which of the following statements is **TRUE**?

(a)  $f(2) = 7$  and  $f'(2) = 4$  \*\*\*

(b)  $f(2) = -1$  and  $f'(2) = 4$

(c)  $f(2) = 4$  and  $f'(2) = -1$

(d)  $f(2) = 4$  and  $f'(2) = 7$

(e) There is not enough information given to determine the values of  $f(2)$  and  $f'(2)$ .

8. Suppose  $f(x)$  is continuous for all values of  $x$  and

$$f(1) = 1, \quad f(3) = 4, \quad f(5) = -7, \quad \text{and} \quad f(7) = -1.$$

On which of the following intervals does the Intermediate Value Theorem guarantee that there exists a number  $c$  such that  $f(c) = 0$ ?

(a)  $(4, 7)$

(b)  $(-7, 4)$

(c)  $(1, 4)$

(d)  $(3, 5)$  \*\*\*

(e)  $(5, 7)$

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9. Let  $a$  be a constant and let  $f(x)$  be a function with domain  $(-\infty, \infty)$ . Assume that  $f$  satisfies

$$\lim_{x \rightarrow 2^-} \frac{f(x) - f(2)}{x - 2} = 8 + a, \quad \text{and} \quad \lim_{x \rightarrow 2^+} \frac{f(x) - f(2)}{x - 2} = 5. \quad (1)$$

Which of the following statements is **TRUE**?

- (a) If  $a = -3$ , then  $f'(2) = 5$ .\*\*\*
- (b) If  $a = -3$ , then  $f'(x) = 5$  for all values of  $x$ .
- (c) If  $a \neq -3$ , then  $f$  is not continuous at  $x = 2$ .
- (d)  $f'(2)$  does not exist for all values of  $a$ .
- (e)  $f'(2) = \frac{a + 8}{5}$ .

10. Consider the function

$$f(x) = \begin{cases} \frac{(x+1)(x+3)}{(x-2)(x+1)} & \text{if } x \geq -3 \\ 0 & \text{if } x < -3. \end{cases}$$

Which of the following statements is **FALSE**?

- (a)  $f$  has a removable discontinuity at  $x = -1$
- (b)  $f$  has an infinite discontinuity at  $x = 2$
- (c)  $f$  is continuous at  $x = 3$
- (d)  $f$  has a jump discontinuity at  $x = -3$  \*\*\*
- (e) For every number  $N$  such that  $f(1) < N < f(0)$ , there exists a number  $c$  in the interval  $(0, 1)$  such that  $f(c) = N$ .

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11. What is the slope of the tangent line to the curve  $x^3 + 6xy + 2y^2 = 21$  at the point  $(1, 2)$ ?

- (a)  $-\frac{11}{12}$
- (b)  $\frac{9}{14}$
- (c)  $\frac{11}{15}$
- (d) 0
- (e)  $-\frac{15}{14}$  \*\*\*

12. Let  $f(x) = \pi^2 + 2^x + x^2 + x^x$ . Which of the following is the derivative of  $f(x)$ ?

- (a)  $2\pi + \ln(2)2^x + 2x + xx^{x-1}$
- (b)  $\pi^2 + \ln(2)2^x + 2x + x^x$
- (c)  $2^x + 2x + \ln(x)x^x + x^x$
- (d)  $2^x + 2x + \ln(x)x^x$
- (e)  $\ln(2)2^x + 2x + \ln(x)x^x + x^x$  \*\*\*

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13. Consider  $f(x) = e^{x^2}$  on the domain  $[0, \infty)$ . Which of the following is equal to  $(f^{-1})'(e^4)$ ?

(a)  $\frac{1}{4e^4}$  \*\*\*

(b)  $8e^{16}$

(c)  $\frac{1}{(e^{-4})(2xe^{x^2})}$

(d)  $\frac{1}{8e^{16}}$

(e)  $(f^{-1})'(e^4)$  does not exist.

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