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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:

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

   (a) $-\infty$ ***

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

   (c) 14

   (d) 0

   (e) ∞

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

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

   (b) $k = -2$ only

   (c) $k = 9$ only ***

   (d) There are no such values of k.

   (e) $k = -8$ only

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3. Evaluate the following limit:

$$\lim_{x\to -2} \frac{|-2x-8|-4}{x+2}.$$

(a) -4

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

(c) 0

(d) ∞

(e) 2 ***

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

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

(b) $\lim_{x\to \infty} \frac{1}{x^2} = 0$

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

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

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

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5. Consider $h(x) = \frac{1}{2}\sin(2x) + \frac{2}{x}$. Which of the following is equal to $h'(x)$?

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

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

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

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

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

6. Let

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

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

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

   (b) xe^x

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

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

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

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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 $y = 5x - 4$. Which of the following statements is **TRUE**?

   (a) $f(2) = 6$ and $f'(2) = 5$ ***

   (b) $f(2) = 5$ and $f'(2) = 6$

   (c) $f(2) = 5$ and $f'(2) = -4$

   (d) $f(2) = -4$ and $f'(2) = 5$

   (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

$$f(1) = 1,\ f(3) = 4,\ f(5) = 6,\ \text{and } f(7) = -1.$$

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

   (a) $(1, 4)$

   (b) $(3, 5)$

   (c) $(5, 7)$ ***

   (d) $(1, 6)$

   (e) $(-1, 6)$

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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

$$\lim_{x\to 2^-} \frac{f(x)-f(2)}{x-2} = 4+a, \quad \text{and} \quad \lim_{x\to 2^+} \frac{f(x)-f(2)}{x-2} = 9. \tag{1}$$

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

(a) $f'(2) = \dfrac{a+4}{9}$.

(b) If $a = 5$, then $f'(x) = 9$ for all values of x.

(c) $f'(2)$ does not exist for all values of a.

(d) If $a \neq 5$, then f is not continuous at $x = 2$.

(e) If $a = 5$, then $f'(2) = 9$.***

10. Consider the function

$$f(x) = \begin{cases} \dfrac{(x+2)(x+3)}{(x-2)(x+1)} & \text{if } x \geq -3 \\ 5 & \text{if } x < -3. \end{cases}$$

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

(a) f has an infinite discontinuity at $x = 2$

(b) f has a removable discontinuity at $x = -1$ ***

(c) f has a jump discontinuity at $x = -3$

(d) f is continuous 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 $x^3 + 4xy + 2y^2 = 17$ at the point $(1, 2)$?

(a) 0

(b) $\frac{9}{14}$

(c) $\frac{11}{15}$

(d) $-\frac{11}{12}$ ***

(e) $-\frac{15}{14}$

12. Let $f(x) = e^3 + x^x + x^3 + 3^x$. Which of the following is the derivative of $f(x)$?

(a) $3^x + 3x^2 + \ln(x)x^x$

(b) $3^x + 3x^2 + \ln(x)x^x + x^x$

(c) $3e^2 + \ln(3)3^x + 3x^2 + xx^{x-1}$

(d) $3^x \ln(3) + 3x^2 + x^x(\ln(x) + 1)$ ***

(e) $e^3 + \ln(3)3^x + 3x^2 + x^x$

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13. Consider $f(x) = e^{x^2}$ on the domain $[0, \infty)$. Which of the following is equal to $(f^{-1})'(e^{16})$?

(a) $\dfrac{1}{(e^{-16})(2xe^{x^2})}$

(b) $\dfrac{1}{8e^{16}}$ ***

(c) $4e^4$

(d) $\dfrac{1}{4e^4}$

(e) $(f^{-1})'(e^{16})$ does not exist.

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