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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) 14

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

(c) $-\infty$

(d) 0

(e) ∞***

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

(a) $k = -2$ only ***

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

(c) $k = -8$ only

(d) $k = 9$ only

(e) There are no such values of k.

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3. Evaluate the following limit:

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

(a) 0

(b) ∞

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

(d) -4***

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

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

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

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

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

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

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

   (d) $2\cos(x^2) + \dfrac{2-x}{x^2}$

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

6. Let

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

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

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

   (b) $\dfrac{e^x\ln(x) - \dfrac{e^x}{x}}{(\ln(x))^2}$ ***

   (c) xe^x

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

   (e) $e^x\ln(x) + \dfrac{e^x}{x}$

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

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

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

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

   (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

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

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

   (a) $(3, 5)$ ***

   (b) $(5, 7)$

   (c) $(4, 7)$

   (d) $(1, 4)$

   (e) $(-7, 4)$

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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

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

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

(a) $f'(2) = \dfrac{a+8}{5}$.

(b) If $a \neq -3$, then f is not continuous at $x = 2$.

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

(d) If $a = -3$, then $f'(2) = 5$.***

(e) If $a = -3$, then $f'(x) = 5$ for all values of x.

10. Consider the function

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

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

(a) f is continuous at $x = 3$

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

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

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

(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) 0

    (b) $-\frac{11}{12}$

    (c) $-\frac{15}{14}$***

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

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

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

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

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

    (c) $\ln(2)2^x + 2x + \ln(x)x^x + x^x$ ***

    (d) $2\pi + \ln(2)2^x + 2x + xx^{x-1}$

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

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

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

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

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

(e) $8e^{16}$

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