AP Calculus AB

Unit #3 Practice – AP Multiple-Choice

Part 1: Review of Limits & Continuity (non-calculator)

1. $\lim_{x\to 2} \frac{x^2-4}{x^2+4}$ is (A) 1 (B) 0 (C) -1/2 (D) -1 (E) ∞

2. $\lim_{x\to \infty} \frac{2^{-x}}{2^x}$ is (A) -1 (B) 1 (C) 0 (D) ∞ (E) none of these

3. The graph of $y = \frac{x^2-9}{3x-9}$ has
   (A) a vertical asymptote at x = 3
   (B) a horizontal asymptote at y = 1/3
   (C) a removable discontinuity at x = 3
   (D) an infinite discontinuity at x = 3
   (E) none of these

4. $\lim_{x\to 0} sin\left(\frac{1}{x}\right)$ is
   (A) ∞ (B) 1 (C) DNE (D) -1 (E) none of these

Part 2a: Differentiation Rules (non-calculator)

Find the derivative of each function below:

5. $y = \frac{2}{(5x+1)^3}$
   (A) $-\frac{30}{(5x+1)^2}$ (B) $-\frac{30}{(5x+1)^4}$ (C) $-\frac{6}{(5x+1)^4}$
   (D) $-\frac{10}{3(5x+1)^{-4/3}}$ (E) $\frac{30}{(5x+1)^4}$

6. $y = \frac{x^2}{\cos(x)}$
   (A) $\frac{2x}{\sin(x)}$ (B) $-\frac{2x}{\sin(x)}$ (C) $\frac{2x\cos(x)-x^2\sin(x)}{\cos^2(x)}$
   (D) $\frac{2x\cos(x)+x^2\sin(x)}{\cos^2(x)}$ (E) $\frac{2x\cos(x)-x^2\sin(x)}{\sin^2(x)}$

7. $y = ln\left(\frac{e^x}{e^x-1}\right)$
   (A) $x - \frac{e^x}{e^x-1}$ (B) $\frac{1}{e^x-1}$ (C) $-\frac{1}{e^x-1}$
   (D) 0 (E) $\frac{e^x-2}{e^x-1}$

8. $y = tan^{-1}\left(\frac{x}{2}\right)$
   (A) $\frac{4}{x^2+4}$ (B) $\frac{1}{2\sqrt{4-x^2}}$ (C) $\frac{1}{\sqrt{4-x^2}}$
   (D) $\frac{1}{2+x^2}$ (E) $\frac{2}{x^2+4}$

9. The equation of the tangent line to the curve $y = x\sin(x)$ at the point $(\pi/2, \pi/2)$ is
(A) $y = x - \pi$ (B) $y = \pi/2$ (C) $y = \pi - x$ (D) $y = x + \pi/2$ (E) $y = x$

Part 2b: Differentiation Rules (calculator)

10. At how many points on the interval $[-5, 5]$ is a tangent line to $y = x + \cos(x)$ parallel to the secant line?
(A) none (B) 1 (C) 2 (D) 3 (E) more than 3

11. Let $f(x) = 3^x - x^3$. The tangent to the curve is parallel to the secant through (0, 1) and (3, 0) for x =
(A) 0.984 only (B) 1.244 only (C) 2.727 only
(D) 0.984 and 2.804 only (E) 1.244 and 2.727 only

Part 3: Curve Skecthing (non-calculator)

12. The minimum value of the slope of the curve $y = x^5 + x^3 - 2x$ is
(A) 0 (B) 2 (C) 6 (D) -2 (E) none of these

13. The number of inflection points of the curve in Question 12 is
(A) 0 (B) 1 (C) 2 (D) 3 (E) 4

14. The function $f(x) = x^4 - 4x^2$ has
(A) one relative minimum and two relative maxima
(B) one relative minimum and one relative maximum
(C) two relative minima and no relative minimum
(D) two relative minima and no relative maximum
(E) two relative minima and one relative maximum

15. The maximum value of the function $y = -4(2 - x)^{1/2}$ is
(A) 0 (B) -4 (C) 2 (D) -2 (E) none of these

16. The total number of maximum and minimum points of the function whose derivative, for all x, is given by $f'(x) = x(x - 3)^2(x + 1)^4$ is
(A) 0 (B) 1 (C) 2 (D) 3 (E) none of these

17. If $f(x) = xe^{-x}$, then at x = 0
(A) f is increasing (B) f is decreasing (C) f has a relative maximum
(D) f has a relative minimum (E) f' does not exits

18. A function f has a derivative for each x such that $|x| < 2$ and has a local minimum at (2, -5). Which statement below must be true?
(A) $f'(2) = 0$ (B) f' exist at x = 2 (C) concave up at x = 2
(D) $f'(x) < 0$ if $x < 2$, $f'(x) > 0$ if $x > 2$ (E) none of these are necessarily true

19. If $f(x) = ax^4 + bx^2$ and $ab > 0$, then
(A) the curve has no horizontal tangents
(B) the curve is concave up for all x
(C) the curve is concave down for all x
(D) the curve has no inflection point
(E) none of the preceding is necessarily true