

AP Calculus TEST: 2.1-2.5 NO CALCULATOR

Part I: SHORT ANSWER (ALL WORK MUST BE SHOWN FOR CREDIT. ANY CORRECT ANSWER IN THE ABSENCE OF SUPPORTING WORK WILL BE COUNTED INCORRECT! **GIVE SIMPLIFIED, EXACT ANSWERS!**)

1. If $f(x) = (3x^2 - 4x - 1)\tan x$, then $f'(0) =$

2. If $f(x) = 3x^{1/3}(2x+1)$, find the values of x for which f is differentiable, that is, find the domain of $f'(x)$. Be sure to show your computation of $f'(x)$ and analysis.

3. If $f(x) = e + \pi x$, then $f'(\sqrt{2}) =$

4. The following limit gives $f'(c)$ for some function $f(x)$ at some $x = c$. Identify $f(x)$, $x = c$, then

find $f'(x)$, and finally $f'(c)$.

$$\lim_{h \rightarrow 0} \frac{3 \csc\left(\frac{\pi}{2} + h\right) - 3}{h} =$$

5. If $f(x) = \sqrt[3]{3x}$, then $f'(\sqrt{3}) =$

6. Let $f(x) = \begin{cases} cx + d, & x \leq 2 \\ x^2 - cx, & x > 2 \end{cases}$, where c and d are constants. If f is differentiable at $x = 2$, what is the value of $c + d$?

7. A particle moves along the x -axis so that at time $t \geq 0$ its position is given by $x(t) = 2t^3 - 21t^2 + 72t - 53$. At what time t is the particle at rest?

8. If $f(x) = (2x - 1) \left(\frac{x^2 - 2}{5x - 7} \right)$, then $f'(0) =$

Part II: FREE RESPONSE (SHOW ALL SET-UPS. INCLUDE UNITS IN ALL ANSWERS. NOTATION, NOTATION, NOTATION. WORK ALL QUESTIONS IN THE SPACE BELOW EACH QUESTION.)

9. A particle moves along a vertical number line and has a position equation for $t \geq 0$ of $y(t) = (3t - 1)(t - 3)$ with $y(t)$ measured in feet and t measured in seconds.

(a) What is the initial position of the particle?

(b) When is the first time the particle is at $y = 0$ on the number line?

(c) What is the particle's displacement on the interval from $t = 0$ to $t = 1$ seconds? Explain what this answer means in terms of the particle's starting position.

(d) What is the particle's average velocity on the interval from $t = 0$ to $t = 1$ seconds?

- (e) What is the particle's velocity $t = 1$ seconds? Explain what this means in terms of the direction and speed of the particle.
- (f) What is the particle's acceleration at $t = 1$ seconds? Explain what this means in terms of the velocity of the particle.
- (g) At what time does the particle change direction? Justify.
- (h) At $t = 1$ seconds, is the speed of the particle increasing or decreasing? Justify.