AP Calculus – How to Navigate FRQs

Name: Key

Particle Motion

When I am asked to find/do this... (question being asked)	I'm going to use... (strategy/equation/formula)
Given the position function, find the velocity function.	$v(t) = x'(t)$
Given the position function, find the acceleration function.	$a(t) = x''(t) = v'(t)$
Given the position function, find the total distance traveled	$v(t) = 0$ t = crit values → t | $x(t)$ find abs value of change in position (add)
Given the velocity function, find the total distance traveled	$\int_a^b \lvert v(t) \rvert dt$
Given the position function, find the displacement of the particle	$x(b) - x(a)$
Given the velocity function, find the displacement of the particle	$\int_a^b v(t)dt$
When is the particle speeding up/slowing down?	speed up $v(t), a(t)$ same signs slow down $v(t), a(t)$ dif signs
When is the particle moving to the left/right?	$v(t)$ pos → right $v(t)$ neg → left
When is the particle at rest?	$v(t) = 0$

Given the position function, find the average velocity	$\frac{x(b)-x(a)}{b-a}$
Given the velocity function, find the average velocity	$\frac{\int_a^b v(t)dt}{b-a}$
Given the velocity function, find the average acceleration	$\frac{v(b)-v(a)}{b-a}$
Given the acceleration function, find the average acceleration	$\frac{\int_a^b a(t)dt}{b-a}$
When does the particle change direction?	$v(t) = 0$ and $v(t)$ changes signs
Find position of a particle given velocity and an initial position value	$x(b) = x(a) + \int_a^b v(t)dt$
Find the position of the particle at the time it changes direction	$v(t) = 0$ $t = A$ $\quad x(A) =$
Given the position function, at what time is the average velocity equal to the instantaneous velocity?	$\frac{x(b)-x(a)}{b-a} = x'(t)$

Function Behavior

When I am asked to find/do this... (question being asked)	I will justify with this reason... (precise & concise)
Given f(x), find the relative extrema $f'(x)=0$ $f'(x)$ ⟷	rel max → f'(x) goes pos to neg rel min → f'(x) goes neg to pos 2nd Der Test: f''(A)>0 ∪ min; f''(A)<0 ∩ max
Given f(x), find the absolute extrema $f'(x)=0$ $\times$ | f(x)	yields highest/lowest value of f(x) * check endpoints
Given f(x), find where the function is increasing/decreasing $f'(x)=0$ $f'(x)$ ⟷	inc → f'(x) pos dec → f'(x) neg
Given f(x), find where the function has a point of inflection $f''(x)=0$ $f''(x)$ ⟷	POI where concavity changes
Given f(x), determine intervals of concave up/concave down $f''(x)=0$ $f''(x)$ ⟷	CC↑ : f''(x) pos CC↓ : f''(x) neg
Determine if a linear approximation is an overestimate or underestimate	CC↑ below CC↓ above
Find a horizontal/vertical tangent line of f(x)	Hor: f'(x)=0 y=# Vert: where f'(x) is undefined x=#