

AP CALCULUS FREE RESPONSE: MOTION

This problem is intended to be solved **without** the use of a calculator.

Two particles move along the x-axis. For $0 \leq t \leq 6$, the position of particle M at time t is given by

$$m(t) = 2 \cos\left(\frac{\pi}{4}t\right), \text{ while the position of particle } N \text{ at time } t \text{ is given by } n(t) = t^3 - 6t^2 + 9t + 3.$$

- (a) For $0 \leq t \leq 6$, find all times t during which particle N is moving to the left. Explain your reasoning.
 - (b) For $0 \leq t \leq 6$, find all times t during which the two particles travel in the same direction. Explain your reasoning.
 - (c) Find the acceleration of particle M at time $t = 3$. Is particle M speeding up, slowing down, or doing neither at time $t = 3$? Explain your reasoning.
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