**Particle Motion Problem**
*AP Calculus*

Give yourself 15 minutes to do this problem. Practice showing clear, concise work. In part (c), remember that "explain your reasoning" means you must use words.

Two particles move along the $x$-axis. For $0 \le t \le 8$, the position of particle $P$ at time $t$ is given by

$x_P(t) = \ln\left(t^2 - 2t + 10\right)$, while the velocity of particle $Q$ at time $t$ is given by $v_Q(t) = t^2 - 8t + 15$.

Particle $Q$ is at position $x = 5$ at time $t = 0$.

(a) For $0 \le t \le 8$, when is particle $P$ moving to the left?

(b) For $0 \le t \le 8$, find all times $t$ during which the two particles travel in the same direction.

(c) Find the acceleration of particle $Q$ at time $t = 2$. Is the speed of particle $Q$ increasing, decreasing, or neither at time $t = 2$ ? Explain your reasoning.

(d) Find the position of particle $Q$ the first time it changes direction.