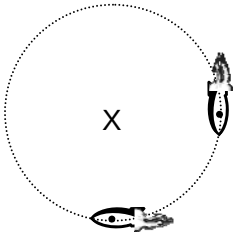
AP Physics C Name:

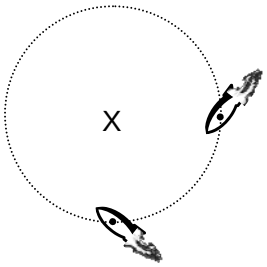
Mixed Centripetal Motion Problems

1. A craft in deep space wishes to circle point X at constant speed in a clockwise direction. Which of the following shows the correct orientation of the rocket thrust at each point? The rocket is continually firing at a constant rate throughout the spacecraft's motion.

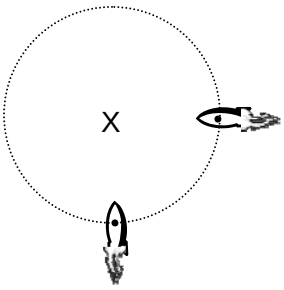
a.



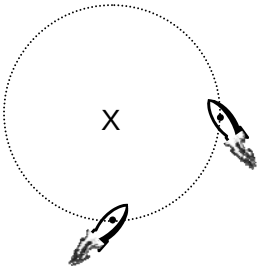
b.



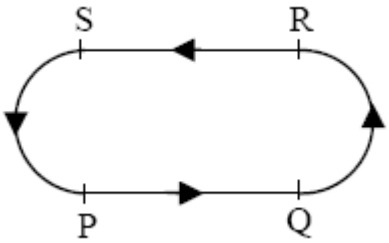
c.



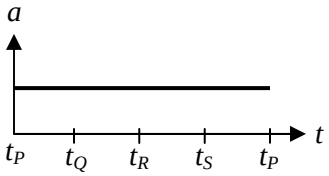
d.



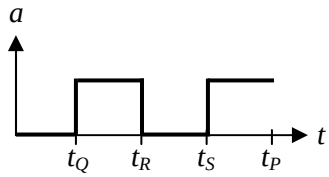
2. A figure of a dancer on a music box moves counterclockwise at constant speed around the path shown here. The path is such that the length of its segments, PQ, QR, RS, and SP, are equal. Arcs QR and SP are semicircles. Which of the following best represents the magnitude of the dancer's acceleration as a function of time *t* during one trip around the path, beginning at point P?



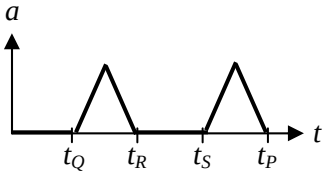
a.



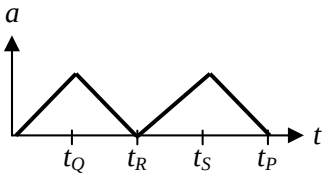
b.



c.



d.



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3. The fetching specimen shown here swings his pocket watch on a chain in a full vertical circle. The mass of the watch portion is 0.15 kg. The chain, which is 25 cm in length, can withstand a tension of 4.5 N before snapping.

   a. At which point, if any, in the motion of the watch, is the chain most likely to snap? Explain your thinking.

   b. At the position you described in part (a), what is the maximum speed the watch can go without the chain snapping?

4. A ball of clay hangs from the end of a string, rotating as a conical pendulum, as shown. Show that the length of the string (L), mass of the ball (m), angle of the pendulum with respect to vertical (θ), and *angular velocity* of the ball of clay about the vertical axis (ω) can be related by the following equation: **$\sec(\theta) = \omega^2 L/g$**