Transition: Linear to Circular

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Part 1

Questions I, II, and III refer to the following scenario:
Some object somewhere is accelerating, for some noticeable and significant amount of time.

I. During this time, the object is necessarily changing its ***velocity***.
   a. True or False?
   b. Justify your answer. If you chose "false" give a counterexample. If you chose "true" justify using ***definitions*** and/or ***laws of physics***.

II. During this time, the object is necessarily changing its ***speed***.
   a. True or False?
   b. Justify your answer. If you chose "false" give a counterexample. If you chose "true" justify using ***definitions*** and/or ***laws of physics***.

III. During such time, the object is necessarily being influenced by a ***net external force***.
   a. True or False?
   b. Justify your answer. If you chose "false" give a counterexample. If you chose "true" justify using ***definitions*** and/or ***laws of physics***.

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IV. If a force is applied to an object for a noticeable and significant period of time, then the particle's ***speed*** will change, regardless of what other forces are doing to that object.
   a. True or False?
   b. Justify your answer. If you chose "false" give a counterexample. If you chose "true" justify using ***definitions*** and/or ***laws of physics***.

V. If a force is applied to an object for a noticeable and significant period of time, then the particle's ***velocity*** will change, regardless of what other forces are doing to that object.
   a. True or False?
   b. Justify your answer. If you chose "false" give a counterexample. If you chose "true" justify using ***definitions*** and/or ***laws of physics***.

Part 2

I. A particle is moving ***due east*** at 100 m/s. A net external force causes the particle to accelerate ***due east*** at 10 m/s^2 for exactly one second. After this one second:
   a. At what speed is the particle moving?
   b. In what direction is the particle moving?

   Nothing tricky here. If this problem looks very simple, it is. If you think maybe you can do it in your head really quickly, you're probably right. If you want to use kinematics equations instead, that's fine too.

II. A particle is moving ***due east*** at 100 m/s. A net external force causes the particle to accelerate ***due west*** at 10 m/s^2 for exactly one second. After this one second:
   a. At what speed is the particle moving?
   b. In what direction is the particle moving?

   This one is also pretty simple. Just be careful with signs.

III. A particle is moving ***due east*** at 100 m/s. A net external force causes the particle to accelerate ***due north*** at 10 m/s^2 for exactly one second. After this one second:
   a. At what speed is the particle moving?
   b. In what direction is the particle moving?

Hint 1: This is a 2D kinematics problem.
Hint 2: Deal with the two axes separately—i.e. find V_x and V_y
Hint 3: Use Pythagoras to find speed.
Hint 4: Use trig to find direction.

IV. Compare the three scenarios above and try to answer the following questions:
   a. If a particle accelerates in the same direction it is moving, what happens to its velocity (speed & direction)?
   b. If a particle accelerates in the opposite direction from the one it's moving in, what happens to its velocity?
   c. If a particle accelerates in a direction perpendicular to the one it's moving in, what happens to its velocity?