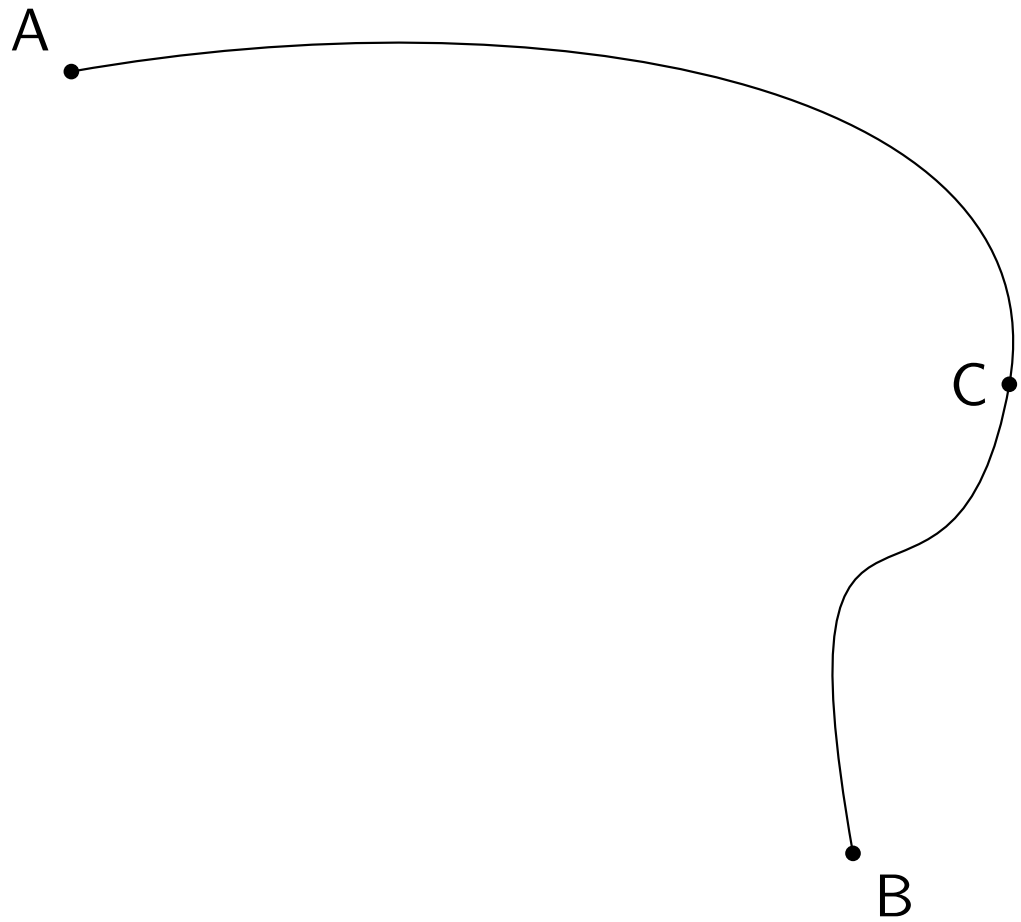
PHYS2350: Motion in 2D

Dr. Wolf

Fall 2024

Group discussion: Direction of velocity vector

Suppose you are traveling along the indicated path from point A to point B at a constant speed of $3\,\frac{\text{m}}{\text{s}}$. Which direction is the velocity at point C? How do you know?



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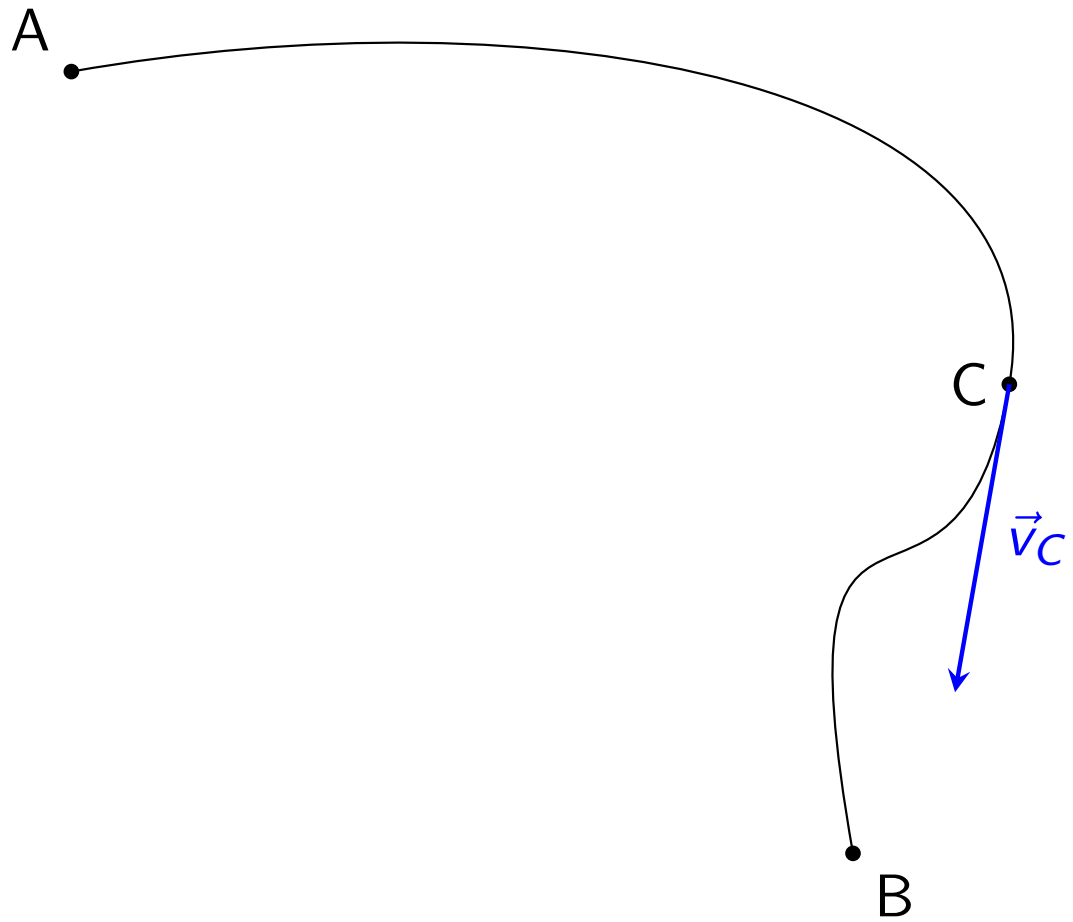

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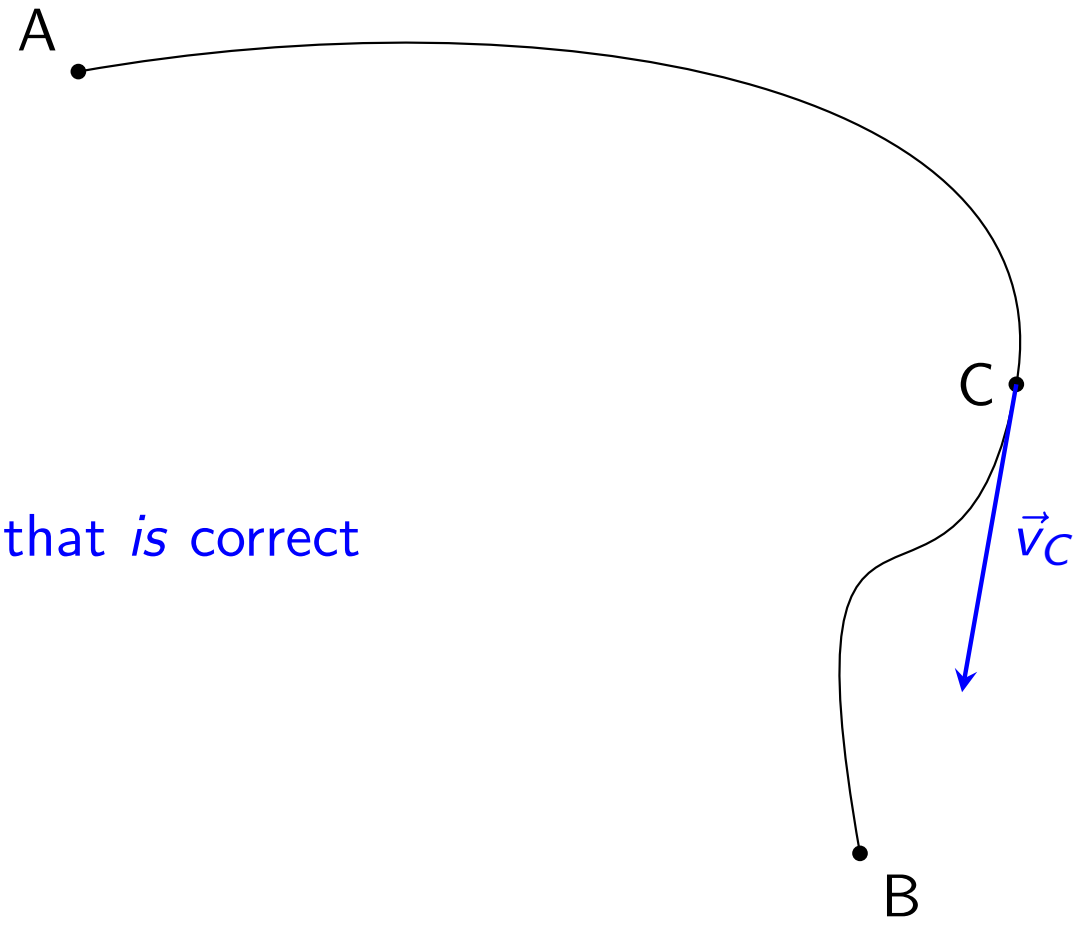

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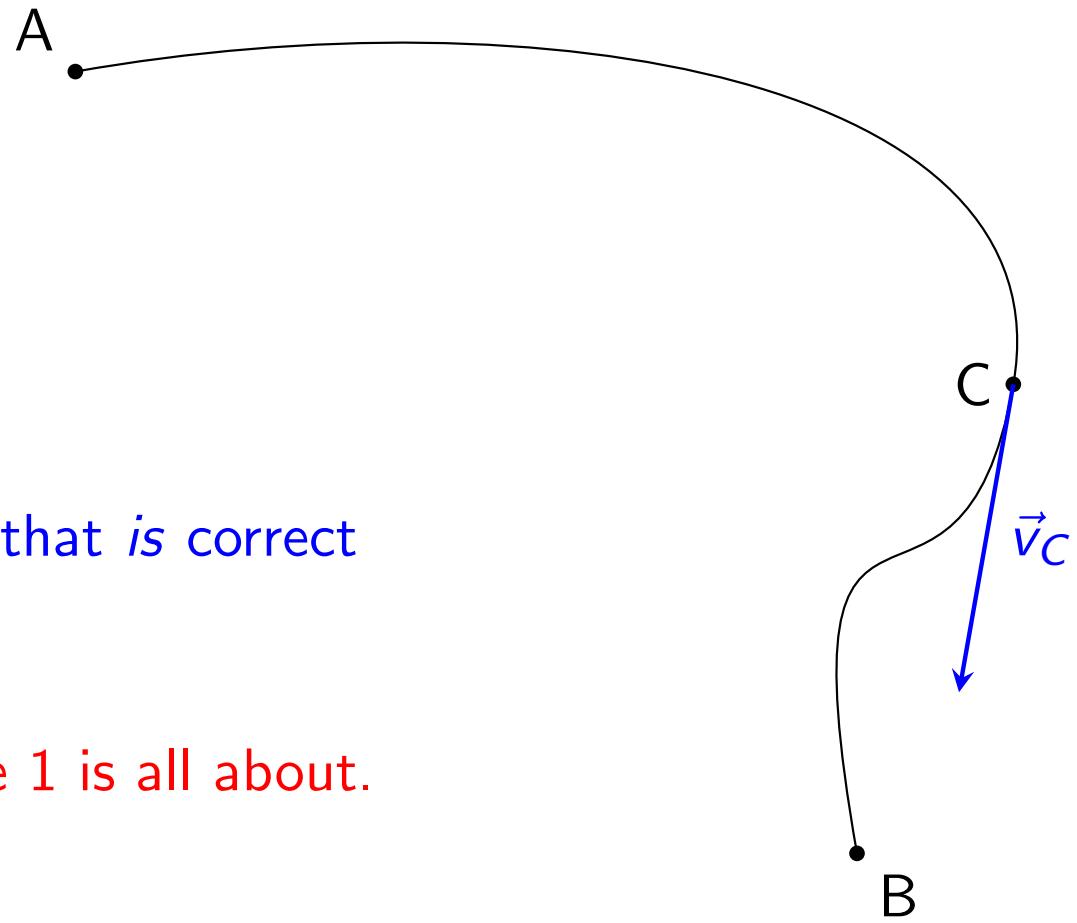

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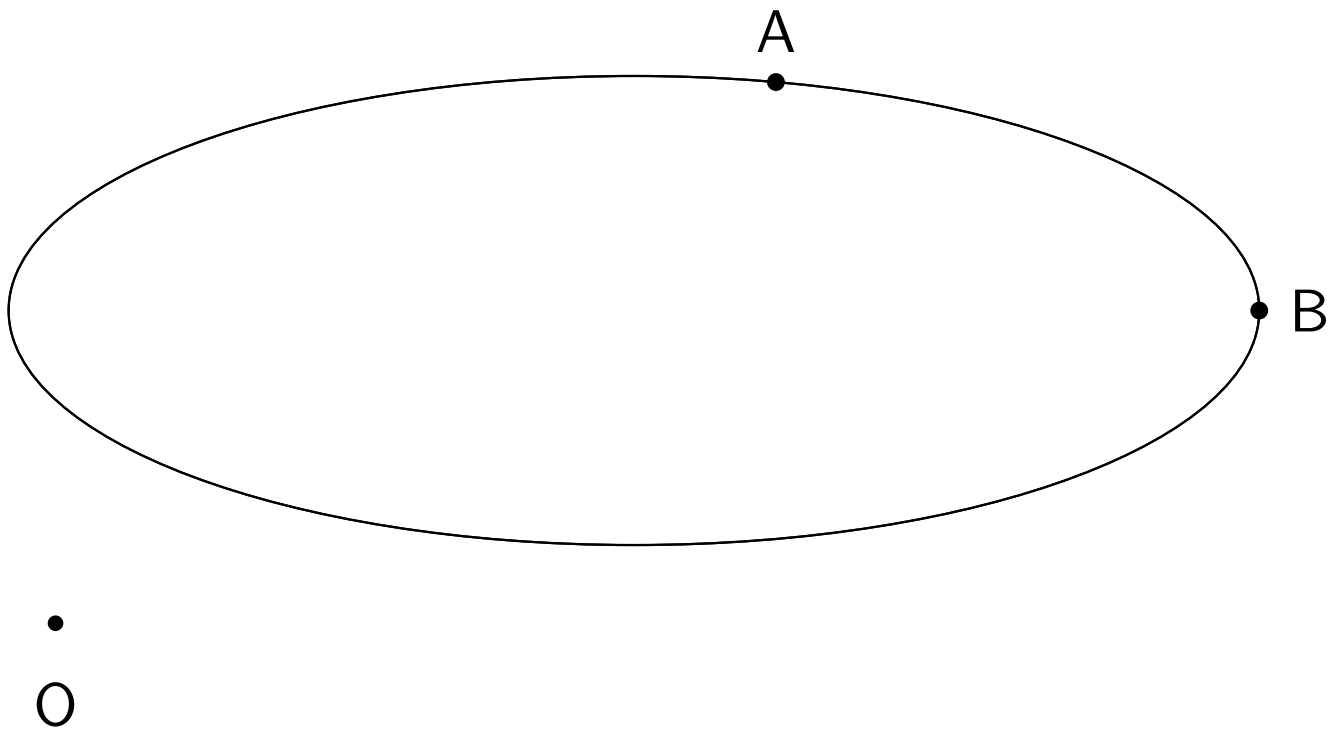
And that's what page 1 is all about.

Direction of the instantaneous velocity is tangent to the curve

Step #1 Draw $\vec{r}_A$ and $\vec{r}_B$, the position vectors for the object when it is at point A and B *relative to the origin* O.



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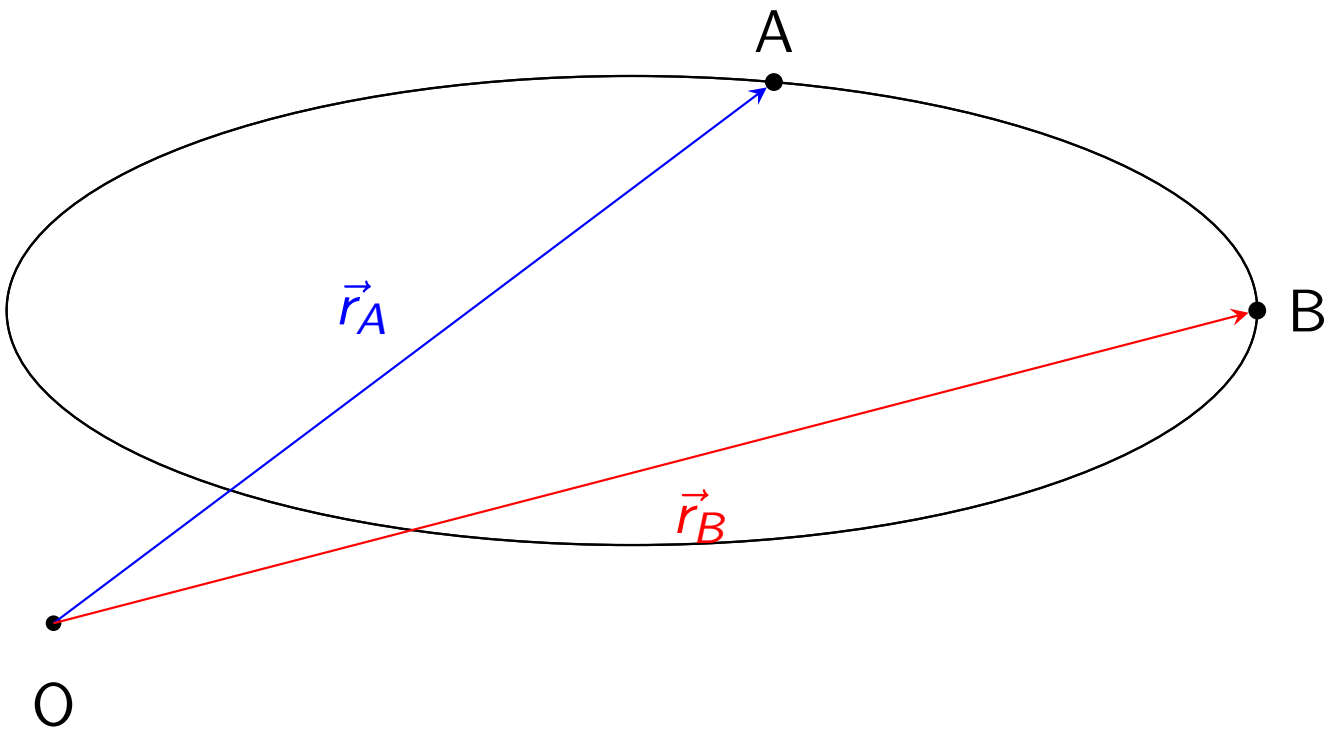

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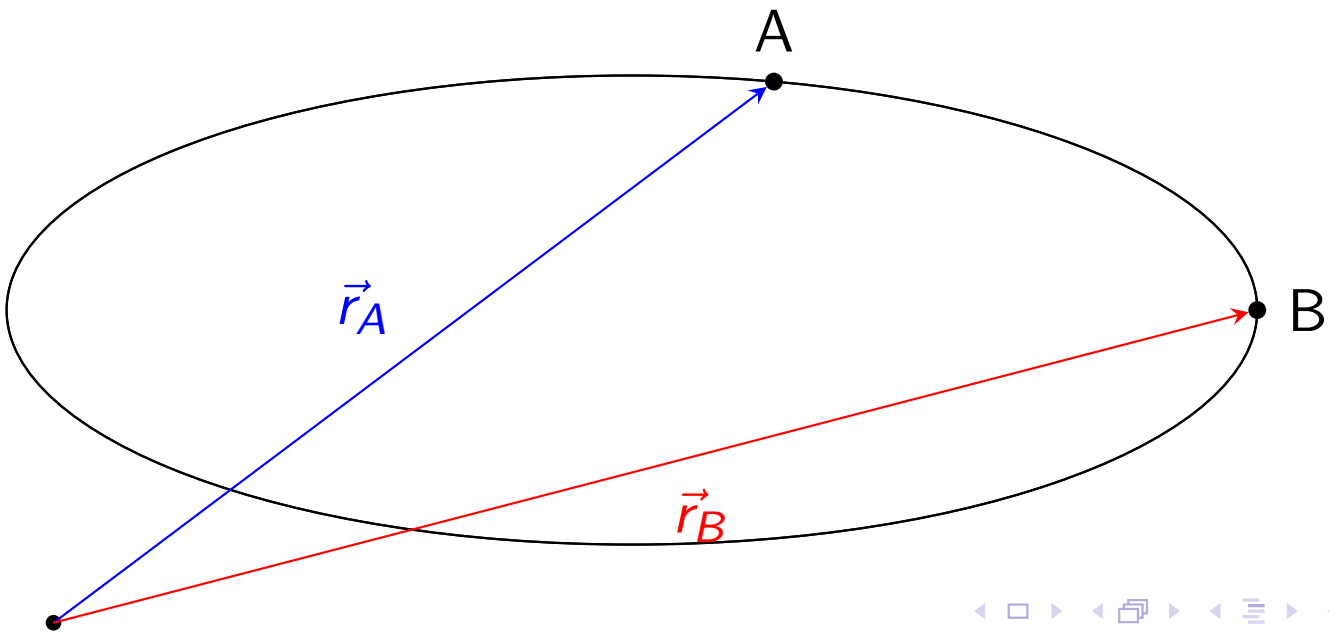
Step #2 Draw the vector that represents the *displacement* of the object from A to B.



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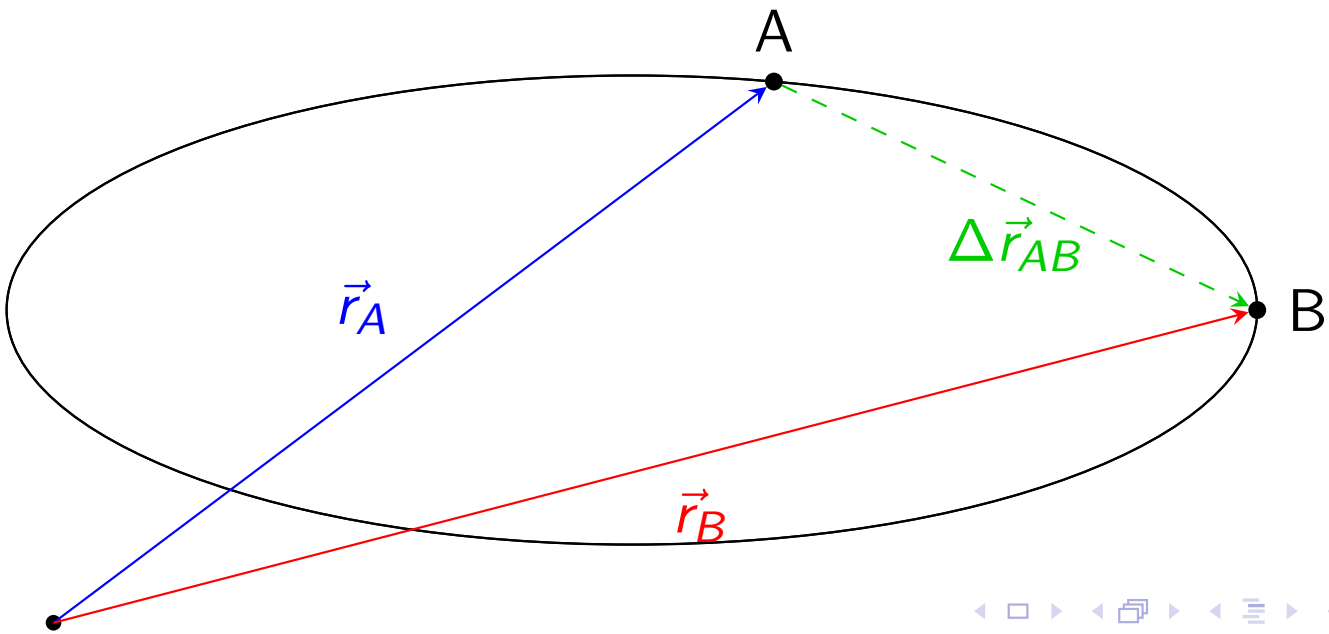
Step #2 Draw the vector that represents the *displacement* of the object from A to B.

$$\Delta\vec{r}_{AB} = \vec{r}_B - \vec{r}_A$$

Describe how to get the average velocity



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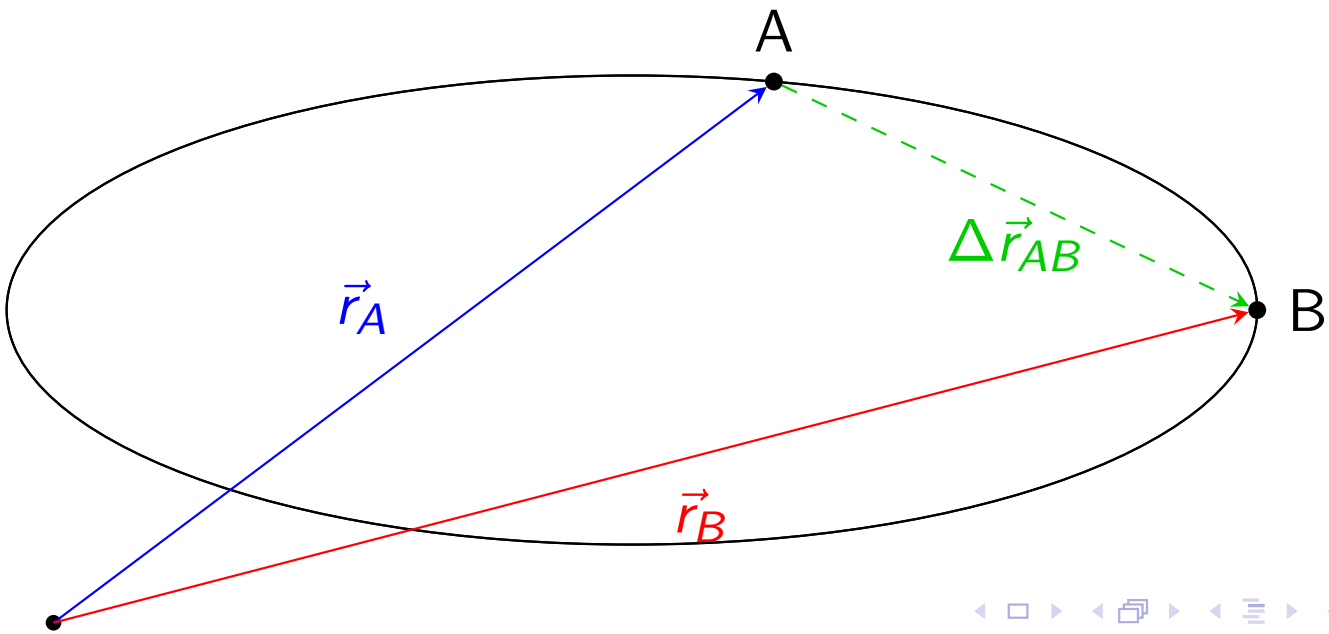

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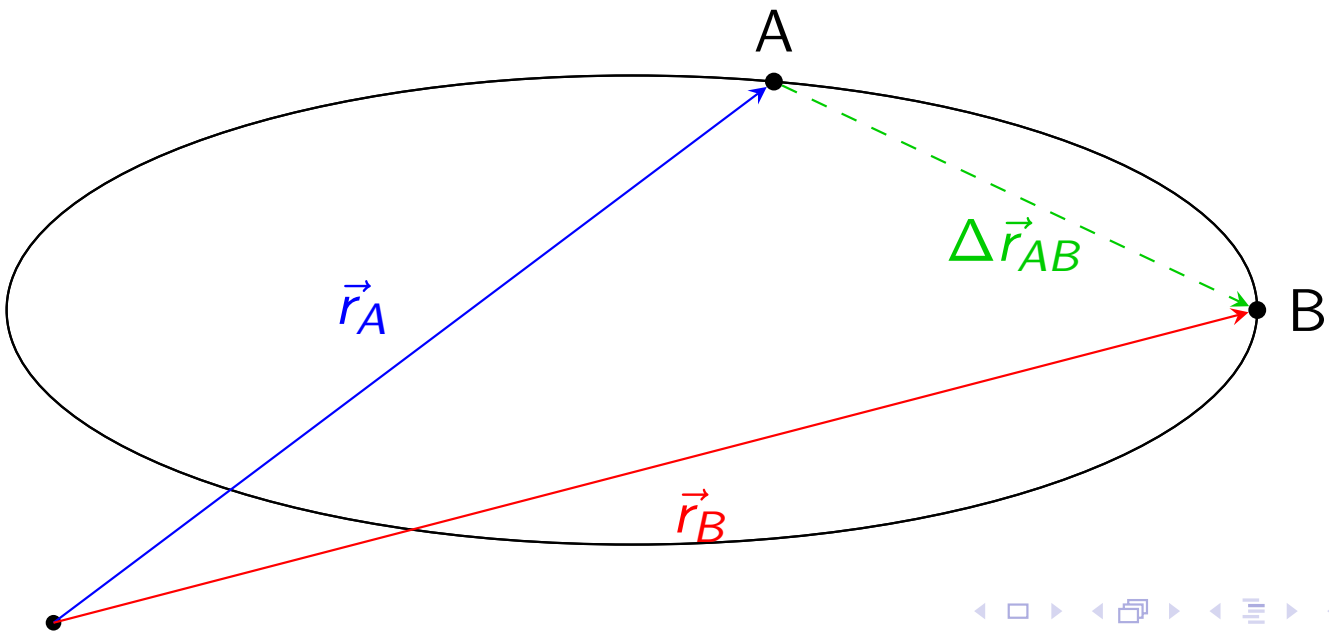

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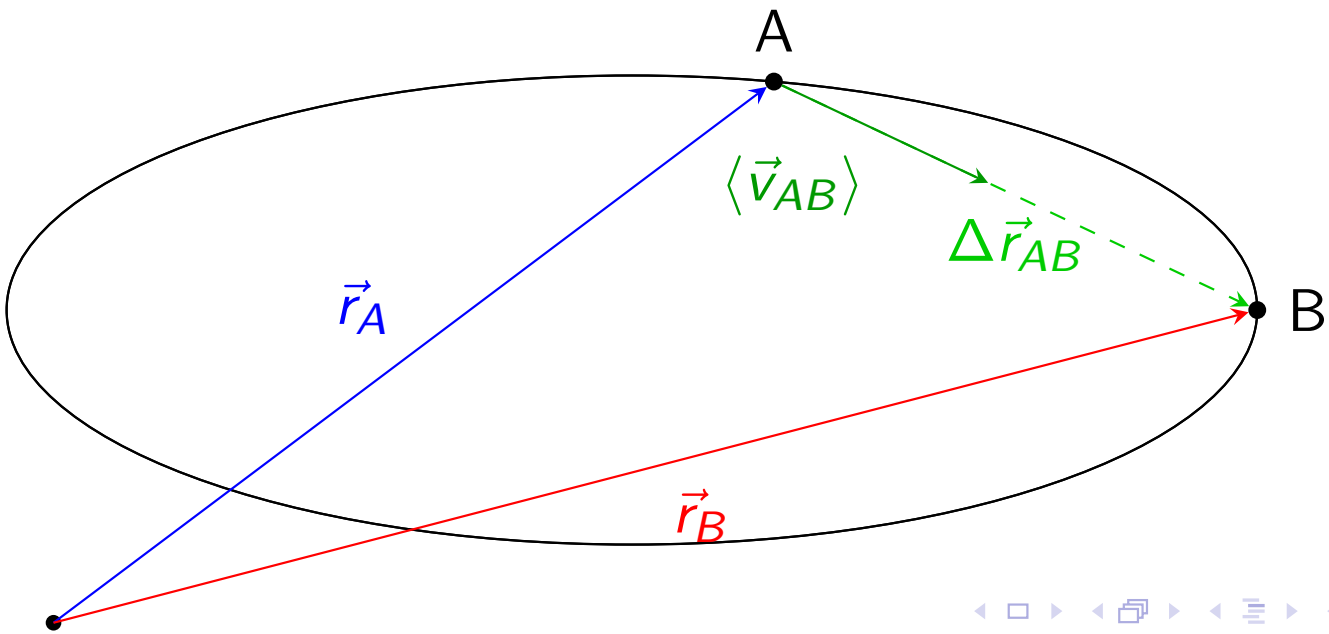

From *average* to *instantaneous*

What do we need to do as we transition from considering the average velocity:

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Plan

Re-do everything we just did, but for a point B' that is closer to A.

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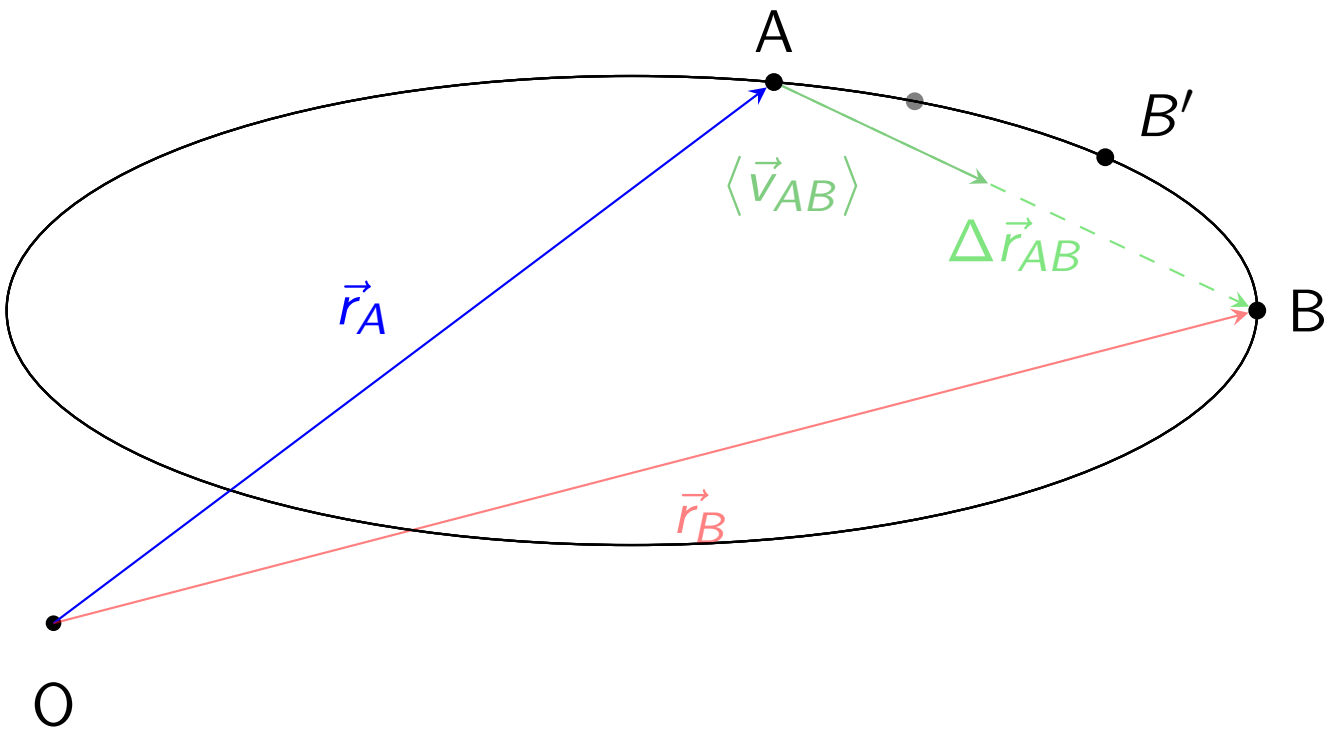
Step #3 Choose a point on the oval between points A and B and label that point B'. Does the direction of the average velocity vector change?



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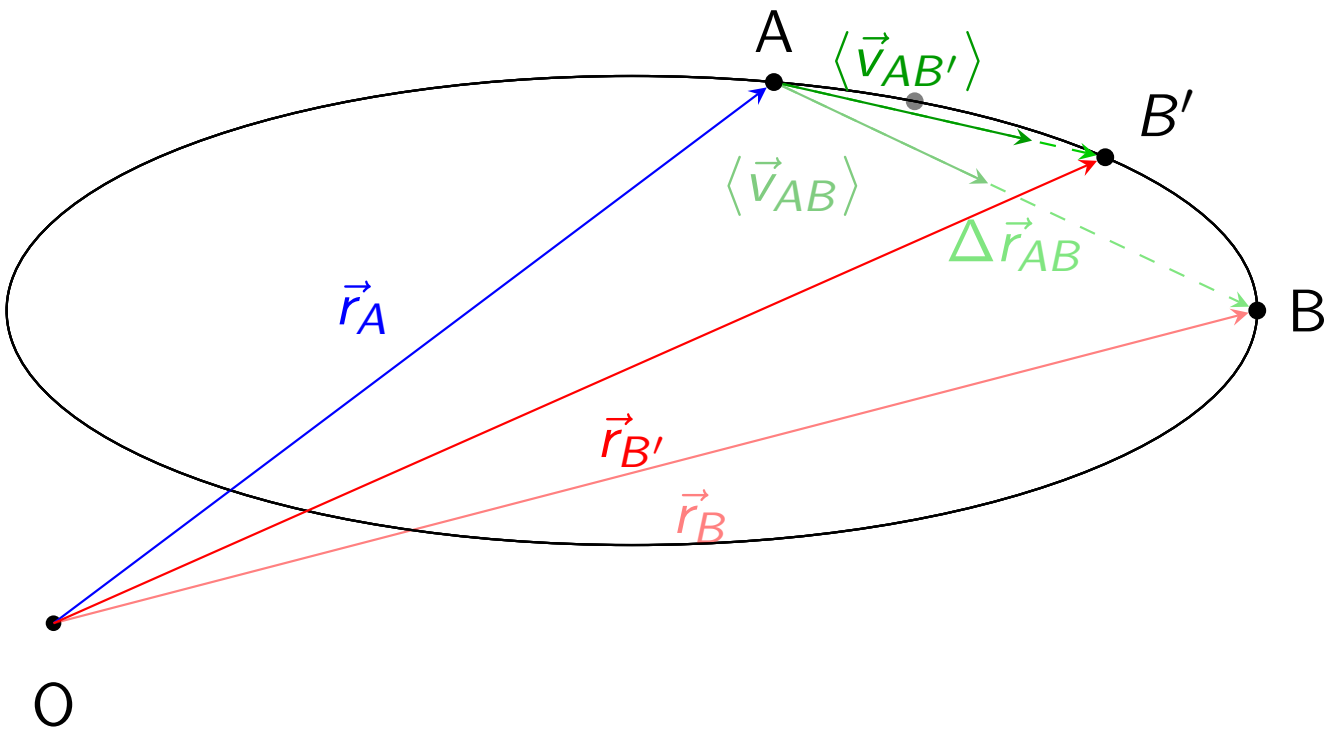

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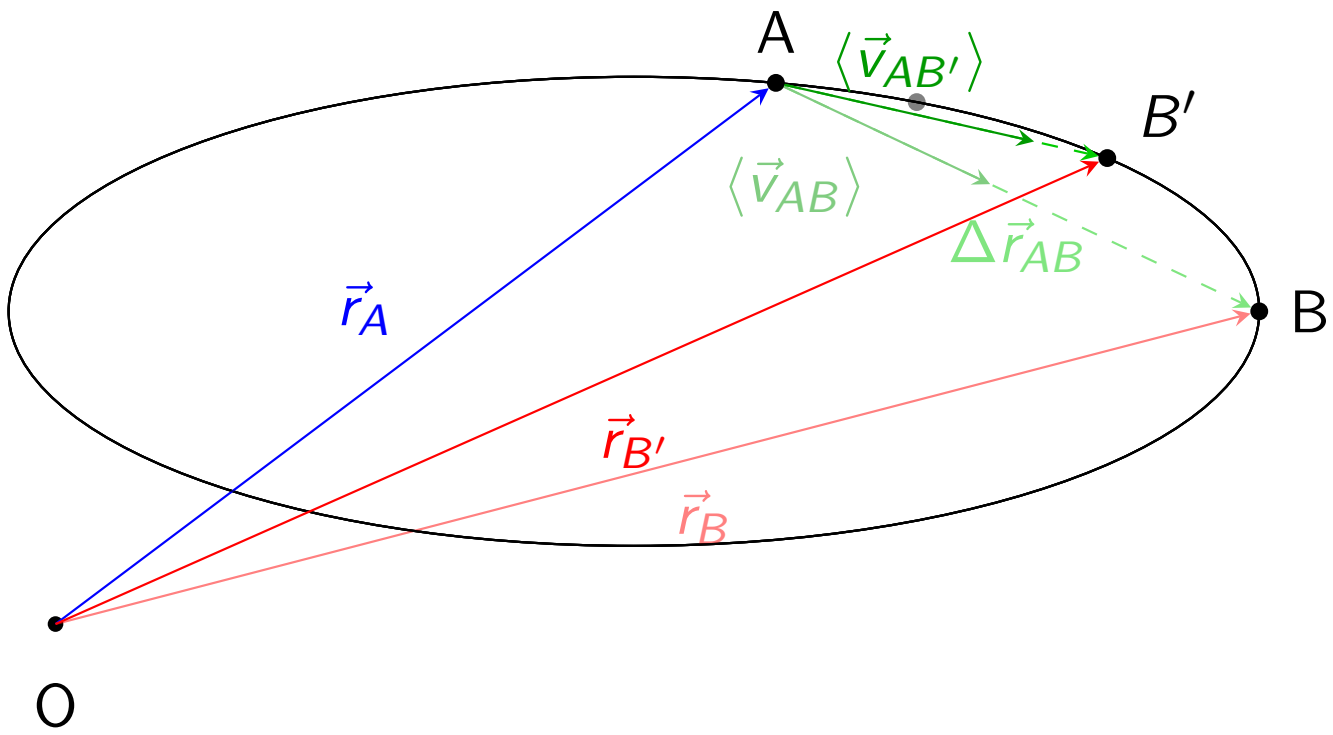
Step #3 Choose a point on the oval between points A and B and label that point B'. Does the direction of the average velocity vector change? YES!



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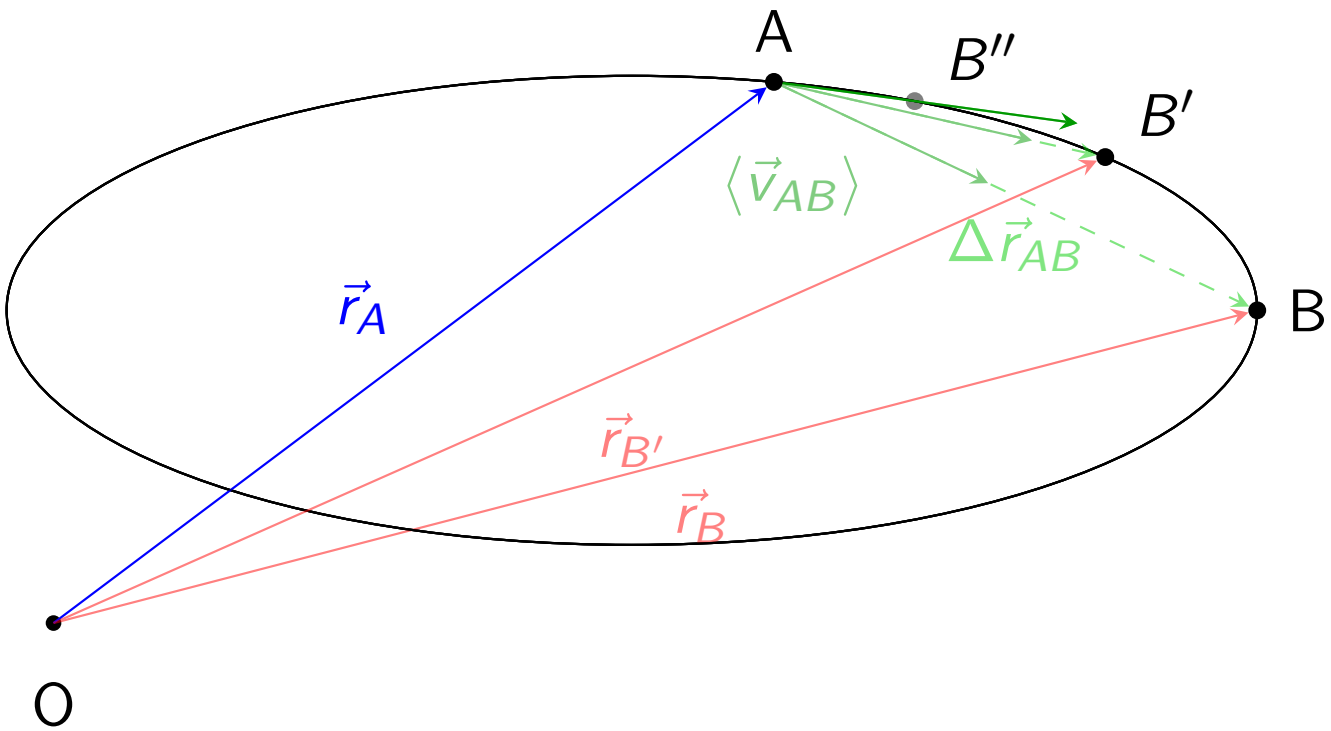

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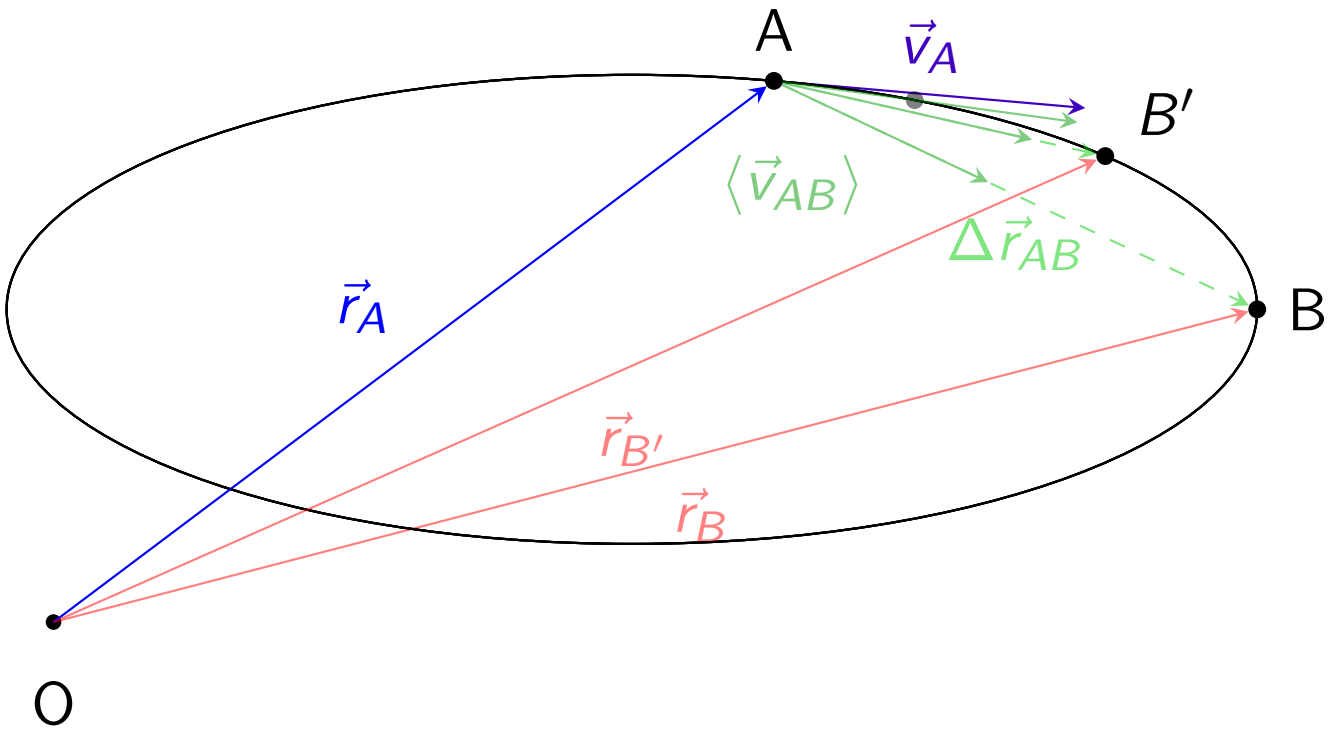
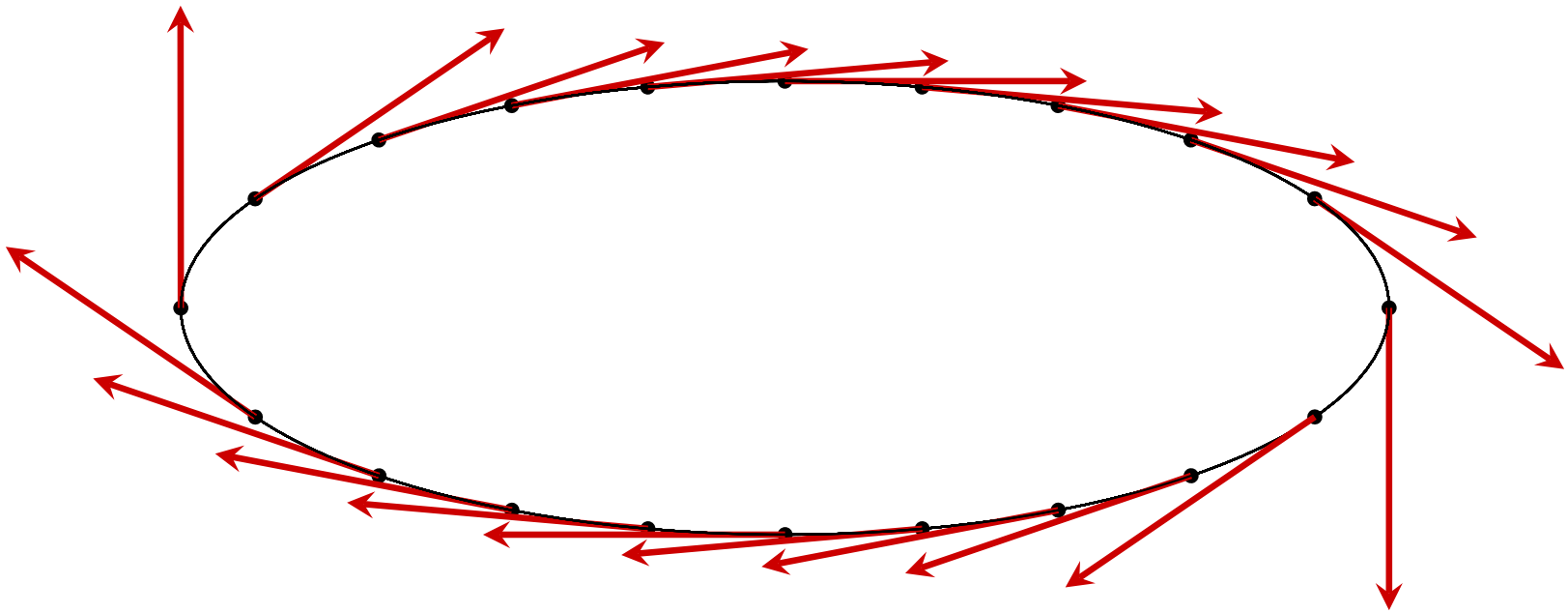


Direction of velocity vector is. . .

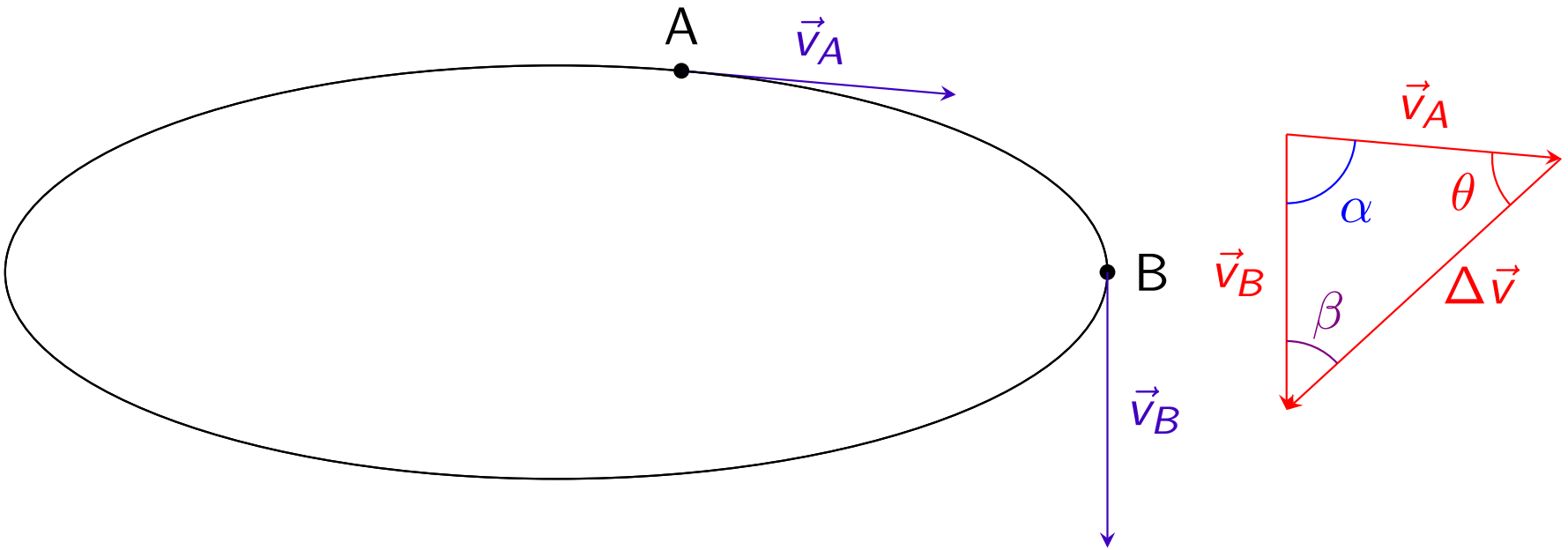
How would you characterize the direction of the (instantaneous) velocity at *any* point?



Tangent to the curve

Acceleration for motion with constant speed

One way of subtracting vectors, tail-to-tail



Questions to consider in II.B

- How are the angles α, β, and θ related?
- How are the magnitudes of $\vec{v}_A$ and $\vec{v}_B$ related?
- As point B moves closer to point A, what happens to the angles and magnitudes mentioned above?

Velocity and Acceleration for constant speed

For constant speed: