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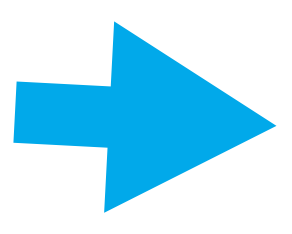
At time t and location $\{X(t), Y(t)\}'$,

$$\begin{bmatrix} \dfrac{dX(t)}{dt} \\ \dfrac{dY(t)}{dt} \end{bmatrix} = \begin{bmatrix} v_x(t) \\ v_y(t) \end{bmatrix}$$

Instantaneous velocity at time t

Velocity is obtained by differentiating location with respect to continuous time.

(Continuous Time Correlated Random Walk, Johnson et al. 2008)



We will numerically approximate (Euler-Maruyama)

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At time t and location $\{X(t), Y(t)\}'$,

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(Continuous Time Correlated Random Walk, Johnson et al. 2008)

Differentiating velocity with respect to time allows for autocorrelation in time and spatially-varying drift in the model.

(Continuous Time Correlated Random Walk, Johnson et al. 2008)