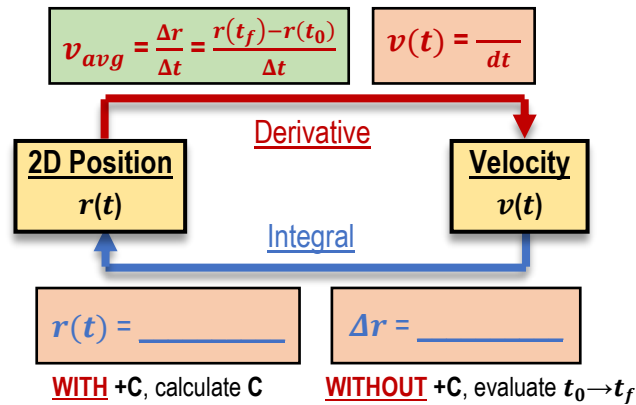


CONCEPT: SOLVING PROBLEMS WITH POSITION AND VELOCITY FUNCTIONS IN 2D

- Some problems GIVE $\mathbf{r}(t)$ and ASK for $\mathbf{v}(t)$, or vice versa, so you'll need to know how to solve $\mathbf{r}(t) \Leftrightarrow \mathbf{v}(t)$ problems.
 - Solve $\mathbf{r}(t) \Leftrightarrow \mathbf{v}(t)$ problems using the SAME operations you did when solving $x(t) \Leftrightarrow v(t)$ problems in 1D!



EXAMPLE: An object's position function $\mathbf{r}(t) = (t^3 - 4)\hat{i} + (5t - 3)\hat{j}$. Determine the velocity function $\mathbf{v}(t)$.

EXAMPLE: An object's velocity function $\mathbf{v}(t) = 3t^2\hat{i} + 5\hat{j}$. At $t = 2$, its position $\mathbf{r} = 4\hat{i} + 7\hat{j}$.

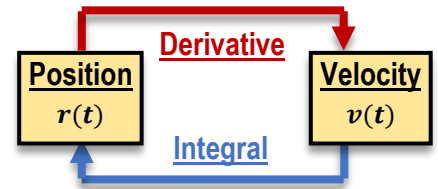
a) Determine the position function $\mathbf{r}(t)$.

Remember: To calculate C, plug given initial conditions from problem text into $\mathbf{r}(t)$ and solve.

b) Calculate $\Delta \vec{r}$ from 2 to 4s.

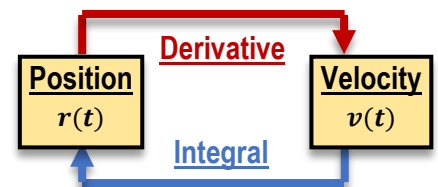
PROBLEM: The velocity of a plane as a function of time is given by $\mathbf{v} = 0.5t \hat{i} - 2\cos(t) \hat{j}$. If the plane started from a point $\mathbf{r} = 5.0 \hat{i}$ at $t = 0$, what is its position at $t = 12\text{s}$?

- A) $41 \hat{i} - 1.1 \hat{j}$
- B) $77 \hat{i} - 1.1 \hat{j}$
- C) $77 \hat{i} - 0.54 \hat{j}$



PROBLEM: A particle's position function is given by $x(t) = 5.0t + 6.0t^2$ and $y(t) = 7.0 - 3.0t^2$, where x and y are in meters and t is in seconds. What is the direction of the particle's velocity at $t = 4 \text{ s}$?

- A) 24.4° below the $+x$ -axis
- B) 19.4° above the $+x$ -axis
- C) 0.34° below the $+x$ -axis
- D) 0.34° below the $+x$ -axis



PROBLEM: A dog running around a park has a velocity described by $v = (0.03t^2 - 2.5) \hat{i} + (-0.1t + 2) \hat{j}$. What is the dog's displacement vector in unit-vector notation from $t = 15\text{s}$ to $t = 30\text{s}$?

- A) $-66 \hat{i} + 15 \hat{j}$
- B) $124 \hat{i} + 56 \hat{j}$
- C) $199 \hat{i} - 3.75 \hat{j}$
- D) $12.75 \hat{i} - 1.5 \hat{j}$

