Example

An object moves along a coordinate line with velocity

\[ v(t) = 6t^2 - 7 \] units per second.

Its initial position (position at time \( t = 0 \)) is 5 units to the left of the origin. Find the position of the object 3 seconds later.

**Solution:** Let \( s(t) \) be the position (coordinate) of the object at time \( t \). We are given that

\[ s(0) = -5. \]

Since \( s'(t) = v(t) \), \( s(t) \) can be expressed by the most general antiderivative of \( v(t) \), i.e.,

\[ s(t) = 2t^3 - 7t + C. \]

Since

\[ s(0) = -5 \quad \text{and} \quad s(0) = 2(0)^3 - 7(0) + C = C, \]

we have \( C = -5 \) and

\[ s(t) = 2t^3 - 7t - 5. \]

The position of the object at time \( t = 3 \) is the value of this function at \( t = 3 \):

\[ s(3) = 2(3)^3 - 7(3) - 5 = 28. \]

Thus at the end of 3 seconds the object is 28 units to the right of the origin.