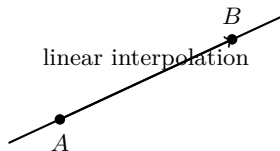


Question 5

Construct a vector function that travels from $A = (-2, 1, 4)$ to $B = (3, -1, 0)$ during $0 \leq t \leq 1$, but does so nonuniformly: it starts and ends at rest while remaining on the line segment.

Question 5 – Solution

Strategy Use $\vec{r} = A + s(t)(B - A)$ with a scalar progress function satisfying $s(0) = 0$, $s(1) = 1$, and $s'(0) = s'(1) = 0$.



Progress function The cubic $s(t) = 3t^2 - 2t^3$ has the required endpoint values and zero endpoint derivatives. Since $0 \leq s(t) \leq 1$ on $[0, 1]$, the path stays on the segment.

Vector function Because $B - A = \langle 5, -2, -4 \rangle$,

$$\boxed{\vec{r}(t) = \langle -2, 1, 4 \rangle + (3t^2 - 2t^3) \langle 5, -2, -4 \rangle}, \quad 0 \leq t \leq 1.$$

Verification Substitution gives the correct endpoints, and $\vec{r}'(0) = \vec{r}'(1) = \vec{0}$.