

FUN	AP CALCULUS BC	
1	Topic: 9.5	Integrating Vector-Valued Functions
Learning Objective FUN-8.A: Determine a particular solution given a rate vector and initial conditions.		

Integration Rules

If $\mathbf{r}(t) = f(t)\mathbf{i} + g(t)\mathbf{j}$ where f and g are continuous on $[a, b]$,

$$\int \mathbf{r}(t) dt = \left[\int f(t) dt \right] \mathbf{i} + \left[\int g(t) dt \right] \mathbf{j} + C_1 \mathbf{i} + C_2 \mathbf{j} \text{ and}$$

$$\int_a^b \mathbf{r}(t) dt = \left[\int_a^b f(t) dt \right] \mathbf{i} + \left[\int_a^b g(t) dt \right] \mathbf{j}$$

Example 1: Vector-Valued Functions and Antidifferentiation

Find $\int (t^2 \mathbf{i} + \ln t \mathbf{j}) dt$.



Scan the QR Code above to watch a video covering Example 1

Example 2: Vector-Valued Functions and Definite Integrals

Find $\int_0^1 \left(e^{-t} \mathbf{i} + \frac{1}{t+3} \mathbf{j} \right) dt$.



Scan the QR Code above to watch a video covering Example 2

Example 3: Vector-Valued Functions and Initial Value Problems

Find $\mathbf{r}(t) = \int \left(\sin 2t \mathbf{i} + \frac{1}{t^2 + 1} \mathbf{j} \right) dt$ if $\mathbf{r}(0) = \frac{1}{2} \mathbf{i} + \mathbf{j}$.



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covering
Example 3