
4321

1. Given vectors \vec{A} and \vec{B} , decompose \vec{A} into the sum of two pieces: \vec{A}_{\parallel} along \vec{B} ; and \vec{A}_{\perp} perpendicular to \vec{B} . Hint: use the dot and cross products.
2. Same question, but with $\vec{A} = (1, 2, 3)$ and $\vec{B} = (1, 3, 1)$.
3. Consider the vector field $\vec{v}(\vec{r}) = (x^2 + y^2)\hat{e}_x + (x^2 + y^2)\hat{e}_y + z^2\hat{e}_z$.
 - (a) Calculate the divergence of $\vec{v}(\vec{r})$
 - (b) Calculate the curl of $\vec{v}(\vec{r})$
 - (c) Calculate the gradient of the divergence of $\vec{v}(\vec{r})$
 - (d) Evaluate the divergence of $\vec{v}(\vec{r})$ at $(1, 2, 3)$
 - (e) Evaluate the curl of $\vec{v}(\vec{r})$ at $(1, 2, 3)$
 - (f) Evaluate the gradient of the divergence of $\vec{v}(\vec{r})$ at $(1, 2, 3)$
 - (g) Decompose the vector field $\vec{v}(\vec{r})$ into the sum of two other vector fields, $\vec{a}(\vec{r})$ and $\vec{b}(\vec{r})$, such that $\vec{a}(\vec{r})$ has no divergence (it is solenoidal) and $\vec{b}(\vec{r})$ has no curl (it is irrotational).

7305

1. Consider the vector field $\vec{v}(\vec{r}) = (x^2 + y^2)\hat{e}_x + (x^2 + y^2)\hat{e}_y + z^2\hat{e}_z$. Decompose the vector field $\vec{v}(\vec{r})$ into the sum of two other vector fields, $\vec{a}(\vec{r})$ and $\vec{b}(\vec{r})$, such that $\vec{a}(\vec{r})$ has no divergence (it is solenoidal) and $\vec{b}(\vec{r})$ has no curl (it is irrotational).
2. Consider the vector field $\vec{v}(\vec{r}) = (r^2 + r^2 \sin^2(\theta))\hat{e}_r + (r^2 \cos^3(\theta))\hat{e}_{\theta} + r^2 \cos^2(\phi)\hat{e}_{\phi}$.
 - (a) Calculate the divergence of $\vec{v}(\vec{r})$
 - (b) Calculate the curl of $\vec{v}(\vec{r})$
 - (c) Calculate the gradient of the divergence of $\vec{v}(\vec{r})$
3. Find the total solid angle in dimensions 5,6,7, and n.

Bonus: Solve as much of the other class' assignment as you can.