

Extra Math Problems, Conservation of Energy in 2D:**Problem 1 (Paul's Online notes): let C be the prescribed path to take the integral.**

Evaluate $\int_C \vec{F} \cdot d\vec{r}$ where $\vec{F}(x, y) = y^2 \vec{i} + (3x - 6y) \vec{j}$ and C is the line segment from $(3, 7)$ to $(0, 12)$.

Prove if \mathbf{F} is conservative/non-conservative

Problem 2 (Paul's Online notes): let C be the prescribed path to take the integral.

Evaluate $\int_C \vec{F} \cdot d\vec{r}$ where $\vec{F}(x, y) = y^2 \vec{i} + (x^2 - 4) \vec{j}$ and C is the portion of $y = (x - 1)^2$ from $x = 0$ to $x = 3$.

Prove if \mathbf{F} is conservative/non-conservative

Problem 3 (OpenStax):

Are the following the vector fields conservative? If so, find the potential function f such that $\mathbf{F} = \nabla f$.

433. $\mathbf{F}(x, y) = y\mathbf{i} + (x - 2e^y)\mathbf{j}$

434. $\mathbf{F}(x, y) = (6xy)\mathbf{i} + (3x^2 - ye^y)\mathbf{j}$

435. $\mathbf{F}(x, y, z) = (2xy + z^2)\mathbf{i} + (x^2 + 2yz)\mathbf{j} + (2xz + y^2)\mathbf{k}$

436. $\mathbf{F}(x, y, z) = (e^x y)\mathbf{i} + (e^x + z)\mathbf{j} + (e^x + y^2)\mathbf{k}$