PEP542 Homework
Spring 2025

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- There could be typos, please let me know if you find any issues.
- Do not copy solutions from Google or other online resources. It is very easy to tell whether the solution is original work or not.
- You are encouraged to discuss the problems with the other students.
- Please scan your solutions (make sure that the solution is recognizable) and upload the PDF file to Canvas.
- Late homework will not be counted in the final grade.
- Each student is granted one late-homework exemption, provided the homework is submitted within five days of the deadline. Please use it wisely.

Homework 1 (Due 2pm, Feb 7th)

1. Prove the identity $\vec{A} \times (\vec{B} \times \vec{C}) = \vec{B}(\vec{A} \cdot \vec{C}) - \vec{C}(\vec{A} \cdot \vec{B})$ by writing out both sides in component forms. You only need to show the x-component of the two sides are equal to each other.

2 (i) Prove $\nabla \cdot (\nabla \times \vec{A}) = 0$.
(ii) Prove $\nabla \times \nabla \psi = 0$

3 (i) Find the gradient of $f(x, y, z) = x^2 y^3 + z^4$.
(ii) Find the divergence of vector $\vec{v} = y^2 \hat{x} + (2xy + z^2)\hat{y} + 2yz\hat{z}$.
(iii) Find the curl of vector $\vec{v} = x^2 \hat{x} + 3xz^2 \hat{y} - 2xz\hat{z}$.

4. Show that (i) $\nabla \cdot (f\vec{A}) = f(\nabla \cdot A) + \vec{A} \cdot (\nabla f)$.
(ii) $\nabla \cdot (\vec{A} \times \vec{B}) = \vec{B} \cdot (\nabla \times \vec{A}) - \vec{A} \cdot (\nabla \times \vec{B})$.
(iii) $\nabla \times (\vec{A} f) = f(\nabla \times \vec{A}) - \vec{A} \times \nabla f$