

PROBLEM OF THE WEEK
Solution of Problem No. 1 (Spring 2014 Series)

Problem:

A simple polygon in the plane has n edges numbered from 1 to n . Let \vec{v}_i be the vector which is perpendicular to the i^{th} edge and which points in the direction away from the polygon's interior on the i^{th} edge, and which has the same length as the i^{th} edge. Find $\sum_{i=1}^n \vec{v}_i$.

Solution: (by Jingbo Wu, Sophomore, College of Engineering, Purdue University)

Consider the simple polygon with n vertices, every edge can be a vector $j(i-1)j(i)$, the last one will be $j(n)j(1)$, and let those vectors be $a(1), a(2), \dots, a(n)$. According to the rule of sum of vectors, the sum of $a(1), a(2), \dots, a(n)$ is the zero vector.

For each vector which is perpendicular to the edge, v_i , can be regard as a result of anti-clockwise rotation of vector $a(i)$, hence, all those vector v_i can be put together to make up a polygon, and according to rule of sum of vectors, the sum of v_i must be the zero vector.

The problem was also solved by:

Undergraduates: Yucheng Chen (Fr, Engr.), Pratham D. Ghael (Fr. Engr.), Bennett Marsh (Jr. Engr.), Sthitapragyan Parida (Fr. Engr.)

Graduates: Suhas Sreehari (ECE), Tairan Yuwen (Chemistry)

Others: Amar Aganovic (Faculty of Mechanical Engineering, Sarajevo), Marco Biagini (Math Teacher, Italy), Pawan Chawla (CA), Jon Dewitt (Student, Haverford College), Tom Engelsman (Tampa, FL), Bruce Fleischer (Research Staff, IBM, NY), Andrew Garmon (Christopher Newport University alumni), Elizabeth Greco (Student, Kenyon College, OH), Lincoln James, Kipp Johnson (Valley Catholic HS teacher, Oregon), Pankaj Joshi (Graduate Student, Belgium), Sribharath Kainkaryam, Chris Kennedy (Professor, Christopher Newport Univ, VA), Peter Kornya (Retired Faculty, Ivy Tech), Tin Lam (Engineer, St. Louis, MO), Steven Landy (Physics Faculty, IUPUI), Wei-Xiang Lien (Miaoli, Taiwan), Vladimir B. Lukianov (Lecturer, Tel-Aviv), Nick Perkins (HS Student, Zionsville, IN), Benjamin Phillabaum (Visiting Scholar, Physics, Purdue), Paul Richter (Jr. Niles High School), Sorin Rubinstein (TAU faculty, Tel Aviv, Israel), Eduardo Enrique Escamilla Saldana (Monterrey, Nuevo Leon, Mexico), Luciano Santos (Teacher, Portugal), Craig Schroeder (Postdoc. UCLA), Bruce Grayson & Rick Shilling (Orlando, FL), Jason L. Smith (Professor, Richland Community College, IL), David Stoner (HS Student, Aiken,

S. Carolina), Edwin WK Tham (MDM Inc.), Michael Tomaine (Bellevue, WA), Motohiro Tsuchiya (Graduate student, USUHS), Justin Wolfe (Graduate student, Old Dominion U), William Wu (QED Inc.), Xu Zhang (Visiting Assistant Professor, Math, Purdue)