Work Sheet 8: Points, Vectors, Segment and Line

Question 1.

You are tasked with developing a Python program that performs basic calculations with points in a 2D plane. Make the `Point` class in Python, write code to complete the following tasks:

1. **Distance Calculation**: Given two points, A(x1,y1) and B(x2,y2), calculate and print the distance between them.
2. **Midpoint Calculation**: Calculate and print the midpoint between the two points A and B.
3. **Line Equation**: Find the equation of the line that passes through points AAA and BBB. The equation should be in the form y=mx+c, where mmm is the slope, and c is the y-intercept.
4. **Reflection of Point**: Given a third point C(x3,y3), calculate and print the coordinates of the reflection of point C over the line that passes through points A and B.

Question 2:

You are given three 2D vectors $\vec{A}$, $\vec{B}$, and $\vec{C}$ in the plane. Write a Python program to perform the following tasks using vector operations and make package:

1. **Vector Addition**: Compute and print the resultant vector $\vec{R}=\vec{A}+\vec{B}+\vec{C}$.
2. **Magnitude Calculation**: Calculate and print the magnitude of each vector $\vec{A}$, $\vec{B}$, and $\vec{C}$.
3. **Dot Product**: Calculate and print the dot product between each pair of vectors: $\vec{A}\cdot\vec{B}$, $\vec{A}\cdot\vec{C}$ and $\vec{B}\cdot\vec{C}$.
4. **Angle Between Vectors**: Calculate and print the angle (in degrees) between each pair of vectors: $\vec{A}$ and $\vec{B}$, $\vec{A}$ and $\vec{C}$, $\vec{B}$ and $\vec{C}$.
5. **Projection of Vector**: Calculate and print the projection of vector $\vec{A}$ onto vector $\vec{B}$.

Question 3:

You are given two points, S(x1,y1) (start point) and E(x2,y2) (end point), that form a segment SE in a 2D plane. Additionally, you are given a third point, P(x3,y3), which is somewhere in the plane. Write a Python program to complete the following tasks:

1. **Distance of Segment**: Calculate and print the length of the segment SE.
2. **Closest Point on Segment**: Determine and print the coordinates of the point on segment SE that is closest to point P.
3. **Distance from Point to Segment**: Calculate and print the distance from point P to the closest point on segment SE.

Question 4:

You are given two lines L1 and L2 in a 2D plane, defined by the following equations:

- Line L1: a1x+b1y=c1
- Line L2: a2x+b2y=c2

Write a Python program to determine if the lines intersect, and if so, find and print the point of intersection (x,y).

1. **If the lines intersect**, print the coordinates of the intersection point (x,y).
2. **If the lines are parallel or coincident**, print "Lines are parallel or coincident."