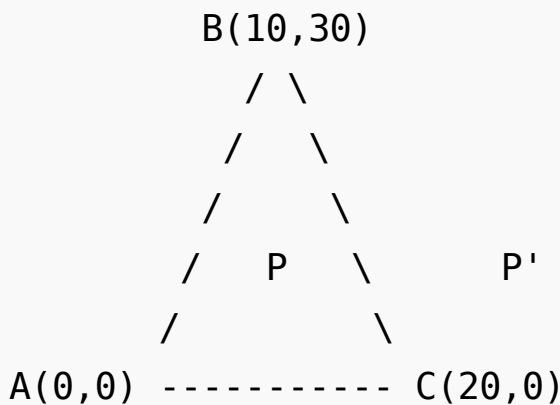


Check whether a given point lies inside a triangle or not

Given three corner points of a triangle, and one more point P. Write a function to check whether P lies within the triangle or not.

For example, consider the following program, the function should return true for P(10, 15) and false for P'(30, 15)



Source: [Microsoft Interview Question](#)

Solution:

Let the coordinates of three corners be (x_1, y_1) , (x_2, y_2) and (x_3, y_3) . And coordinates of the given point P be (x, y)

- 1) Calculate area of the given triangle, i.e., area of the triangle ABC in the above diagram. Area $A = [x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)]/2$
- 2) Calculate area of the triangle PAB. We can use the same formula for this. Let this area be A_1 .
- 3) Calculate area of the triangle PBC. Let this area be A_2 .
- 4) Calculate area of the triangle PAC. Let this area be A_3 .
- 5) If P lies inside the triangle, then $A_1 + A_2 + A_3$ must be equal to A.

```
#include <stdio.h>
#include <stdlib.h>
```

```
/* A utility function to calculate area of triangle formed
   (x2, y2) and (x3, y3) */
float area(int x1, int y1, int x2, int y2, int x3, int y3)
```

```
{
    return abs((x1*(y2-y3) + x2*(y3-y1)+ x3*(y1-y2))/2.0);
}
```

```
/* A function to check whether point P(x, y) lies inside
   by A(x1, y1), B(x2, y2) and C(x3, y3) */
```

```
bool isInside(int x1, int y1, int x2, int y2, int x3, int y3)
{
    /* Calculate area of triangle ABC */
    float A = area (x1, y1, x2, y2, x3, y3);

    /* Calculate area of triangle PBC */
    float A1 = area (x, y, x2, y2, x3, y3);

    /* Calculate area of triangle PAC */
    float A2 = area (x1, y1, x, y, x3, y3);

    /* Calculate area of triangle PAB */
    float A3 = area (x1, y1, x2, y2, x, y);

    /* Check if sum of A1, A2 and A3 is same as A */
    return (A == A1 + A2 + A3);
}
```

```
/* Driver program to test above function */
```

```
int main()
{
    /* Let us check whether the point P(10, 15) lies inside
       formed by A(0, 0), B(20, 0) and C(10, 30) */
    if (isInside(0, 0, 20, 0, 10, 30, 10, 15))
        printf ("Inside");
    else
        printf ("Not Inside");

    return 0;
}
```

Ouptut:

```
Inside
```

Exercise: Given coordinates of four corners of a rectangle, and a point P. Write a function to check whether P lies inside the given rectangle or not.