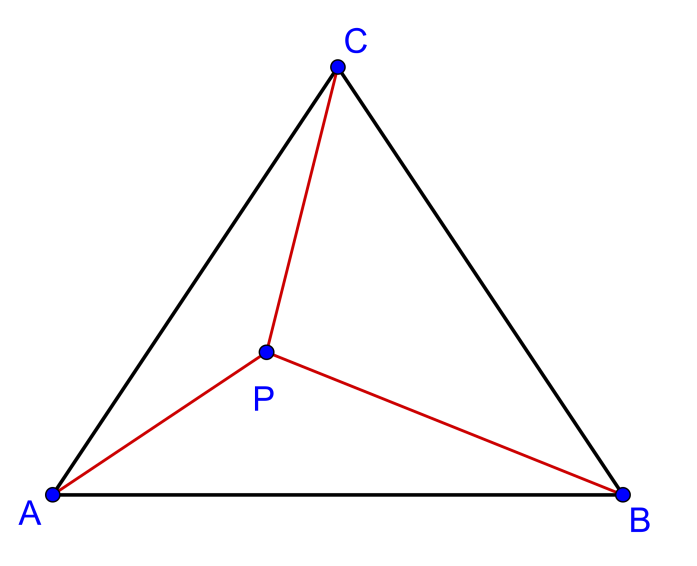
**Vector**

**(a)** Let be a point inside such that ,

find , where represents the area of the .



**(b)** Let be a point inside such that ,

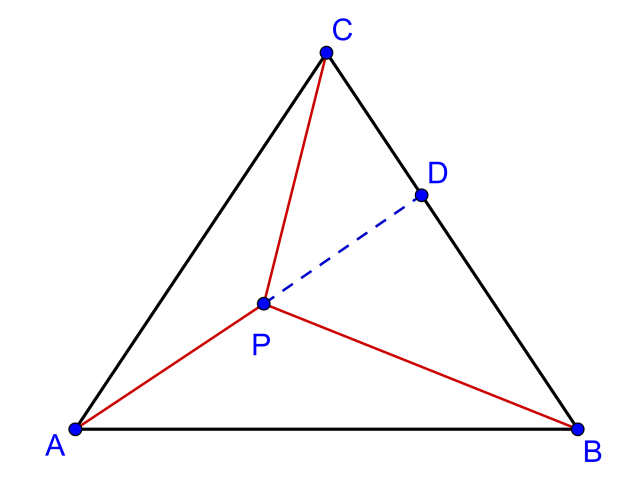
find .

**(c)** If be a point inside such that , find

, where is the concave quadrilateral.

**(a)**

**Method 1**



Produce to meet at .

Let

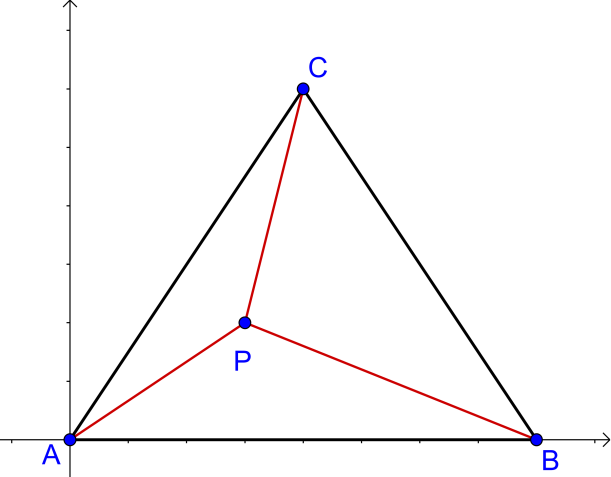
Since are collinear, ,

and

Also,

Since and

**Method 2**



Place a coordinate system with as origin  
and along x-axis.

Since

Consider the y-cordinates,

Hence,

If we place a coordinate system with as origin and along x-axis, we get:

If we place a coordinate system with as origin and along x-axis, we get:

**Method 3**

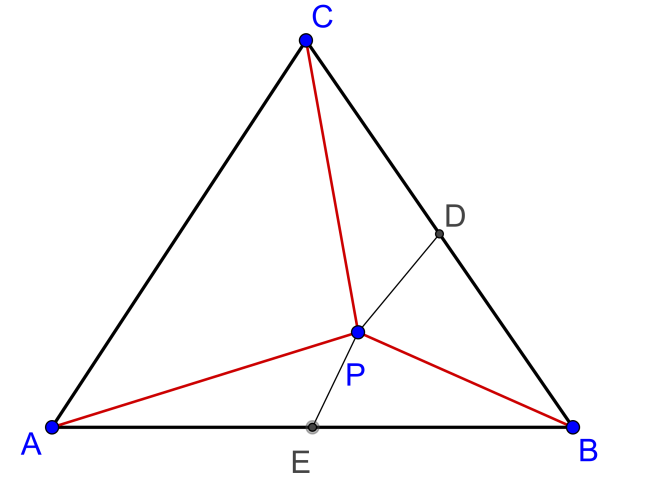
Let

Then

Hence, is the **centroid** of the .

Similarly,

**Method 4**



Construct the mid-point of as .

Then

Construct the mid-point of as .

Then

Hence we can get

Then is a straight line and

Let , then

Since are mid-points of and respectively,

Hence

By Mid-point Theorem, and note that

Since ,

**Method 5** Note:

Let be the origin and  **, ,**

**Method 6**

There is a one-to-one correspondence between vector and complex number.

For any vector , there is a complex number .

The problem then becomes:

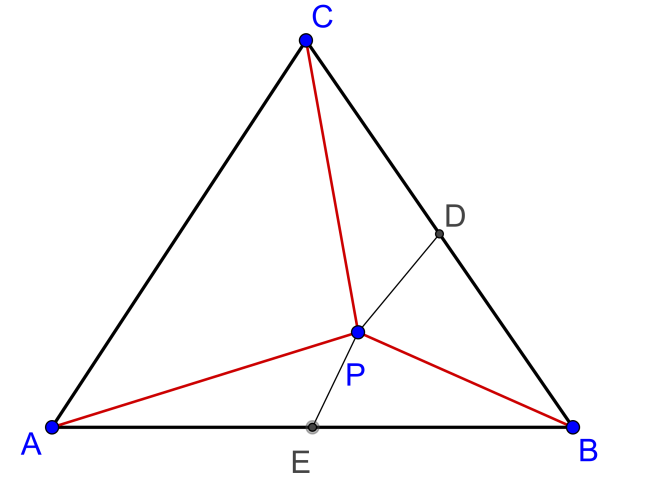
Take to be the origin of the complex plane and , and

, find , where represents the area of the .

Since , we have the conjugate equation .

Hence .

By the area formula in complex number, we have

**(b)** Place a coordinate system with as origin and

along x-axis.

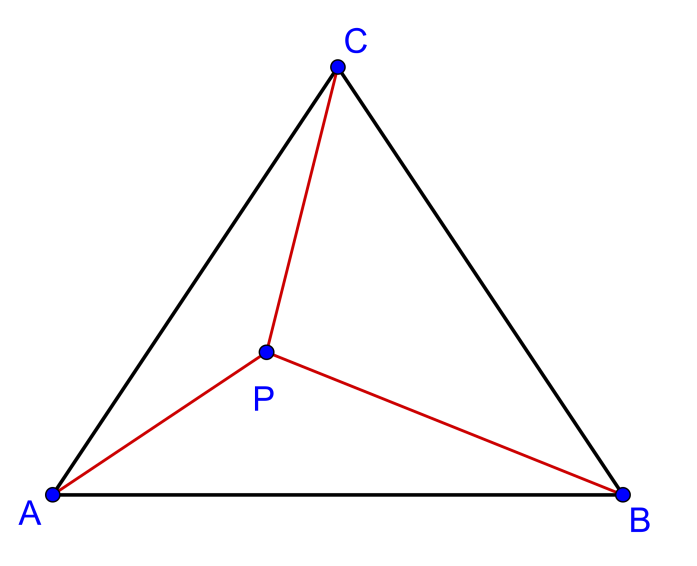
Since

Consider the y-cordinates,

Hence,

If we set a coordinate system with as origin and along x-axis, then:

If we set a coordinate system with as origin and along x-axis, then:



**(c)** , by (**b)**,

Therefore,

and

**Yue Kwok Choy**

**1-3-2016**

**Method 6 of part (a) added on 10-3-16**