Finding the Center of an Inscribed Triangle

Given three points defining a triangle, we will construct the center and radius of the inscribed circle. All lines in `Courier New` can be entered into TestGiver.

We begin with three points, **u,v,w,** defining a triangle.

```
u=[3;7];v=[7;1];w=[-3;-3];
```

The vector **uv** is a unit vector parallel to **v − u** , and similarly for **uw** and **vw**.

```
uv=(v-u)/norm(v-u,2);uw=(w-u)/norm(w-u,2);vw=(w-v)/norm(v-
w,2);
```

u1 is a direction vector for the line through **u** bisecting the angle at **u**. **v1** is a direction vector for the line through **v** bisecting the angle at **v**.

```
u1=uv+uw;
v1=-uv+vw;
```

The line through **u** with direction **u1** has equation $ax+by=c$.
The line through **v** with direction **v1** has equation $dx+ey=f$.

```
a=u1[2];b=-u1[1];c=a*u[1]+b*u[2];
d=v1[2];e=-v1[1];f=d*v[1]+e*v[2];
```

The two lines intersect at the point ($x1,y1$) = **cc.**

```
x1=(c*e-b*f)/(a*e-b*d);
y1=(a*f-c*d)/(a*e-b*d);

cc=[x1;y1];
```

cu is the vector from vertex **u** to center **cc.**
cv is the vector from vertex **v** to center **cc.**
cw is the vector from vertex **w** to center **cc.**

```
cu=cc-u;
cv=cc-v;
cw=cc-w;
```

pw is the point where the perpendicular from the center **cc** meets the line through **u** and **v** (since |**uv**|=1).

```
pw=(cu.uv)*uv+u;
```

The radius of the inscribed circle is the distance from the center **cc** to **pw.**

```
norm(pw-cc,2)
```