

**C1:** Short answer. Show no work.

Please write **DNE** in a blank if the described object does not exist or if the indicated operation cannot be performed.

**a** A real number which is *not* transcendental is circle  
 arthritic astringent irrational isometric acerbic chiral  
 pedestrian polyhedral asthmatic algebraic tardy

**b** Points  $P := (1, 2)$ ,  $Q := (6, 2)$  and  $R := (9, 2)$  are colinear, with  $P$  and  $R$  lying on a circle with center  $\mathcal{O}$  and radius  $r$ . And  $\text{Dist}(Q, \mathcal{O}) = 2$ . So  $r =$  \_\_\_\_\_.

**c** Matrix  $M := \begin{bmatrix} a & b & v \\ c & d & w \\ 0 & 0 & 1 \end{bmatrix}$  rotates the plane CCW about point  $Q := (5, 2)$ , by  $90^\circ$ . So  $\begin{bmatrix} a & b \\ c & d \end{bmatrix} = \begin{bmatrix} \text{.....} & \text{.....} \\ \text{.....} & \text{.....} \end{bmatrix}$ .  
 Importantly,  $v =$  \_\_\_\_\_ and  $w =$  \_\_\_\_\_. [Hint:  $M$  acts, from the left, on column-vectors  $\begin{bmatrix} x \\ y \\ 1 \end{bmatrix}$ . And  $M$  fixes  $Q$ .]

OYOP: In grammatical English *sentences*, write your essay on every *third* line (usually), so that I can easily write between the lines.

**C2:** Consider a triangle  $\mathbf{S} := \triangle ABC \subset \mathbb{R}^2$ .

**i** For a point  $Q \in \mathbb{R}^2$ , define the *pedal triangle*  $\text{Pedals}(Q)$ . Draw an example where  $\mathbf{S}$  is obtuse and:  $Q$  lies outside of  $\mathbf{S}$ , and another example with  $Q$  inside  $\mathbf{S}$ .

**ii** Carefully state the *Simson-line theorem*. Include a picture to show the idea.

**iii** Write a careful *proof* of the *Simson-line thm*. Illustrate the steps in your (written) proof with (large) illustrations. Carefully identify each cyclic quadrilateral (abbrev. "CQuad") that you use.

Start next essay on a new sheet-of-paper.

**C3:** Given a triangle  $\triangle PQR$ , describe a compass-and-straightedge construction of its in-circle,  $\Omega$ . Show how to construct  $\mathcal{O} := \text{Center}(\Omega)$ , as well as a point  $V$  st.  $\text{Dist}(V, \mathcal{O}) = \text{Radius}(\Omega)$ .

End of Class-C

**C1:** \_\_\_\_\_ 80pts  
**C2:** \_\_\_\_\_ 95pts  
**C3:** \_\_\_\_\_ 45pts

Not triple-spaced: \_\_\_\_\_ -15pts

Ouch!, scratch work handed-in : \_\_\_\_\_ -5pts

**Total:** \_\_\_\_\_ 220pts

Please PRINT your name and ordinal. Ta:

Ord: \_\_\_\_\_

**HONOR CODE:** "I have neither requested nor received help on this exam other than from my professor."

Signature: \_\_\_\_\_