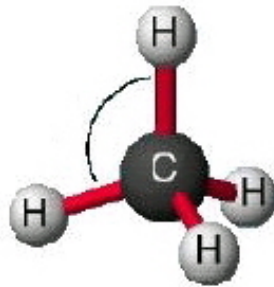


- (5 points) Prove that if  $0^\circ < \alpha < 90^\circ$ , then  $\sin \alpha + \cos \alpha > 1$ .
- (5 points) Compute the exact value of  $\sin 18^\circ$ .
- (10 points) Prove that if  $\alpha$ ,  $\beta$ , and  $\gamma$  are angles in a triangle, then

$$\tan \alpha \tan \beta \tan \gamma = \tan \alpha + \tan \beta + \tan \gamma$$

- (10 points) Consider the quadratic system  $\begin{cases} (x - 10)^2 + (y - 2)^2 = 125 \\ y = 2x + b \end{cases}$  Find the value of  $b$  for which this system has only one solution for  $(x, y)$ .
- (10 points) Consider the circle  $x^2 + (y + 1)^2 = 25$ . Find an equation for all tangent lines drawn to the circle from the point  $P(-10, -6)$ .
- (10 points) Find the exact value of the angle formed near the carbon atom by two hydrogen atoms in the methane ( $\text{CH}_4$ ) molecule.



- (10 points) Compute the measure of angle  $\alpha$  based on the picture if we know that the area of square  $ABCD$  is twice the area of square  $PQRS$ .

