Instructions: Time is 20 minutes and the total score is 10 points. Wait until the last minute.

1. Find the center and the radius of the sphere \( x^2 + y^2 + z^2 - 6y + 8z = 0 \) (2′) and the midpoint between the point where the sphere meets the x-axis and the center (1′).

2. \( \overrightarrow{AB} = \langle 1, 2, 4 \rangle \), \( O \) is the origin and \( A(0, 0, 1) \).
   For \( \overrightarrow{AB} \), write it as the magnitude times the direction. (1′)
   Find the angle between \( \overrightarrow{OB} \) and \( \overrightarrow{AB} \) (2′) and the projection of \( \overrightarrow{OB} \) onto \( \overrightarrow{OA} \) (2′)
   Write \( \overrightarrow{AB} - \frac{1}{2}\overrightarrow{OA} \) as a linear combination of \( \overrightarrow{OB} \) and \( \overrightarrow{OA} \) (2′)
   (Bonus) Find a point \( P \) between \( O \) and \( B \) such that \( AP \) is perpendicular to \( OB \) (2′)