1. [6] Use Green’s theorem to compute the line integral:
\[ \int_C ((1 + x^2)^{3/2} - 3y)dx + (x + e^{y^3})dy, \]
where \( C \) is the oriented boundary of the region between the curves \( x^2 + y^2 = 2, x^2 + y^2 = 5 \).

2. [6] Show that the following vector field in \( \mathbb{R}^3 \) is conservative. Then use this fact to compute the line integral \( \int_C \mathbf{F} \cdot d\mathbf{r} \), where \( C \) is any curve from \((0,0,0)\) to \((1,2,3)\).
\[ \mathbf{F} = (e^y, xe^y + e^z, ye^z). \]

3. [6] Find the center of mass of a thin wire in the shape of a quarter-circle \((x^2 + y^2 = 4, x \geq 0, y \geq 0)\), assuming the mass density is constant. (The length of the wire, of course, is \( \pi \).)

4. [6] Evaluate the surface integral:
\[ \iint_S (y^2 x + xz^2) dS, \]
where \( S \) is the part of the plane \( x = 6 + y + z \) inside the cylinder \( y^2 + z^2 = 9 \).

5. [7] Use Stokes’ theorem to evaluate \( \int_C \mathbf{F} \cdot d\mathbf{r} \):
\[ \mathbf{F}(x, y, z) = (x + y^2, y + z^2, z + x^2). \]
\( C \) is the triangle with vertices \((1,0,0), (0,1,0), (0,0,1)\), oriented counterclockwise as seen from above.

6. [7] Use the divergence theorem to evaluate the surface integral:
\[ \int \int_S (y^2 + z^2 + 2x) dS, \]
where \( S \) is the sphere \( x^2 + y^2 + z^2 = 9 \). (Hint: write the integrand in the form \( \mathbf{F} \cdot \mathbf{N} \), for suitable \( \mathbf{F} \) and \( \mathbf{N} \).)