1. Write down the system of four equations that you get when you apply the method of LaGrange multipliers to the following problem.

Find the maximum and minimum value of $F(x, y, z) = xy + xz + yz$
subject to the constraint $x^2 + y^2 + z^2 = 4$.

Do not solve the system, just write down the equations.

2. **Set up** an **iterated double integral** for $\iint_R f\ dA$ where $f(x, y) = y\sin(x)$ and where R is the region in the first quadrant between the curves $y = x^2$ and $y = -x^2 + 8$ **Do not evaluate the integral.**

3. **Set up** a triple integral in **cylindrical coordinates** that gives the volume of the solid region D where D is the region above the paraboloid $z = x^2 + y^2$ and below the plane $z = 9$.

Do not evaluate the integral.

4. **Set up** a double integral in **polar coordinates** that gives the area of **one of the eight regions** bounded by the polar curve $r = 2\sin 4\theta$.

Do not evaluate the integral.

5. **Set up** an integral that gives the **surface area** of the part of the surface $z = 4 - x^2 - y^2$ that lies above the xy plane.

Do not evaluate the integral.

6. **Set up** an **iterated triple integral** for $\iiint_D f\ dV$ where $f(x, y, z) = xyz$ and where D is the solid region bounded by the planes $x = 0$, $y = 0$, $z = 0$, $z = 2 - y$, and $y = 2 - 2x$.

Do not evaluate the integral.

7. For the space curve $\mathbf{r}(t) =< t, t^2, t^3 >$ find the unit tangent vector $\mathbf{T}(t)$ when $t = 1$.

8. Find the curvature κ of the plane curve $y = e^x$ when $x = 1$.

9. For the space curve $\mathbf{r}(t) =< \sin t, t^2, 2t >$ find the tangential component of acceleration, $\mathbf{a_T}(t)$, when $t = 0$.