1. Find the volume of the solid bounded in the first octant bounded by the cylinder $z = 9 - y^2$ and the planes $x = 1$.

2. Evaluate the double integral.

   $\iint_D x\cos y \, dA$ where D is bounded by $y = x^2$, $y = 0$ and $x = 3$.

3. Use Stoke's theorem to evaluate $\int_C \mathbf{F} \cdot d\mathbf{r}$, $\mathbf{F}(x, y, z) = 6yx^2\mathbf{i} + 2x^3\mathbf{j} + 6xy\mathbf{k}$,

   C is the curve of intersection of the hyperbolic paraboloid $z = y^2 - x^2$ and the cylinder $x^2 + y^2 = 25$ oriented counterclockwise as viewed from above.

4. The **flow lines** (or **streamlines**) of a vector field are the paths followed by a particle whose velocity field is the given vector field. Thus, the vectors in a vector field are tangent to the flow lines. The flow lines of the vector field
   $\mathbf{F}(x,y) = 6x\mathbf{i} - 12y\mathbf{j}$

   satisfy the differential equations

   $\frac{dx}{dt} = 6x$ and $\frac{dy}{dt} = -12y$

   Solve these differential equations to find the equations of the family of flow lines.

5. Find all the second partial derivatives of $f(x, y) = 2x^3y - 6xy^2$.

6. Use polar coordinates to find the limit.

   $$\lim_{(x, y)\to(0, 0)} \frac{x^7 + y^7}{x^6 + y^6}$$