Question 1: Let D be the set of points in the xy-plane that are inside and on the boundary of the triangle with vertices $(0,0)$, $(0,2)$ and $(4,0)$. Find the absolute maximum value of $f(x,y) = x + y - xy$ on D .

[10]

Question 2: Use the method of Lagrange multipliers to find both the maximum and minimum values of $f(x, y, z) = x + y - z$ over the sphere $x^2 + y^2 + z^2 = 1$.

[10]

Question 3: Find the volume of the solid that lies under the hyperbolic paraboloid $z = 3y^2 - x^2 + 2$ and above the rectangle $R = [-1, 1] \times [1, 2]$.

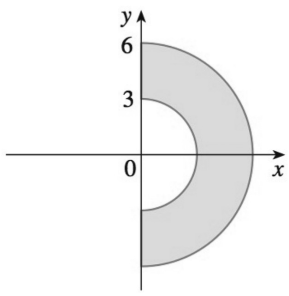
[5]

Question 4: Evaluate the following double integral:

$$\int_0^{\pi/2} \int_y^{\pi/2} \frac{\sin x}{x} \, dx \, dy$$

[5]

Question 5: Evaluate $\iint_D \frac{y}{x^2+y^2}\,dA$ where D is the shaded region in the following figure:



[5]

Question 6: Determine the volume of the region below the paraboloid $z = 18 - 2x^2 - 2y^2$ and above the xy-plane.

[5]

Question 7: Compute $\iiint_E 6xy\, dV$ where E lies under the plane $z = 1 + x + y$ and above the region in the xy-plane bounded by the curves $y = \sqrt{x}$, $y = 0$ and $x = 1$.

[7]

Question 8: Fill in the boxes with the appropriate bounds of integration:

$$\int_0^1 \int_y^1 \int_0^z f(x,y,z)\, dx\, dz\, dy = \int_{\Box}^{\Box} \int_{\Box}^{\Box} \int_{\Box}^{\Box} f(x,y,z)\, dy\, dx\, dz$$

[3]