- Compute the integral $\iint_R \sqrt{4-x^2-y^2}\ \mathrm{d}A$, where R is the region bounded by the function $x=\sqrt{4-y^2}$ and the y-axis.

$\boxed{\frac{8}{3}\pi}$

- Find the maximum and minimum values of the function $f(x,y,z) = 8x - 4z$ subject to the constraint $x^2 + 10y^2 + z^2 = 5$.

max: 20
min. -20

- Evaluate the integral $\int x^2 \cos 3x \mathrm{d}x$.

$\boxed{\frac{x^2}{3}\sin 3x + \frac{2}{9}\left(x\cos 3x - \frac{1}{3}\sin 3x\right) + C}$

- Compute the line integral $\int_C \mathbf{F} \bullet \mathbf{dr}$ where $\mathbf{F}(x,y) = \langle \frac{-y}{x^2+y^2}, \frac{x}{x^2+y^2} \rangle$ and C is the closed path, the unit circle, parametrized by $\mathbf{r}(t) = \langle \cos t, \sin t \rangle$.

$\boxed{2\pi}$

- Let $\mathbf{F}(x,y) = \langle \frac{-y}{x^2+y^2}, \frac{x}{x^2+y^2} \rangle$. Compute $\frac{\partial P}{\partial y}$ and $\frac{\partial Q}{\partial x}$ and then determine if $\mathbf{F}$ is a conservative vector field.

Not conservative because undefined at (0,0).

- Find an equation for the plane that passes through the point $(1,2,3)$ and contains the line $x = 3t$, $y = 1 + t$, $z = 2 - t$.

$\boxed{2x - 4y + 2z = 0}$

- Find the maximum rate of change of $f(x,y,z) = \frac{x+y}{z}$ at the point $(1,1,-1)$.

$\boxed{\sqrt{6}}$

- Evaluate the integral $\int (\tan^2 x + \tan^4 x)\ \mathrm{d}x$.

$\boxed{\frac{\tan^3 x}{3} + C}$