Evaluate the surface integral $G(x,y,z)$

(5.) $G(x,y,z) = x$

$z = 2 - x^2$

$f(x,y) = 2 - x^2$

$2 - x^2 = 0$

$+ x^2 \quad + x^2$

$2 = x^2$

$\sqrt{2} = x$

$$\iint_S G(x,y,z)\, dS$$

$$dS = \sqrt{1 + f_x^2 + f_y^2}\, dA$$

$$\iint_S x \sqrt{1 + f_x^2 + f_y^2}\, dA$$

$f_x = -2x$

$f_y = 0$

$$= \iint_S x \sqrt{1 + (-2x)^2}\, dx\, dy$$

$$= \iint_S x \sqrt{1 + 4x^2}\, dx\, dy$$

$$= \int_0^4 \int_0^{\sqrt{2}} x \sqrt{1 + 4x^2}\, dx\, dy$$

$$= \boxed{\frac{26}{3}}$$

(2.) b) What happenes to the magnitude and the phase of V at $\omega = 1/\sqrt{LC}$

Magnitude

$$|V_{out}| = \frac{V_{in}}{1} = V_{in} \qquad V_{in} = 1V$$

$$\boxed{|V_{out}| = 1V}$$

The output voltage is equal to the input voltage

Phase

Parellel circuit behaves like an open circuit at $\omega = 1/\sqrt{LC}$ so

$$\boxed{\angle V_{out} = 0}$$

$$\omega = \frac{1}{\sqrt{LC}}$$

Impedance of the parellel combo

$$Z_{CL} = \frac{Z_C Z_L}{Z_C + Z_L}$$

Impedance of capicitor $Z_C = \frac{1}{j\omega C}$

$$Z_{CL} = \frac{j\omega L}{Cj^2\omega^2 L + 1}$$

Impedance of inductor $Z_L = j\omega L$

$$V_{out} = \frac{V_{in} \times Z_{CL}}{R + Z_{CL}}$$

$k_1 = 0$

3.

$$\frac{dx}{dt} = 2x + y \qquad x(0) = 1$$

$$\frac{dy}{dt} = 16x + 2y \qquad y(0) = 0$$

a) write this system as a matrix equation

$$\det(A - \lambda I) = \begin{vmatrix} 2-\lambda & 1 \\ 16 & 1-\lambda \end{vmatrix}$$

4.

d) how many non-zero terms do you need to include in the fourier series to have the jump discontinuity to be less than .01

50 terms