

※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. (15%) Evaluate
$$I = \int_{\Gamma} \vec{v} \cdot d\vec{R} ,$$

where $\vec{v} = 2x^2\hat{i} - 2yz\hat{j} - (y^2 + 3)\hat{k}$, and Γ is some rather complicated path from $(0, 0, 0)$ to $(0, 0, 4)$ as sketched in Fig. 1.

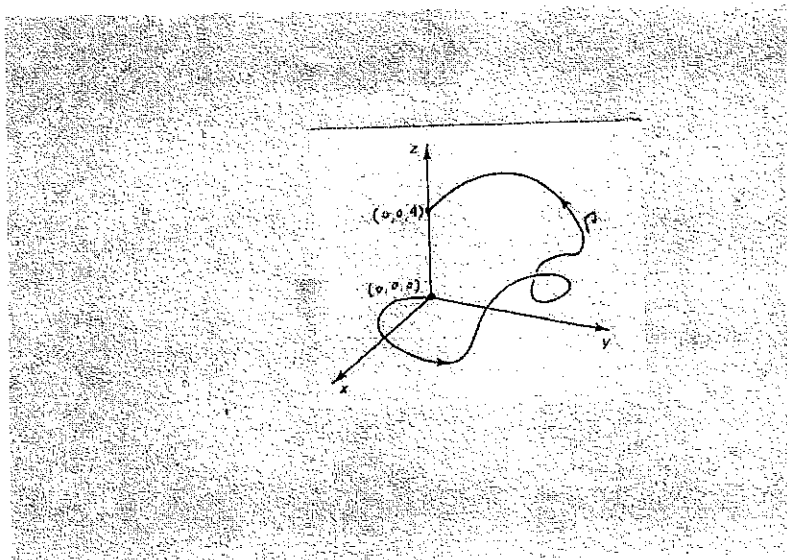


Fig. 1

2. (15%) (a) Find the Fourier integral representation of the Rectangular pulse f shown in Fig. 2.

(5%) (b) Evaluate the value of $f(x)$ at points $x = \pm L$ where f has jump discontinuities.

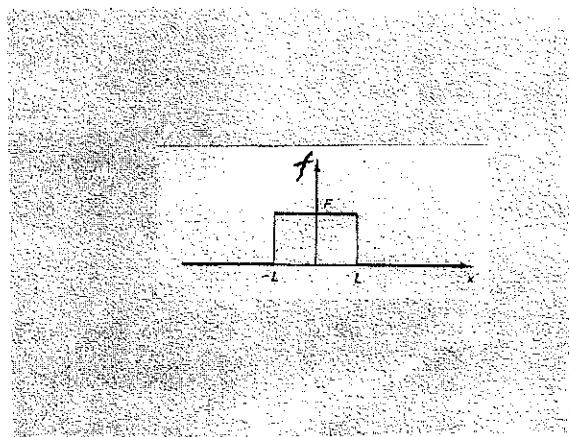


Fig. 2

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3. (15%) How many roots does the equation

$$z^7 - 2z^5 + 6z^3 - z + 1 = 0$$

have inside $|z| = 2$?

(Hint: use Rouché's theorem)

4. (15 %) Solve the following differential equations.

$$\begin{cases} x'(t) = x(t) - 3y(t) \\ y'(t) = -x(t) - y(t) - 4t^2 \end{cases}$$

5. (20%) Solve the following differential equation:

$$x \frac{dy}{dx} - (x+1)y - x^2 + x^3 = 0$$

6. (15%) Solve the following differential equation

$$4y'' - 20y' + 25y = 0$$