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**(Ex 1)** (4 pts) Calculate  $\int (3x^2 - 4x + 5) \sin x dx$

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**(Ex 2)** (3 pts) Calculate  $\int x^3 e^{x^2} dx$

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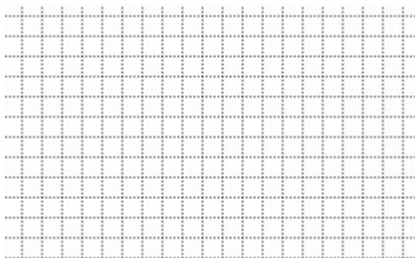
**(Ex 3)** (4 pts) Calculate  $\int \frac{x^4 + x^3}{x^4 - x^3 + x^2 - x} dx$

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**(Ex 4)** (2 pts) Calculate  $\int \sin^3 x dx$

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**(Ex 5)** (3 pts) Calculate the area of a region bounded by the graphs of  $y = \frac{1}{x}$ ,  $y = \sqrt{x}$ ,  $x = 2$  and the OX axis.



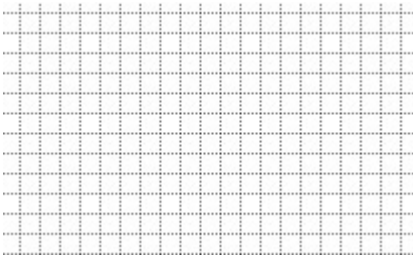
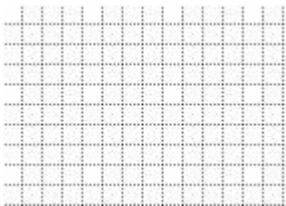


**(Theory 1)** (3 pts) Give three applications of a definite integral different than the one given in the previous Exercise.

Provide a graph and a formula for each application.



**(Ex 6)** (5 pts) Find all complex roots of  $\sqrt[6]{z}$  if  $z = 64$ .



**(Ex 7)** (3 pts) Solve a complex equation:  $2z - \bar{z} = 3 - 4i$ .



**(Theory 2)** (3 pts) Find the values of  $k$  for which matrix  $A = \begin{bmatrix} 6 - k & 2 & 0 & 0 \\ -2 & 1 - k & 0 & 0 \\ 0 & 0 & 7 & 0 \\ 0 & 0 & 0 & k \end{bmatrix}$  is singular.

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**(Ex 8)** (3 + 1 pts) Consider the following system of equations: 
$$\begin{cases} 2x + 4y - z = -1 \\ 3x + 3y + 2z = 2 \end{cases}.$$

a) solve the system using the Gaussian Elimination Method.

b) discuss the number of solutions using the Kronecker-Capelli theorem.

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**(Theory 3)** (3 pts) Give three properties of a matrix rank.

(a)

(b)

(c)

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**(Ex 9)** (3 pts) Find eigenvalues and eigenvectors of matrix  $A = \begin{bmatrix} 3 & 0 \\ 1 & 3 \end{bmatrix}$ .

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**(Ex 10)** (3 pts) Find eigenvalues of matrix  $((2B - I)^{-1})^4$  if  $B = \begin{bmatrix} 2 & 3 \\ 8 & -1 \end{bmatrix}$ .

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**(Ex 11)** (2 pts) Calculate the area of a parallelogram spanned by vectors  $\vec{a} = 8\vec{p} + 9\vec{q}$  and  $\vec{b} = 9\vec{p} - 7\vec{q}$  if you know that the area of a triangle spanned by vectors  $2\vec{p}$  and  $3\vec{q}$  equals  $19 [u^2]$ .



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**(Ex 12)** (3 pts) Find a normal equation of a plane that passes through points  $A = (4, 5, 5)$ ,  $B = (9, 1, -1)$  and  $C = (0, 6, 2)$ .



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**(Theory 4)** (2 pts) Describe the algorithm of finding the distance between point  $P = (x_0, y_0, z_0)$  and plane  $\pi : Ax + By + Cz + D = 0$ . Provide graphs and formulas, if necessary.

