

I recommend trying to attempt the problems without referring to your lecture notes to begin with.

1. Consider the polynomial $f(x) = \frac{x^4}{4} - \frac{2x^3}{3} + 2$. Find the critical points and determine their nature. Sketch the function. Are there any real zeros of f ? For how many values of x does f attain the value 1?

2. Compute the given integrals:

(a) $\int \frac{3x+1}{(x-1)^2(x+2)}$

(b) $\int_0^4 \log \sqrt{x}$

(c) $\int \frac{d(\text{cabin})}{\text{cabin}}$

3. Differentiate $f(x) = \int_0^{x^2} e^{t^2} dt$.

4. By writing the right hand side in exponential polar form, solve the equation $z^4 = 2/(1 + \sqrt{3}i)$ over the complex numbers.

5. Consider the surface $z^3 + y^3 + x^2y = 2$ in \mathbb{R}^3 . What is the normal at $(x, y, z) = (0, 1, 1)$? Show that the surface is tangent to the sphere of radius $\sqrt{2}$ at this point.

6. Solve the following differential equations:

(a) $y' + \frac{y}{2\sqrt{x}} = xe^{\sqrt{x}}$

(b) $y'' + y' + y = t^2$

7. Solve the system of differential equations $4\dot{x} + 3\dot{y} = 3x$, $\dot{y} = x - y$.

8. Find the inverse of the matrix $A = \begin{pmatrix} 1 & 2 & 0 \\ 3 & -1 & 1 \\ 1 & 0 & 1 \end{pmatrix}$ (without using a formula!)

9. Exchange a problem with a friend, and discuss!