

Do all problems in detail.

(1)

(a) [10%] Evaluate $\int_0^{\infty} e^{-st} \sin at \, dt$ for $a, s > 0$.

(b) [10%] Evaluate $\int_0^2 x^3 \sqrt{4-x^2} \, dx$.

(2)

(a) [15%] Determine whether the series $\sum_{n=1}^{\infty} \frac{n(n+1)}{(n+2)^3}$ is convergent or divergent.

(b) [10%] Find the radius of convergence of the power series $\sum_{n=1}^{\infty} \frac{x^n}{n^2+1}$.

(3)

(a) [10%] Find all local extrema of $f(x, y) = x^2 - xy + y^2 + 2x + 2y + 1$.

(b) [10%] Evaluate $\int_0^1 \int_0^{\sqrt{1-x^2}} \int_0^{\sqrt{1-x^2-y^2}} \frac{z^3}{\sqrt{x^2+y^2}} \, dz \, dy \, dx$.

(4)

(a) [10%] Is the vector field $f(x, y) = (x^2 + xy^2, x^2y + y^2)$ conservative?

(b) [15%] A particle is moving along the parabola $y = x^2 + x - 1$ subject to the vector field given as in (a). Find the work done in moving from the point $(-1, -1)$ to the point $(3, 11)$ if forces are measured in newtons and distances are measured in meters?

(c) [10%] Evaluate the surface integral $\int_S (x - 2x^3 + 3x^5) \, d\sigma$ where S is the part of the surface $z = x^2$ lying over $\{(x, y) : -1 \leq x \leq 1, 0 \leq y \leq 2\}$.

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1. Complete the following table: 20%

<code>int i=3, j=5, *p=&i, *q=&j, *r;</code>	
expression	value
<code>p==&i</code>	
<code>**&p*2</code>	
<code>7**q/*p+7</code>	
<code>*(r=&i)*=*q</code>	

2. What do dpi and bps stand for? Give some examples device that use dpi as a measure. Also give some examples that use bps as a measure. 20%
3. 20%
- Explain parity check and ECC?
 - Construct a code for the characters A, B, C, and D using bit patterns of length five so that the Hamming distance between any two patterns is at least three.
4. Consider an 8-bit binary number with the following bit pattern: 20%
- 10101110
- What is the decimal number if the bit pattern is in excess-128 notation?
 - What is the decimal number if the bit pattern is in 2s complement notation?
 - What is the decimal number if the bit pattern represents a floating number of the following format: SEEEMMMM (S: sign E: exponent M: mantissa). The sign is 0 for positive and 1 for negative, exponent is stored in excess-4 notation, and the implied binary point is to the left of mantissa.
 - What are the maximal and the minimal positive numbers that can be represented by this format?
 - Write a function in the C programming language to print the bit pattern (higher order bits on the left) of an 8-bit character. This function should take a character as its argument and print the bit pattern of this character to the standard output.
5. Bubble sort 20%
- An array contains eight elements (7, 8, 26, 44, 13, 23, 57, 98). The first two elements have been sorted using a bubble sort. What would be the value of the elements in the array after one more passes of the bubble sort algorithm? Use the version of bubble sort that starts from the end and bubbles the smallest element.
 - Analyze the time complexity of bubble sort and give a big-O notation.