Question 1

Not yet answered

Marked out of 1

Consider the following sets:

- $A = \{(x, y) \in \mathbb{R}^2 : x \neq y^2\}$,
- $B = \{(x, y, z) \in \mathbb{R}^3 : x^2 + y^2 + z^2 > 9\}$,
- $C = (-3, -2) \cup (-2, 3)$,
- $D = \{(x, y) \in \mathbb{R}^2 : 0 < x^2 + y^2 < 1\}$.

For each function choose the set which corresponds to the domain of that function.

$f(x, y) = \frac{x-3y+7}{x-y^2}$ Choose...

$f(x, y) = (\log(1 - x^2 - y^2), x, (x^2 + y^2)^{-1})$ Choose...

$f(x) = ((x - 2)/(x + 2), \log(9 = x^2))$ Choose...

$f(x, y, z) = \log(x^2 + y^2 + z^2 - 3^2)$ Choose...

Question 2

Not yet answered

Marked out of 1

Calculate the partial derivatives of the function

$$f(x, y) = \int_x^y \cos t^2 \, dt.$$

Choose the correct answers from the following:

- a. $\cos(x)$
- b. $\cos(y^2)$
- c. $-\cos(x^2)$
- d. $\sin(x)$
- e. $\sin(y^2)$
- f. $-\sin(x^2)$

$\frac{\partial f}{\partial x}(x, y) =$? Choose...

$\frac{\partial f}{\partial y}(x, y) =$? Choose...

Question 3

Not yet answered

Marked out of 1

Assume that the coefficients a_k are such that $\sum_{k=0}^{\infty} a_k x^k$ converges when $x = -2$ and diverges when $x = 3$.

$\sum_{k=0}^{\infty} a_k 7^k$ Choose...

$\sum_{k=0}^{\infty} a_k$ Choose...

$\sum_{k=0}^{\infty} a_k (-4)^k$ Choose...

$\sum_{k=0}^{\infty} a_k (-3)^k$ Choose...

Question 4

Not yet answered

Marked out of 10

Consider the sequence of maps,

$$f_n(x) = \arctan(nx), \quad x \in \mathbb{R}.$$

1. The sequence converges pointwise on $\mathbb{R}$?
2. The sequence converges pointwise on $[1, \infty)$?
3. The sequence converges uniformly on $\mathbb{R}$?
4. The sequence converges uniformly on $[1, \infty)$?
5. For each n, the function f_n is continuous on $\mathbb{R}$?
6. The limit function is continuous on $\mathbb{R}$?
7. The limit function is constant on $(-1, 1)$?
8. The limit function is constant on $(0, \infty)$?
9. The limit function is constant on $(-\infty, 0)$?
10. The sequence converges pointwise to an unbounded function?

Question 5

Not yet answered

Marked out of 3

Calculate the gradient of the function

$$f(x, y) = \arctan \tfrac{x+y}{x-y}.$$

$$\nabla f(x, y) = \left(-\frac{\boxed{\text{a}}}{x^{\boxed{\text{c}}} + y^{\boxed{\text{c}}}}, \frac{\boxed{\text{b}}}{x^{\boxed{\text{c}}} + y^{\boxed{\text{c}}}} \right)$$

The missing symbols are: $\boxed{\text{a}}$: , $\boxed{\text{b}}$: , $\boxed{\text{c}}$: .

Question 6

Not yet answered

Marked out of 4

Let

$$f(s, t) = \sqrt{s + t},$$
$$g(x, y) = xy\mathbf{i} + \tfrac{x}{y}\mathbf{j}.$$

Compute the gradient of the composition of the two functions:

$$\nabla(f \circ g)(x, y) = \left(\frac{1}{\boxed{\text{a}}} \sqrt{\frac{\boxed{\text{b}}}{xy^2 + x}} \left(y + \tfrac{1}{y}, \right), \frac{1}{\boxed{\text{a}}} \sqrt{\frac{\boxed{\text{b}}}{xy^2 + x}} \left(\boxed{\text{c}} - \frac{\boxed{\text{d}}}{y^2}, \right) \right)$$

. The missing symbols are: $\boxed{\text{a}}$: , $\boxed{\text{b}}$: , $\boxed{\text{c}}$: , $\boxed{\text{d}}$: .

Question 7

Not yet answered

Marked out of 2

Write as a Maclaurin series the following indefinite integral:

$$\int \sin(x^2)\, dx.$$

The Maclaurin series of the integral is:

$$C + \sum_{k=0}^{\infty} \frac{(-1)^k}{(4k+\boxed{\text{b}})(2k+1)!} x^{\boxed{\text{a}}k+3}$$

where the missing coefficients are a: , b: .

Question 8

Not yet answered

Marked out of 4

The Jacobian matrix of the function

$$f(x,y) = e^{2x+y}\mathbf{i} + \cos(x+2y)\mathbf{j}$$

is

$$\mathbf{J}f(x,y) = \begin{pmatrix} \boxed{\text{a}}\exp(2x+y) & \boxed{\text{b}}\exp(\boxed{\text{c}}x+y) \\ -\sin(x+2y) & \boxed{\text{d}}\sin(x+2y) \end{pmatrix}$$

where the missing coefficients are a: , b: , c: , d: .

Question 9

Not yet answered

Marked out of 3

Find the Maclaurin series (Taylor series around the point $x_0 = 0$) of the following function and compute the radius of convergence:

$$f(x) = \log \tfrac{1+x}{1-x}.$$

The Maclaurin series is:

$$\sum_{k=0}^{\infty} \frac{\boxed{\text{a}}}{2k+\boxed{\text{b}}} x^{2k+1}$$

where the missing coefficients are a: , b: . The radius of convergence is $R =$. Hint: use the expansion of $\log(1+t)$.

Question 10

Not yet answered

Marked out of 2

The partial derivatives of the function

$$f(x,y) = \sqrt{3x+y^2},$$

at the point $(x_0, y_0) = (1,2)$ are

$$\frac{\partial f}{\partial x}(1,2) = \frac{\boxed{\text{b}}}{2\sqrt{7}}, \quad \frac{\partial f}{\partial y}(1,2) = \frac{2}{\sqrt{\boxed{\text{a}}}},$$

where the missing coefficients are a: , b: .

Question 11

Not yet answered

Marked out of 2

The partial derivatives of the function

$$g(x,y,z) = ye^{x+yz},$$

at the point $(x_0, y_0, z_0) = (0, 1, -1)$ are

$$\frac{\partial g}{\partial x}(0,1,-1) = e^{\boxed{\text{a}}}, \quad \frac{\partial g}{\partial x}(0,1,-1) = \boxed{\text{b}},$$
$$\frac{\partial g}{\partial x}(0,1,-1) = e^{\boxed{\text{a}}}$$

where the missing coefficients are $\boxed{\text{a}}$: , $\boxed{\text{b}}$: .

Question 12

Not yet answered

Marked out of 5

Consider the power series:

$$\sum_{k=2}^{\infty} (-1)^k \frac{x^k}{3^k \log k}.$$

The radius of convergence is $R =$ and the set of convergence is the interval $I =$, .

Question 13

Not yet answered

Marked out of 5

Consider the power series:

$$\sum_{k=0}^{\infty} k^2 (x-4)^k.$$

The radius of convergence is $R =$ and the set of convergence is the interval $I =$, .

Question 14

Not yet answered

Marked out of 3

Identify and classify the stationary points of the function

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

There are local minima, local maxima and saddle point(s).

Question 15

Not yet answered

Marked out of 3

Identify and classify the stationary points of the function

$$f(x,y) = xye^{-x/5 - y/6}.$$

There are local minima, local maxima and saddle point(s).

Question 16

Not yet answered

Marked out of 3

Find the Taylor series of the function $f(x) = \frac{1}{x}$ about the point $x_0 = 1$ and determine the radius of convergence of the series.
The Taylor series is:

$$\sum_{k=0}^{\infty} (\boxed{\text{a}})^k (x-1)^{\boxed{\text{b}}},$$

where the missing coefficients is $\boxed{\text{a}}$: [ ] and the missing symbol is $\boxed{\text{b}}$: [ ]. The radius of convergence is $R =$ [ ].

Question 17

Not yet answered

Marked out of 1

Let p be a positive integer. Find, as a function of p, the radius of convergence of

$$\sum_{k=0}^{\infty} \frac{(k!)^p}{(pk)!} x^k.$$

Select one:

- a. 0
- b. ∞
- c. 1
- d. $1/p$
- e. $p!$
- f. p^p

Question 18

Not yet answered

Marked out of 10

Consider the sequence of functions

$$f_n(x) = \frac{nx}{1+n^3x^3},$$

defined for $x \in [0, \infty)$.

- Sketch the functions for a couple of choices of n,
- Determine the limit function,
- Determine the sets of pointwise and uniform convergence.

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Question 19

Not yet answered

Marked out of 10

Sketch the following sets and determine the interior, the closure and the boundary. Identify if the sets are open, closed, connected, convex or bounded.

- $A = \{(x, y) \in \mathbb{R}^2 : 0 \leq x \leq 1, 0 < y < 1\}$,
- $B = (\{x^2 + y^2 \leq 4\} \setminus ([-1, 1] \times \{0\})) \cup ((-1, 1) \times \{3\})$,
- $C = \{(x, y) \in \mathbb{R}^2 : |y| > 2\}$.

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Question 20

Not yet answered

Marked out of 10

Determine the Taylor polynomial of order two for the function

$$f(x, y) = \cos x \cos y$$

at the point $(x_0, y_0) = (0, 0)$.

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