Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 1

Exercise 1

Given the functions

$f(x_1, x_2, x_3, x_4) = (-2 + x_2 x_4 + 2 x_3 x_4 + 2 x_4^2, -3 x_1^2 - x_1 x_2 + 3 x_3 + x_3^2 - 2 x_4)$

and

$g(u, v) = (-u - 3 u^2 + v - 3 u v, -1 - u^2 - 2 v + 3 u v + v^2, 3 - 3 u - u^2 + 3 v + 3 u v + v^2, -2 + 2 u^2 - v - u v - 2 v^2)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (0, 1, 3, 3)$.

1) -0.473363

2) -0.800147

3) 0.213585

4) 0.

5) -0.247397

Exercise 2

Given the system

$-2 u^2 x_3 + 2 u x_4^2 == -42$
$3 u x_2 x_3 + x_2^2 x_3 == -16$
$u x_1 x_2 - u x_1 x_3 == -40$
$-3 u x_3 + 2 x_2^2 x_3 == -140$

determine if it is possible to solve for variables x_1, x_2, x_3, x_4 in terms of variable u arround the point $p = (x_1, x_2, x_3, x_4, u) = (5, 4, -4, -5, -1)$. Compute if possible $\frac{\partial x_2}{\partial u}(-1)$.

1) $\frac{\partial x_2}{\partial u}(-1) = -\frac{144}{37}$

2) $\frac{\partial x_2}{\partial u}(-1) = -\frac{141}{37}$

3) $\frac{\partial x_2}{\partial u}(-1) = -\frac{143}{37}$

4) $\frac{\partial x_2}{\partial u}(-1) = -\frac{140}{37}$

5) $\frac{\partial x_2}{\partial u}(-1) = -\frac{142}{37}$

Exercise 3

Given the function

$f(x, y, z) = -7 + 4x - x^2 + 4y - y^2 - z^2$ defined over the domain $D \equiv \frac{x^2}{9} + \frac{y^2}{9} + \frac{z^2}{25} \leqslant 1$, compute its absolute maxima and minima.

1) We have a maximum at {?, 1.8, 1.}

2) We have a maximum at {?, 2.8, 1.}

3) We have a maximum at {?, 1.4, -0.4}

4) We have a maximum at {1.2, 1., ?}

5) We have a maximum at {2, ?, 0}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 2

Exercise 1

Given the functions

$f(x_1, x_2, x_3, x_4) = (-1 - 3x_1 + 2x_3 + 2x_4^2, -x_1 + x_1^2 - 3x_1x_3 - 2x_4)$

and

$g(u, v) = (2u + 3u^2 - uv + 2v^2, -1 + u - 3u^2 + 2v + 2uv - 3v^2, -1 - u + v - 2uv + v^2, u + u^2 + 3v + 2uv + 3v^2),$

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (1, 2, -1, 3)$.

1) 0.354536

2) 0.436994

3) 0.543751

4) −0.775218

5) 0.

Exercise 2

Given the system

$3x_2 - ux_2^2 + 2x_1x_2x_4 == 65$

$-x_1x_2 + x_1^2x_3 + 3x_1x_3^2 - 3x_3x_4 == 105$

$2x_2^2 + 3x_1x_2^2 - 2x_1x_3x_4 == 145$

$2x_1x_3^2 == 50$

determine if it is possible to solve for variables x_1, x_2, x_3, x_4 in terms of variable u arround the point $p = (x_1, x_2, x_3, x_4, u) = (1, -5, -5, 2, -4)$. Compute if possible $\frac{\partial x_2}{\partial u}(-4)$.

1) $\frac{\partial x_2}{\partial u}(-4) = -\frac{141}{289}$

2) $\frac{\partial x_2}{\partial u}(-4) = -\frac{144}{289}$

3) $\frac{\partial x_2}{\partial u}(-4) = -\frac{142}{289}$

4) $\frac{\partial x_2}{\partial u}(-4) = -\frac{145}{289}$

5) $\frac{\partial x_2}{\partial u}(-4) = -\frac{143}{289}$

Exercise 3

Given the function

$f(x, y, z) = -16 + 2x - x^2 + 2y - y^2 + 6z - z^2$ defined over the domain D≡ $\frac{x^2}{16} + \frac{y^2}{25} + \frac{z^2}{4} \leqslant 1$, compute its absolute maxima and minima.

1) We have a minimum at {?, -5.06525, -0.255256}

2) We have a minimum at {?, 1, 3}

3) We have a minimum at {?, -5.06525, -0.355256}

4) We have a minimum at {?, -5.16525, -0.955256}

5) We have a minimum at {-1.1143, ?, -0.455256}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 3

Exercise 1

Given the functions

$f(x, y, z) = (-2x - 2z, -2y + 2y^2 - xz - 3yz)$

and

$g(u, v) = (-2 - 3u^2 - v + 3uv - 3v^2, 1 + 2u + 3u^2 + v + uv, -3 - 3u + 2u^2 + 2v - 3uv + 3v^2)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (-3, -2, -2)$.

1) -0.164022

2) -0.877694

3) 0.572457

4) -0.19994

5) $0.$

Exercise 2

Given the system

$2z + 2yz - 3uyz == -40$
$2u^2y - 2xz + 2yz^2 - z^3 == -32$
$3u^3 - 3uxy == 0$

determine if it is possible to solve for variables x, y, z in terms of variable u arround the point $p = (x, y, z, u) = (-2, -2, -4, 2)$. Compute if possible $\frac{\partial x}{\partial u}(2)$.

1) $\frac{\partial x}{\partial u}(2) = -\frac{47}{16}$

2) $\frac{\partial x}{\partial u}(2) = -\frac{49}{16}$

3) $\frac{\partial x}{\partial u}(2) = -\frac{25}{8}$

4) $\frac{\partial x}{\partial u}(2) = -3$

5) $\frac{\partial x}{\partial u}(2) = -\frac{51}{16}$

Exercise 3

Given the function

$f(x, y, z) = 7 - x^2 - y^2 + 2z - z^2$ defined over the domain $D \equiv \frac{x^2}{9} + \frac{y^2}{4} + \frac{z^2}{4} \leqslant 1$, compute its absolute maxima and minima.

1) We have a maximum at {0.2, 0.1, ?}

2) We have a maximum at {0.3, -0.5, ?}

3) We have a maximum at {-0.4, ?, 1.4}

4) We have a maximum at {0, 0, ?}

5) We have a maximum at {?, -0.5, 0.6}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 4

Exercise 1

Given the functions

$f(x_1, x_2, x_3, x_4) = (-2 + 2x_2 - 3x_2x_3, 3x_1^2 + 3x_3 - 3x_1x_4 - 3x_2x_4 - 3x_4^2, x_2 + 3x_1x_3 - 3x_2x_3 + x_3^2, 2x_1 - 3x_1x_2 + 3x_1x_3 + 2x_4 - 2x_1x_4 - x_3x_4)$

and

$g(u_1, u_2, u_3, u_4) = (2 - 3u_2 + 2u_2u_4 + 2u_3u_4 - u_4^2, -u_1u_2 + u_1u_3 + 3u_3u_4, -u_2 + 3u_2^2 - 3u_2u_3 - 3u_1u_4, -3u_1 + u_2 - u_1u_2 - 3u_1u_3 + u_3^2 + u_4)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (0, -2, 1, 0)$.

1) $-537423.$

2) -3.71312×10^6

3) -2.01447×10^6

4) -3.84555×10^6

5) -2.41919×10^6

Exercise 2

Given the system

$3wx_2x_4 == -9$

$-3wx_1^2 + 2vx_2^2 - 2u^2x_4 == 235$

$-3x_2x_3 + 3x_1x_3^2 + x_1x_2x_4 == 71$

$3x_1x_4^2 == 15$

determine if it is possible to solve for variables x_1, x_2, x_3, x_4 in terms of variables u, v, w arround the point $p = (x_1, x_2, x_3, x_4, u, v, w) = (5, -1, 2, -1, 2, 1, -3)$. Compute if possible $\frac{\partial x_3}{\partial w}(2, 1, -3)$.

1) $\frac{\partial x_3}{\partial w}(2, 1, -3) = -\frac{1663}{7056}$

2) $\frac{\partial x_3}{\partial w}(2, 1, -3) = -\frac{79}{336}$

3) $\frac{\partial x_3}{\partial w}(2, 1, -3) = -\frac{1661}{7056}$

4) $\frac{\partial x_3}{\partial w}(2, 1, -3) = -\frac{277}{1176}$

5) $\frac{\partial x_3}{\partial w}(2, 1, -3) = -\frac{415}{1764}$

Exercise 3

Given the function

$f(x, y, z) = -26 + 6x - x^2 + 6y - y^2 + 2z - z^2$ defined over the domain $D \equiv \frac{x^2}{16} + \frac{y^2}{16} + \frac{z^2}{4} \leqslant 1$, compute its absolute maxima and minima.

1) We have a minimum at {?, -2.9217, -0.437879}

2) We have a minimum at {?, -3.0217, -0.537879}

3) We have a minimum at {-2.4217, ?, -0.237879}

4) We have a minimum at {3, ?, 1}

5) We have a minimum at {-2.8217, -2.8217, ?}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 5

Exercise 1

Given the functions

$f(x, y) = (2x - 2x^2 + 3y + 3xy - 3y^2,$
$-2x + x^2 + xy + y^2, 1 + 3x + x^2 + 3xy + y^2, 2x + 2x^2 - 3y - 3xy - 2y^2)$

and

$g(u_1, u_2, u_3, u_4) = (2u_1^2 + 2u_2 + 3u_1u_2 - u_3u_4, -u_2 - 2u_1u_2 - 3u_1u_3 - u_2u_3 + 3u_4),$

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (-1, -3)$.

1) -1.03439×10^6

2) -2.25482×10^6

3) $-400898.$

4) -1.54075×10^6

5) -2.53851×10^6

Exercise 2

Given the system

$-2xy^2 == -32$
$-xu_1u_2 + 3xyu_4 == 56$

determine if it is possible to solve for variables x, y in terms of variables u_1, u_2, u_3, u_4, u_5 arround the point $p = (x, y, u_1, u_2, u_3, u_4, u_5) = (1, 4, 2, 2, 4, 5, 4)$. Compute if possible $\frac{\partial x}{\partial u_4}(2, 2, 4, 5, 4)$.

1) $\frac{\partial x}{\partial u_4}(2, 2, 4, 5, 4) = -\frac{4}{13}$

2) $\frac{\partial x}{\partial u_4}(2, 2, 4, 5, 4) = -\frac{5}{13}$

3) $\frac{\partial x}{\partial u_4}(2, 2, 4, 5, 4) = -\frac{6}{13}$

4) $\frac{\partial x}{\partial u_4}(2, 2, 4, 5, 4) = -\frac{2}{13}$

5) $\frac{\partial x}{\partial u_4}(2, 2, 4, 5, 4) = -\frac{3}{13}$

Exercise 3

Given the function

$f(x, y, z) = -12 + 6x - x^2 + 4y - y^2 - z^2$ defined over the domain D≡ $\frac{x^2}{4} + \frac{y^2}{16} + \frac{z^2}{9} \leqslant 1$, compute its absolute maxima and minima.

1) We have a maximum at {3, 2, ?}

2) We have a maximum at {1.98714, 1.35519, ?}

3) We have a maximum at {2.52909, ?, 0.361299}

4) We have a maximum at {2.70974, 1.17454, ?}

5) We have a maximum at {?, 1.71649, 0.}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 6

Exercise 1

Given the functions

$f(x,y) = (-3 - 3x + 3x^2 - 3y^2,\ 2 - 2x^2 + 2y - 2xy + 3y^2,\ 3 - 2x - 2x^2 - xy)$

and

$g(u,v,w) = (-2 - 2u^2 - 2uv + 2v^2,\ u + 3u^2 - 3v - uv - w + w^2)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (1, -2)$.

1) $-301\,284.$

2) $-166\,684.$

3) $-547\,890.$

4) $-114\,833.$

5) $-98\,917.4$

Exercise 2

Given the system

$-u v^2 - 2 u x - v x^2 - w y^2 == -20$
$v x - 2 y == 2$

determine if it is possible to solve for variables x, y in terms of variables u, v, w arround the point $p = (x, y, u, v, w) = (0, -1, 1, -5, -5)$. Compute if possible $\frac{\partial x}{\partial u}(1, -5, -5)$.

1) $\frac{\partial x}{\partial u}(1, -5, -5) = \frac{29}{23}$

2) $\frac{\partial x}{\partial u}(1, -5, -5) = \frac{28}{23}$

3) $\frac{\partial x}{\partial u}(1, -5, -5) = \frac{26}{23}$

4) $\frac{\partial x}{\partial u}(1, -5, -5) = \frac{27}{23}$

5) $\frac{\partial x}{\partial u}(1, -5, -5) = \frac{25}{23}$

Exercise 3

Given the function

$f(x,y,z) = 23 - 2x + x^2 - 6y + y^2 - 6z + z^2$ defined over the domain D≡ $\frac{x^2}{25} + \frac{y^2}{25} + \frac{z^2}{9} \leqslant 1$, compute its absolute maxima and minima.

1) We have a maximum at {-1.21914, -4.35741, ?}

2) We have a maximum at {-1.51914, ?, -0.831877}

3) We have a maximum at {-1.91914, -4.75741, ?}

4) We have a maximum at {?, 3, 3}

5) We have a maximum at {-1.11914, ?, -1.03188}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 7

Exercise 1

Given the functions

$f(x, y, z) = (-1 - 2x^2, -3z + xz)$

and

$g(u, v) = (1 - u + 3u^2 - 2v + 3uv + 2v^2, -1 - u - 3u^2 - 3v - 2uv - 2v^2, 2 + 3u^2 + 3v - uv + 2v^2)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (-1, -1, 0)$.

1) 0.786646

2) −0.552676

3) 0.

4) 0.144858

5) −0.687152

Exercise 2

Given the system

$x z == 20$
$-3 y u_3 + 3 z u_4^2 == -90$
$3 z + 3 y z u_1 == -315$

determine if it is possible to solve for variables x, y, z in terms of variables u_1, u_2, u_3, u_4 arround the point $p = (x, y, z, u_1, u_2, u_3, u_4) = (-4, 5, -5, 4, -1, 5, -1)$. Compute if possible $\frac{\partial x}{\partial u_1}(4, -1, 5, -1)$.

1) $\frac{\partial x}{\partial u_1}(4, -1, 5, -1) = -\frac{19}{17}$

2) $\frac{\partial x}{\partial u_1}(4, -1, 5, -1) = -1$

3) $\frac{\partial x}{\partial u_1}(4, -1, 5, -1) = -\frac{20}{17}$

4) $\frac{\partial x}{\partial u_1}(4, -1, 5, -1) = -\frac{18}{17}$

5) $\frac{\partial x}{\partial u_1}(4, -1, 5, -1) = -\frac{16}{17}$

Exercise 3

Given the function

$f(x, y, z) = 5 + x^2 - 6y + y^2 - 4z + z^2$ defined over the domain D≡ $\frac{x^2}{25} + \frac{y^2}{9} + \frac{z^2}{25} \leqslant 1$, compute its absolute maxima and minima.

1) We have a minimum at {-0.552966, 3.04132, ?}

2) We have a minimum at {0., ?, 1.94058}

3) We have a minimum at {-1.10593, 3.59428, ?}

4) We have a minimum at {1.10593, ?, 2.77003}

5) We have a minimum at {0, ?, 2}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 8

Exercise 1

Given the functions

$f(x, y, z) = (2x - xy - xz, 2y + 3y^2 - 2xz)$

and

$g(u, v) = (3 - 3u + u^2 - 2v - 3uv - v^2, 2u - 3u^2 + 2v - 3uv - 3v^2, 3u + v + 3uv + 2v^2)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (-2, -2, 3)$.

1) 0.553221

2) 0.

3) -0.812341

4) -0.448928

5) 0.829352

Exercise 2

Given the system

$-3ux^2 - uy^2 + u^2 z + 3z^2 == 127$
$-3u - 2y - 2y^2 + z^2 + 3z^3 == 402$
$-2uy^2 + xy^2 - 2uyz == -16$

determine if it is possible to solve for variables x, y, z in terms of variable u arround the point $p = (x, y, z, u) = (2, -2, 5, -2)$. Compute if possible $\frac{\partial y}{\partial u}(-2)$.

1) $\frac{\partial y}{\partial u}(-2) = \frac{6284}{817}$

2) $\frac{\partial y}{\partial u}(-2) = \frac{12569}{1634}$

3) $\frac{\partial y}{\partial u}(-2) = \frac{6285}{817}$

4) $\frac{\partial y}{\partial u}(-2) = \frac{12571}{1634}$

5) $\frac{\partial y}{\partial u}(-2) = \frac{12567}{1634}$

Exercise 3

Given the function

$f(x, y, z) = -19 + 2x - x^2 + 6y - y^2 - z^2$ defined over the domain D≡ $\frac{x^2}{25} + \frac{y^2}{9} + \frac{z^2}{4} \leqslant 1$, compute its absolute maxima and minima.

1) We have a minimum at {1, ?, 0}

2) We have a minimum at {-4.54108, -1.2555, ?}

3) We have a minimum at {-4.74108, ?, -0.3}

4) We have a minimum at {-4.64108, ?, 0.1}

5) We have a minimum at {-4.34108, -1.0555, ?}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 9

Exercise 1

Given the functions

$f(x_1, x_2, x_3, x_4) = (x_1 x_4 + 2 x_2 x_4, -x_1^2 - 2 x_3 + 2 x_2 x_3 - x_4 + x_1 x_4)$

and

$g(u, v) = (2 + 3u - 2v - 2uv - 3v^2, 3u - 2u^2 - v - 3uv + 3v^2, 3 + u + 2u^2 - v + 3uv + v^2, -2u + u^2 - 3v - 3uv),$

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (3, -1, 2, 1)$.

1) 0.648598

2) 0.453256

3) −0.362701

4) 0.

5) −0.403714

Exercise 2

Given the system

$-3 x_2^2 x_4 == 3$
$u^2 + u x_2^2 - 2 x_2^3 - 2 u x_1 x_3 - 2 x_2^2 x_3 - 2 x_1 x_3 x_4 - 2 x_2 x_4^2 == -6$
$2 u^2 - 2 u x_2^2 + x_1 x_2^2 + 3 u x_2 x_4 + x_3 x_4 + 2 x_2 x_4^2 + x_4^3 == -5$
$-2 x_1^2 x_2 - 3 x_3^3 == 5$

determine if it is possible to solve for variables x_1, x_2, x_3, x_4 in terms of variable u arround the point $p = (x_1, x_2, x_3, x_4, u) = (-2, -1, 1, -1, -1)$. Compute if possible $\frac{\partial x_4}{\partial u}(-1)$.

1) $\frac{\partial x_4}{\partial u}(-1) = \frac{134}{331}$

2) $\frac{\partial x_4}{\partial u}(-1) = \frac{136}{331}$

3) $\frac{\partial x_4}{\partial u}(-1) = \frac{135}{331}$

4) $\frac{\partial x_4}{\partial u}(-1) = \frac{137}{331}$

5) $\frac{\partial x_4}{\partial u}(-1) = \frac{133}{331}$

Exercise 3

Given the function

$f(x, y, z) = 19 + x^2 + y^2 - 6z + z^2$ defined over the domain D≡ $\frac{x^2}{25} + \frac{y^2}{16} + \frac{z^2}{25} \leqslant 1$, compute its absolute maxima and minima.

1) We have a maximum at {0.4, ?, -5.4}

2) We have a maximum at {0.2, ?, -5.4}

3) We have a maximum at {-0.5, -0.4, ?}

4) We have a maximum at {0., 0., ?}

5) We have a maximum at {0, 0, ?}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 10

Exercise 1

Given the functions

$f(x_1, x_2, x_3, x_4) = (-2 x_2^2 - 3 x_3 + 3 x_2 x_3 + 3 x_2 x_4 - 2 x_3 x_4$
$, 2 - 2 x_1^2 - 2 x_3^2 + x_1 x_4 - 2 x_2 x_4, -x_1^2 + 3 x_2 - 3 x_1 x_3 - 2 x_1 x_4)$

and

$g(u, v, w) = (-3 u v - 2 w^2, -u + 3 u w + 2 v w, 3 u^2 - 2 u v - 3 w, 2 + 3 v - 3 v^2 + 2 u w + 3 w^2)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (0, -1, -1, 0)$.

1) 0.

2) -0.16867

3) -0.856047

4) 0.362694

5) 0.315744

Exercise 2

Given the system

$-3 v^2 + 3 v x_3 + v x_4 == -57$
$2 x_1 x_2 - 2 v x_3 + 2 u x_1 x_4 == 56$
$-3 x_1^3 + 3 x_4^3 == -378$
$3 u x_1^2 + 2 u v x_4 == -66$

determine if it is possible to solve for variables x_1, x_2, x_3, x_4 in terms of variables u, v arround the point $p = (x_1, x_2, x_3, x_4, u, v) = (1, 3, 5, -5, -2, -3)$. Compute if possible $\frac{\partial x_1}{\partial v}(-2, -3)$.

1) $\frac{\partial x_1}{\partial v}(-2, -3) = \frac{127}{72}$

2) $\frac{\partial x_1}{\partial v}(-2, -3) = \frac{125}{72}$

3) $\frac{\partial x_1}{\partial v}(-2, -3) = \frac{7}{4}$

4) $\frac{\partial x_1}{\partial v}(-2, -3) = \frac{43}{24}$

5) $\frac{\partial x_1}{\partial v}(-2, -3) = \frac{16}{9}$

Exercise 3

Given the function

$f(x, y, z) = -6 + 2x - x^2 + 4y - y^2 + 2z - z^2$ defined over the domain D≡ $\frac{x^2}{16} + \frac{y^2}{9} + \frac{z^2}{4} \leqslant 1$, compute its absolute maxima and minima.

1) We have a maximum at {0.8, 2.4, ?}

2) We have a maximum at {2., 3., ?}

3) We have a maximum at {1, 2, ?}

4) We have a maximum at {1.2, ?, 0.2}

5) We have a maximum at {1.8, ?, 0.6}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 11

Exercise 1

Given the functions

$f(x_1, x_2, x_3, x_4) = (3x_1 - 2x_2 + 3x_1x_3 - 3x_3^2 + 2x_4 + 2x_3x_4, 2x_1x_2 - 2x_2x_3 + 3x_1x_4 - 2x_4^2, 3x_2 - 3x_1x_2 + 3x_3)$

and

$g(u, v, w) = (1 - w, 3v^2 + uw + 3w^2, -uv - w + 3vw - 2w^2, -uv - w^2)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (1, 2, 3, -2)$.

1) 0.141403

2) −0.701602

3) 0.

4) 0.349957

5) −0.688989

Exercise 2

Given the system

$2x_1^2x_3 == -32$
$-3x_2^2 + vx_3 - 3vx_1x_4 + 2vx_4^2 == -56$
$-2x_2^2 + 3x_1x_2x_4 == 40$
$2ux_1x_2 - 2ux_3^2 - 2x_3x_4^2 == 120$

determine if it is possible to solve for variables x_1, x_2, x_3, x_4 in terms of variables u, v arround the point $p = (x_1, x_2, x_3, x_4, u, v) = (2, 4, -4, 3, -3, 2)$. Compute if possible $\frac{\partial x_1}{\partial u}(-3, 2)$.

1) $\frac{\partial x_1}{\partial u}(-3, 2) = -\frac{50}{1069}$

2) $\frac{\partial x_1}{\partial u}(-3, 2) = -\frac{48}{1069}$

3) $\frac{\partial x_1}{\partial u}(-3, 2) = -\frac{46}{1069}$

4) $\frac{\partial x_1}{\partial u}(-3, 2) = -\frac{47}{1069}$

5) $\frac{\partial x_1}{\partial u}(-3, 2) = -\frac{49}{1069}$

Exercise 3

Given the function

$f(x, y, z) = 20 - 4x + x^2 - 4y + y^2 - 6z + z^2$ defined over the domain D≡ $\frac{x^2}{25} + \frac{y^2}{16} + \frac{z^2}{9} \leqslant 1$, compute its absolute maxima and minima.

1) We have a maximum at {?, -1.15324, -0.878188}

2) We have a maximum at {?, 2, 3}

3) We have a maximum at {?, -1.65324, -0.678188}

4) We have a maximum at {?, -1.75324, -1.07819}

5) We have a maximum at {?, -1.55324, -0.978188}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 12

Exercise 1

Given the functions

$f(x_1, x_2, x_3, x_4) = (x_1^2 - 3x_2, -2 - 2x_1 + 3x_1^2 - x_1 x_3 - 2x_3^2)$

and

$g(u, v) = (-3 - 2u - 2u^2 + 2v - uv - v^2,$
$3 - u^2 + 2v - 3v^2, 2 - u^2 - 2v - uv - 3v^2, -3 - u^2 - 2v + 3uv + v^2),$

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (-2, -2, 3, 0)$.

1) 0.746848

2) 0.

3) 0.384822

4) −0.480347

5) −0.685713

Exercise 2

Given the system

$-u x_3^2 + 3 x_3^2 x_4 == -162$
$x_2 x_3^2 - 3 x_2 x_3 x_4 - x_3^2 x_4 == 81$
$2 x_1 - 3 x_2 x_3 - u^2 x_4 + x_1 x_4 + u x_1 x_4 == 18$
$x_1^2 + x_3^3 == -26$

determine if it is possible to solve for variables x_1, x_2, x_3, x_4 in terms of variable u arround the point $p = (x_1, x_2, x_3, x_4, u) = (1, -1, -3, -5, 3)$. Compute if possible $\frac{\partial x_3}{\partial u}(3)$.

1) $\frac{\partial x_3}{\partial u}(3) = -\frac{259}{3291}$

2) $\frac{\partial x_3}{\partial u}(3) = -\frac{86}{1097}$

3) $\frac{\partial x_3}{\partial u}(3) = -\frac{87}{1097}$

4) $\frac{\partial x_3}{\partial u}(3) = -\frac{262}{3291}$

5) $\frac{\partial x_3}{\partial u}(3) = -\frac{260}{3291}$

Exercise 3

Given the function

$f(x, y, z) = -10 - x^2 + 2y - y^2 + 4z - z^2$ defined over the domain $D \equiv \frac{x^2}{16} + \frac{y^2}{4} + \frac{z^2}{9} \leqslant 1$, compute its absolute maxima and minima.

1) We have a maximum at {?, 0.8, 2.2}

2) We have a maximum at {-0.8, 2., ?}

3) We have a maximum at {?, 2., 1.6}

4) We have a maximum at {-1., ?, 1.4}

5) We have a maximum at {0, 1, ?}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 13

Exercise 1

Given the functions

$f(x_1, x_2, x_3, x_4) = (3x_2 + 3x_2^2 + x_1 x_3 + 2x_3^2,\ 3 + 2x_1 + 3x_1^2 + 3x_2^2 - x_3^2 + x_1 x_4 - 3x_2 x_4,\ 2x_1^2 - x_2 x_3 - 2x_4^2)$

and

$g(u, v, w) = (-3u^2 + 2v,\ 3 - 2v - uw,\ 3u^2 + w - 3uw,\ -v - 3uv + 3uw)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (-2, -1, -3, -2)$.

1) 0.343582

2) −0.291923

3) 0.200508

4) 0.860313

5) 0.

Exercise 2

Given the system

$3u x_3 + 3u^2 x_4 == -78$
$2uv x_1 + 3v x_1^2 + v x_3 - u x_3^2 - 3x_2 x_4 == -158$
$2u x_4 + 3v x_1 x_4 == 208$
$2x_1^3 - 2x_2^2 x_4 == 328$

determine if it is possible to solve for variables x_1, x_2, x_3, x_4 in terms of variables u, v arround the point $p = (x_1, x_2, x_3, x_4, u, v) = (4, -5, 5, -4, -2, -4)$. Compute if possible $\frac{\partial x_2}{\partial u}(-2, -4)$.

1) $\frac{\partial x_2}{\partial u}(-2, -4) = \frac{4433}{1894}$

2) $\frac{\partial x_2}{\partial u}(-2, -4) = \frac{8863}{3788}$

3) $\frac{\partial x_2}{\partial u}(-2, -4) = \frac{8867}{3788}$

4) $\frac{\partial x_2}{\partial u}(-2, -4) = \frac{8865}{3788}$

5) $\frac{\partial x_2}{\partial u}(-2, -4) = \frac{2216}{947}$

Exercise 3

Given the function

$f(x, y, z) = 15 - 6x + x^2 - 4y + y^2 - 4z + z^2$ defined over the domain D≡ $\frac{x^2}{25} + \frac{y^2}{16} + \frac{z^2}{9} \leqslant 1$, compute its absolute maxima and minima.

1) We have a minimum at {2.66176, ?, 2.51474}

2) We have a minimum at {3, 2, ?}

3) We have a minimum at {4.14051, 3.13909, ?}

4) We have a minimum at {1.7745, 3.43484, ?}

5) We have a minimum at {2.95751, 1.95609, ?}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 14

Exercise 1

Given the functions

$f(x_1, x_2, x_3, x_4) = (-3 x_1 + 2 x_2 + x_1 x_2 - 2 x_3 - 3 x_3^2 - 3 x_2 x_4 - 3 x_3 x_4, -2 - x_2^2 - 3 x_1 x_3 - 3 x_2 x_3 - 3 x_1 x_4, -1 - x_1^2 - 3 x_1 x_2 - 2 x_3 + x_2 x_3 - 2 x_3^2 - 2 x_4 + 2 x_2 x_4 - x_4^2, 2 x_2 + 3 x_4 - 3 x_1 x_4 + 3 x_3 x_4 - 3 x_4^2)$

and

$g(u_1, u_2, u_3, u_4) = (3 u_1 - u_2 + u_1 u_4 + 2 u_4^2, 2 u_1 + u_1 u_2 + u_3 - 2 u_2 u_4, 3 u_1^2 + 2 u_2 - u_2 u_3 - 3 u_3^2 + 2 u_4, u_1 + 2 u_1^2 + 3 u_2^2 - u_2 u_3 + 3 u_4^2)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (-2, 3, 3, -1)$.

1) -1.62579×10^{12}

2) -1.47145×10^{12}

3) -4.55039×10^{11}

4) -4.40679×10^{11}

5) -2.12292×10^{11}

Exercise 2

Given the system

$v x_1 x_3 == 30$
$-v^2 w + 2 x_3^2 x_4 == 20$
$2 u x_3^2 - 2 x_1 x_4 == -20$
$3 v^2 x_2 + 2 v x_1 x_3 + x_2 x_3 x_4 == 60$

determine if it is possible to solve for variables x_1, x_2, x_3, x_4 in terms of variables u, v, w arround the point $p = (x_1, x_2, x_3, x_4, u, v, w) = (5, 0, -2, -2, -5, -3, -4)$. Compute if possible $\frac{\partial x_1}{\partial v}(-5, -3, -4)$.

1) $\frac{\partial x_1}{\partial v}(-5, -3, -4) = \frac{5}{2}$

2) $\frac{\partial x_1}{\partial v}(-5, -3, -4) = 3$

3) $\frac{\partial x_1}{\partial v}(-5, -3, -4) = \frac{9}{2}$

4) $\frac{\partial x_1}{\partial v}(-5, -3, -4) = 4$

5) $\frac{\partial x_1}{\partial v}(-5, -3, -4) = \frac{7}{2}$

Exercise 3

Given the function

$f(x, y, z) = 2 + 2x - x^2 + 2y - y^2 + 4z - z^2$ defined over the domain D≡ $\frac{x^2}{16} + \frac{y^2}{25} + \frac{z^2}{16} \leqslant 1$, compute its absolute maxima and minima.

1) We have a maximum at {2., ?, 1.8}

2) We have a maximum at {?, 1.6, 1.6}

3) We have a maximum at {1, ?, 2}

4) We have a maximum at {1.8, ?, 2.4}

5) We have a maximum at {0.4, ?, 3.}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 15

Exercise 1

Given the functions

$f(x, y, z) = (2y^2 - z + 2xz + yz, x - 2y + 3xy + 2xz, x^2 - xy - 2xz - yz, 3x^2 + 3y^2 + z + 3xz)$

and

$g(u_1, u_2, u_3, u_4) = (-3u_2^2 + u_3 - u_1 u_3 - u_2 u_3, 2 - 2u_1 + u_2^2 - 2u_3 + 3u_1 u_3, 2u_1 - 3u_2 - 3u_2 u_3 - 3u_3 u_4)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (3, -2, 3)$.

1) 6.84277×10^6

2) 4.27916×10^6

3) 6.95813×10^6

4) 3.75064×10^6

5) 6.04812×10^6

Exercise 2

Given the system

$y^2 z == 16$
$-3v^2 + 2v^2 x + 2y == -283$
$u + vy - 2wxy - uwz == -126$

determine if it is possible to solve for variables x, y, z in terms of variables u, v, w arround the point $p = (x, y, z, u, v, w) = (-4, -4, 1, 5, 5, 3)$. Compute if possible $\frac{\partial x}{\partial w}(5, 5, 3)$.

1) $\frac{\partial x}{\partial w}(5, 5, 3) = -\frac{73}{1027}$

2) $\frac{\partial x}{\partial w}(5, 5, 3) = -\frac{70}{1027}$

3) $\frac{\partial x}{\partial w}(5, 5, 3) = -\frac{72}{1027}$

4) $\frac{\partial x}{\partial w}(5, 5, 3) = -\frac{74}{1027}$

5) $\frac{\partial x}{\partial w}(5, 5, 3) = -\frac{71}{1027}$

Exercise 3

Given the function

$f(x, y, z) = 16 + x^2 - 4y + y^2 - 4z + z^2$ defined over the domain D≡ $\frac{x^2}{9} + \frac{y^2}{16} + \frac{z^2}{25} \leqslant 1$, compute its absolute maxima and minima.

1) We have a maximum at {-0.1, -1.30648, ?}

2) We have a maximum at {0., -1.60648, ?}

3) We have a maximum at {-0.2, ?, -4.67903}

4) We have a maximum at {-0.3, -1.10648, ?}

5) We have a maximum at {0, 2, ?}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 16

Exercise 1

Given the functions

$f(x_1, x_2, x_3, x_4) = (3 x_1 x_3 + x_4 + 2 x_2 x_4 + 2 x_3 x_4, x_1 x_3 + 2 x_2 x_3, 3 x_1 x_2 + 3 x_3 - x_3^2 - 3 x_4)$

and

$g(u, v, w) = (-2 w - 3 v w, -3 v + 3 u v, 3 u v, 3 - u + 3 w + 2 u w)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (0, 1, -3, -3)$.

1) 0.

2) 0.107575

3) −0.321766

4) 0.686089

5) −0.858098

Exercise 2

Given the system

$3 v^3 + 2 x_2 x_3^2 == -8$
$-3 x_1^2 x_2 == 48$
$-x_1 x_2 - 2 x_2 x_3^2 == 28$
$-3 x_1 x_3 - 3 x_3^2 x_4 == 48$

determine if it is possible to solve for variables x_1, x_2, x_3, x_4 in terms of variables u, v arround the point $p = (x_1, x_2, x_3, x_4, u, v) = (-4, -1, 4, 0, 5, 2)$. Compute if possible $\frac{\partial x_1}{\partial v}(5, 2)$.

1) $\frac{\partial x_1}{\partial v}(5, 2) = 37$

2) $\frac{\partial x_1}{\partial v}(5, 2) = 39$

3) $\frac{\partial x_1}{\partial v}(5, 2) = 36$

4) $\frac{\partial x_1}{\partial v}(5, 2) = 38$

5) $\frac{\partial x_1}{\partial v}(5, 2) = 40$

Exercise 3

Given the function

$f(x, y, z) = 8 - 2x + x^2 - 6y + y^2 - 2z + z^2$ defined over the domain D≡ $\frac{x^2}{25} + \frac{y^2}{16} + \frac{z^2}{9} \leqslant 1$, compute its absolute maxima and minima.

1) We have a maximum at {-3.35825, -2.91894, ?}

2) We have a maximum at {?, -2.41894, 0.0161122}

3) We have a maximum at {-3.75825, -2.51894, ?}

4) We have a maximum at {1, ?, 1}

5) We have a maximum at {?, -3.31894, 0.0161122}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 17

Exercise 1

Given the functions

$f(x, y) = (-2 + 3x - 2x^2 + y - xy - 2y^2, -2 + 2x - 3x^2 - 2y - 3xy - 3y^2)$

and

$g(u, v) = (-2u - 3u^2 + 2v - 3uv + 2v^2, 3u^2 + 3v + 2uv + v^2)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (2, -2)$.

1) -12740.3

2) -17553.5

3) $-31429.$

4) -48747.1

5) $-26048.$

Exercise 2

Given the system

$-3u^3 + 2v^2 + vx + v^2 x - 3x^2 - 2u^2 y - 2x^2 y == -309$
$-3u + u^3 - v^2 x + 2x^2 - 3xy + 2vxy == 124$

determine if it is possible to solve for variables x, y in terms of variables u, v arround the point $p = (x, y, u, v) = (-3, 1, 4, 5)$. Compute if possible $\frac{\partial y}{\partial v}(4, 5)$.

1) $\frac{\partial y}{\partial v}(4, 5) = \frac{35}{92}$

2) $\frac{\partial y}{\partial v}(4, 5) = \frac{37}{92}$

3) $\frac{\partial y}{\partial v}(4, 5) = \frac{39}{92}$

4) $\frac{\partial y}{\partial v}(4, 5) = \frac{19}{46}$

5) $\frac{\partial y}{\partial v}(4, 5) = \frac{9}{23}$

Exercise 3

Given the function

$f(x, y, z) = 15 + x^2 - 6y + y^2 - 4z + z^2$ defined over the domain D≡ $\frac{x^2}{25} + \frac{y^2}{25} + \frac{z^2}{4} \leqslant 1$, compute its absolute maxima and minima.

1) We have a minimum at {?, 3.47409, 1.34113}

2) We have a minimum at {0.289507, 3.18458, ?}

3) We have a minimum at {0, 3, ?}

4) We have a minimum at {0., 2.89507, ?}

5) We have a minimum at {-0.579015, 3.7636, ?}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 18

Exercise 1

Given the functions

$f(x_1, x_2, x_3, x_4) = (x_1 + 2x_2 + 2x_4, 3x_1 - 3x_1^2 + 3x_3 - x_1x_3 - 3x_2x_3 - x_3^2 - 2x_1x_4 + 2x_4^2)$

and

$g(u, v) = (-2 + u^2 - 2v + 2v^2, 3 - 3u + 3u^2 + 2v + uv - v^2, 3 - u + 2u^2 + v + uv - v^2, -3 + 2u + 3u^2 - 3v - 2uv - 3v^2)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (-1, 3, 2, -1)$.

1) 0.491201

2) 0.420936

3) −0.371159

4) −0.514105

5) 0.

Exercise 2

Given the system

$-3u - 3ux_2^2 - 2ux_1x_3 - 2x_2^2x_4 == 4$
$-ux_3x_4 + x_3^2x_4 + 2x_4^3 == 60$
$-2x_3^2 + x_3^3 + 3u^2x_4 - ux_4^2 == 2$
$u - 2x_1x_2x_3 == -5$

determine if it is possible to solve for variables x_1, x_2, x_3, x_4 in terms of variable u arround the point $p = (x_1, x_2, x_3, x_4, u) = (-1, 1, -2, 3, -1)$. Compute if possible $\frac{\partial x_2}{\partial u}(-1)$.

1) $\frac{\partial x_2}{\partial u}(-1) = -\frac{1104}{1201}$

2) $\frac{\partial x_2}{\partial u}(-1) = -\frac{2211}{2402}$

3) $\frac{\partial x_2}{\partial u}(-1) = -\frac{2209}{2402}$

4) $\frac{\partial x_2}{\partial u}(-1) = -\frac{1105}{1201}$

5) $\frac{\partial x_2}{\partial u}(-1) = -\frac{2207}{2402}$

Exercise 3

Given the function

$f(x, y, z) = 9 - 4x + x^2 - 2y + y^2 - 2z + z^2$ defined over the domain D≡ $\frac{x^2}{16} + \frac{y^2}{4} + \frac{z^2}{25} \leqslant 1$, compute its absolute maxima and minima.

1) We have a maximum at {-2.14149, -0.148462, ?}

2) We have a maximum at {-1.74149, ?, -3.90674}

3) We have a maximum at {-2.34149, ?, -4.00674}

4) We have a maximum at {2, 1, ?}

5) We have a maximum at {-2.04149, -0.0484624, ?}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 19

Exercise 1

Given the functions

$f(x, y) = (-2 + x - x^2 + 3y - 3y^2, 2 - x^2 - 3y + y^2, 1 - 3x + x^2 - 2y - 2xy - y^2)$

and

$g(u, v, w) = (v^2 - uw, 2u^2 + v)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (-2, 3)$.

1) -499439.

2) -327431.

3) -613758.

4) -538148.

5) -329455.

Exercise 2

Given the system

$v x^2 - w^2 y == -48$
$-v - w^3 - 3ux - wx^2 - 3x^3 - wy + 2vwy - 2y^2 == -149$

determine if it is possible to solve for variables x, y in terms of variables u, v, w arround the point $p = (x, y, u, v, w) = (4, 0, 0, -3, -2)$. Compute if possible $\frac{\partial y}{\partial u}(0, -3, -2)$.

1) $\frac{\partial y}{\partial u}(0, -3, -2) = \frac{19}{53}$

2) $\frac{\partial y}{\partial u}(0, -3, -2) = \frac{22}{53}$

3) $\frac{\partial y}{\partial u}(0, -3, -2) = \frac{18}{53}$

4) $\frac{\partial y}{\partial u}(0, -3, -2) = \frac{20}{53}$

5) $\frac{\partial y}{\partial u}(0, -3, -2) = \frac{21}{53}$

Exercise 3

Given the function

$f(x, y, z) = -21 - x^2 + 6y - y^2 + 4z - z^2$ defined over the domain D≡ $\frac{x^2}{25} + \frac{y^2}{4} + \frac{z^2}{9} \leqslant 1$, compute its absolute maxima and minima.

1) We have a maximum at {0., 1.72913, ?}

2) We have a maximum at {0.345827, ?, 2.37212}

3) We have a maximum at {-0.172913, ?, 1.68047}

4) We have a maximum at {?, 3, 2}

5) We have a maximum at {0.51874, 1.38331, ?}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 20

Exercise 1

Given the functions

$f(x,y) = (-3 - 3x + 3x^2 + 3xy + 3y^2,\ 3 + x + 2x^2 + y + 2xy + 2y^2,\ 3 - 2x + 2x^2 + 3y + 3xy - 3y^2)$

and

$g(u,v,w) = (-3u^2 - 2w + vw - w^2,\ uv + 3w - uw)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p=(1,0)$.

1) 252.571

2) 3284.37

3) 3230.66

4) 886.537

5) 2034.

Exercise 2

Given the system

$w^2 x - 2u^2 y + 3y^3 == 378$
$3v^2 + 2u^2 w - 2vw + 3v^2 x - 3uwx + 3vwx + 3uxy - 3wy^2 + y^3 == 364$

determine if it is possible to solve for variables x, y in terms of variables u, v, w arround the point $p=(x,y,u,v,w)=(3,5,0,4,-1)$. Compute if possible $\frac{\partial x}{\partial v}(0,4,-1)$.

1) $\frac{\partial x}{\partial v}(0,4,-1) = -\frac{1335}{533}$

2) $\frac{\partial x}{\partial v}(0,4,-1) = -\frac{1332}{533}$

3) $\frac{\partial x}{\partial v}(0,4,-1) = -\frac{1331}{533}$

4) $\frac{\partial x}{\partial v}(0,4,-1) = -\frac{1334}{533}$

5) $\frac{\partial x}{\partial v}(0,4,-1) = -\frac{1333}{533}$

Exercise 3

Given the function

$f(x, y, z) = 22 + x^2 - 6y + y^2 - 6z + z^2$ defined over the domain D≡ $\frac{x^2}{4} + \frac{y^2}{9} + \frac{z^2}{4} \leqslant 1$, compute its absolute maxima and minima.

1) We have a minimum at {-1.02262, ?, 0.645075}

2) We have a minimum at {0.409049, ?, 0.645075}

3) We have a minimum at {-0.409049, 1.22715, ?}

4) We have a minimum at {0., ?, 1.46317}

5) We have a minimum at {?, 3, 3}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 21

Exercise 1

Given the functions

$f(x, y, z) = (3y - 3y^2 + 2z, 2 + 3x^2, 3y^2 + 2z)$

and

$g(u, v, w) = (3 - uv, 2v + 3w, -2w + 2vw)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (0, 2, -1)$.

1) -0.563772

2) 0.

3) 0.511831

4) -0.842005

5) -0.760106

Exercise 2

Given the system

$x^2 y + 3 u_1^2 u_2 == -32$
$2 z u_3 - x^2 u_4 == 32$
$-2 x u_2^2 - z^2 u_3 + y u_1 u_4 == 108$

determine if it is possible to solve for variables x, y, z in terms of variables u_1, u_2, u_3, u_4 arround the point $p = (x, y, z, u_1, u_2, u_3, u_4) = (-4, 1, 2, 4, -1, 4, -1)$. Compute if possible $\frac{\partial z}{\partial u_4}(4, -1, 4, -1)$.

1) $\frac{\partial z}{\partial u_4}(4, -1, 4, -1) = \frac{38}{25}$

2) $\frac{\partial z}{\partial u_4}(4, -1, 4, -1) = \frac{36}{25}$

3) $\frac{\partial z}{\partial u_4}(4, -1, 4, -1) = \frac{39}{25}$

4) $\frac{\partial z}{\partial u_4}(4, -1, 4, -1) = \frac{8}{5}$

5) $\frac{\partial z}{\partial u_4}(4, -1, 4, -1) = \frac{37}{25}$

Exercise 3

Given the function

$f(x, y, z) = 15 + x^2 - 4y + y^2 - 6z + z^2$ defined over the domain D≡ $\frac{x^2}{9} + \frac{y^2}{25} + \frac{z^2}{9} \leqslant 1$, compute its absolute maxima and minima.

1) We have a minimum at {?, 1.94058, 2.76483}

2) We have a minimum at {?, 2, 3}

3) We have a minimum at {?, 2.21706, 1.38242}

4) We have a minimum at {?, 1.11113, 2.48835}

5) We have a minimum at {0.276483, ?, 1.93538}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 22

Exercise 1

Given the functions

$f(x, y) = (1 - 3x + 2x^2 - y - xy - 2y^2, 3 + 2x - 3x^2 + 2y - y^2, 2x - 3x^2 + 2y - xy + y^2)$

and

$g(u, v, w) = (3v - 3uv - w + w^2, 2v^2 - 3w)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (0, 0)$.

1) 58.6481

2) 436.879

3) 324.

4) 526.747

5) 517.258

Exercise 2

Given the system

$x^2 u_4 + 2 y u_1 u_4 + 3 x u_4^2 == 160$
$-3 x y == -18$

determine if it is possible to solve for variables x, y in terms of variables u_1, u_2, u_3, u_4 arround the point $p = (x, y, u_1, u_2, u_3, u_4) = (3, 2, 1, -5, -2, -5)$. Compute if possible $\frac{\partial x}{\partial u_3}(1, -5, -2, -5)$.

1) $\frac{\partial x}{\partial u_3}(1, -5, -2, -5) = 1$

2) $\frac{\partial x}{\partial u_3}(1, -5, -2, -5) = 4$

3) $\frac{\partial x}{\partial u_3}(1, -5, -2, -5) = 2$

4) $\frac{\partial x}{\partial u_3}(1, -5, -2, -5) = 0$

5) $\frac{\partial x}{\partial u_3}(1, -5, -2, -5) = 3$

Exercise 3

Given the function

$f(x, y, z) = 2 - 6x + x^2 + y^2 - 2z + z^2$ defined over the domain D≡ $\frac{x^2}{4} + \frac{y^2}{9} + \frac{z^2}{25} \leqslant 1$, compute its absolute maxima and minima.

1) We have a minimum at {2.35881, 0.589703, ?}

2) We have a minimum at {2.55538, -0.196568, ?}

3) We have a minimum at {2.16224, -0.786271, ?}

4) We have a minimum at {3, 0, ?}

5) We have a minimum at {1.96568, 0., ?}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 23

Exercise 1

Given the functions

$f(x,y) = (x + 3y - y^2, -1 - 3x - y - xy + y^2, -3 - x + x^2 + 3y + 2xy - 3y^2, 3x - x^2 + y - 2xy)$

and

$g(u_1, u_2, u_3, u_4) = (-2u_1^2 - u_2 - 2u_1u_2 + 3u_2^2 + 3u_3 + 3u_1u_3 - u_4 + u_4^2, -2u_3 + 3u_4 - 3u_1u_4 - 3u_4^2)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (-2, 2)$.

1) -11 776.3

2) -3268.54

3) -19 522.

4) -35 613.4

5) -5745.25

Exercise 2

Given the system

$-2xyu_1 - 2yu_2 - u_2^3 == -6$
$2xu_1^2 - 2yu_4^2 - u_2u_5^2 == 24$

determine if it is possible to solve for variables x, y in terms of variables u_1, u_2, u_3, u_4, u_5 arround the point $p = (x, y, u_1, u_2, u_3, u_4, u_5) = (3, -1, -1, 0, -1, 3, 3)$. Compute if possible $\frac{\partial y}{\partial u_3}(-1, 0, -1, 3, 3)$.

1) $\frac{\partial y}{\partial u_3}(-1, 0, -1, 3, 3) = 2$

2) $\frac{\partial y}{\partial u_3}(-1, 0, -1, 3, 3) = 4$

3) $\frac{\partial y}{\partial u_3}(-1, 0, -1, 3, 3) = 1$

4) $\frac{\partial y}{\partial u_3}(-1, 0, -1, 3, 3) = 0$

5) $\frac{\partial y}{\partial u_3}(-1, 0, -1, 3, 3) = 3$

Exercise 3

Given the function

$f(x, y, z) = -16 + 6x - x^2 + 4y - y^2 + 2z - z^2$ defined over the domain D≡ $\frac{x^2}{4} + \frac{y^2}{16} + \frac{z^2}{9} \leqslant 1$, compute its absolute maxima and minima.

1) We have a minimum at {-0.484209, -4.14681, ?}

2) We have a minimum at {-0.0842086, -3.84681, ?}

3) We have a minimum at {-0.584209, -3.74681, ?}

4) We have a minimum at {-0.0842086, ?, -0.0791279}

5) We have a minimum at {3, ?, 1}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 24

Exercise 1

Given the functions

$f(x, y, z) = (2 - 3z + z^2, -2x + x^2 - xy - y^2 - 3z + 3xz - 3z^2, -3 - 2y - 3xy + 2z^2)$

and

$g(u, v, w) = (3 - 3v + 2uw + 3vw + 2w^2, 3u + v - v^2 - w, -2w^2)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (0, 2, -1)$.

1) -22819.9

2) -57380.2

3) -17081.1

4) $-36000.$

5) -49789.9

Exercise 2

Given the system

$x^2 z == 4$

$y u_2 + 2 x u_4^2 == 4$

$-x z^2 == 16$

determine if it is possible to solve for variables x, y, z in terms of variables u_1, u_2, u_3, u_4 arround the point $p = (x, y, z, u_1, u_2, u_3, u_4) = (-1, -3, 4, 0, -2, 3, 1)$. Compute if possible $\frac{\partial y}{\partial u_2}(0, -2, 3, 1)$.

1) $\frac{\partial y}{\partial u_2}(0, -2, 3, 1) = -\frac{1}{2}$

2) $\frac{\partial y}{\partial u_2}(0, -2, 3, 1) = -1$

3) $\frac{\partial y}{\partial u_2}(0, -2, 3, 1) = -\frac{3}{2}$

4) $\frac{\partial y}{\partial u_2}(0, -2, 3, 1) = \frac{1}{2}$

5) $\frac{\partial y}{\partial u_2}(0, -2, 3, 1) = 0$

Exercise 3

Given the function

$f(x, y, z) = -31 + 4x - x^2 + 6y - y^2 + 6z - z^2$ defined over the domain D≡ $\frac{x^2}{9} + \frac{y^2}{25} + \frac{z^2}{9} \leqslant 1$, compute its absolute maxima and minima.

1) We have a minimum at {-0.563523, -4.70459, ?}

2) We have a minimum at {?, -4.20459, -1.04529}

3) We have a minimum at {?, -4.90459, -0.345285}

4) We have a minimum at {?, -4.60459, -0.545285}

5) We have a minimum at {2, 3, ?}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 25

Exercise 1

Given the functions

$f(x, y, z) = (-3y + 2y^2 - 2z + z^2, 1 - x - 3x^2 + 3yz)$

and

$g(u, v) = (2 + u - 3u^2 + v - 3uv, 1 - u - 3v - 2uv - v^2, -3 - u + 3v - 2uv + 2v^2)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (0, -2, 1)$.

1) 0.840211

2) 0.

3) −0.581992

4) 0.515225

5) 0.613692

Exercise 2

Given the system

$-u^3 - x + ux - 3y^3 + 3uyz == 197$
$2y^2 + 2xy^2 - 2y^3 + 2xz == -20$
$2uy^2 - 3yz + uyz + 2yz^2 == -8$

determine if it is possible to solve for variables x, y, z in terms of variable u arround the point $p = (x, y, z, u) = (-5, -4, 2, 0)$. Compute if possible $\frac{\partial x}{\partial u}(0)$.

1) $\frac{\partial x}{\partial u}(0) = \frac{258}{1739}$

2) $\frac{\partial x}{\partial u}(0) = \frac{257}{1739}$

3) $\frac{\partial x}{\partial u}(0) = \frac{260}{1739}$

4) $\frac{\partial x}{\partial u}(0) = \frac{7}{47}$

5) $\frac{\partial x}{\partial u}(0) = \frac{261}{1739}$

Exercise 3

Given the function

$f(x, y, z) = 31 - 6x + x^2 - 6y + y^2 - 4z + z^2$ defined over the domain D≡ $\frac{x^2}{9} + \frac{y^2}{4} + \frac{z^2}{4} \leqslant 1$, compute its absolute maxima and minima.

1) We have a maximum at {3, 3, ?}

2) We have a maximum at {?, -0.788442, -0.525628}

3) We have a maximum at {-2.24191, ?, -0.625628}

4) We have a maximum at {-2.44191, -1.28844, ?}

5) We have a maximum at {-2.14191, -1.08844, ?}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 26

Exercise 1

Given the functions

$f(x,y,z)=(3y, x^2-z, -z+3xz+2yz)$

and

$g(u,v,w)=(2-3u-v+3uw, -3u-2u^2-2v-3vw, 2uv+v^2+2uw-3vw)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p=(-1,-2,-2)$.

1) −293 746.

2) −382 008.

3) −344 790.

4) −231 516.

5) −77 570.1

Exercise 2

Given the system

$-u^2 v-2vy+3uxz==-467$

$v^2-uv^2-x^2+3y^2+2z-3x^2 z==-291$

$3xy-uy^2==-10$

determine if it is possible to solve for variables x, y, z in terms of variables u, v arround the point $p=(x,y,z,u,v)=(5,-1,5,-5,4)$. Compute if possible $\frac{\partial z}{\partial v}(-5,4)$.

1) $\frac{\partial z}{\partial v}(-5,4)=-\frac{37963}{32223}$

2) $\frac{\partial z}{\partial v}(-5,4)=-\frac{12654}{10741}$

3) $\frac{\partial z}{\partial v}(-5,4)=-\frac{12655}{10741}$

4) $\frac{\partial z}{\partial v}(-5,4)=-\frac{37966}{32223}$

5) $\frac{\partial z}{\partial v}(-5,4)=-\frac{37964}{32223}$

Exercise 3

Given the function

$f(x, y, z) = 13 + x^2 - 6y + y^2 - 2z + z^2$ defined over the domain D≡ $\frac{x^2}{9} + \frac{y^2}{25} + \frac{z^2}{16} \leqslant 1$, compute its absolute maxima and minima.

1) We have a maximum at {0, 3, ?}

2) We have a maximum at {-0.4, ?, -0.46091}

3) We have a maximum at {-0.1, ?, -0.56091}

4) We have a maximum at {0., ?, -0.66091}

5) We have a maximum at {0.4, -5.13128, ?}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 27

Exercise 1

Given the functions

$f(x, y, z) = (-2x^2, -y - xy + xz - z^2, 1 + x - 2z)$

and

$g(u, v, w) = (u^2 + 2w - 2uw + vw, 2v + 3v^2, -uv)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (3, 1, -3)$.

1) -1.42297×10^6

2) -4.39296×10^6

3) -3.83357×10^6

4) -3.59448×10^6

5) -5.42315×10^6

Exercise 2

Given the system

$-u + v^2 - 3ux + 2xy^2 == -14$
$x + 2uxy + uy^2 + 2v^2 z - 3uz^2 + 2vz^2 == 190$
$-u^2 y + 2vxy == 99$

determine if it is possible to solve for variables x, y, z in terms of variables u, v arround the point $p = (x, y, z, u, v) = (-3, -3, 4, 3, 4)$. Compute if possible $\frac{\partial x}{\partial v}(3, 4)$.

1) $\frac{\partial x}{\partial v}(3, 4) = \frac{44}{27}$

2) $\frac{\partial x}{\partial v}(3, 4) = \frac{307}{189}$

3) $\frac{\partial x}{\partial v}(3, 4) = \frac{34}{21}$

4) $\frac{\partial x}{\partial v}(3, 4) = \frac{305}{189}$

5) $\frac{\partial x}{\partial v}(3, 4) = \frac{304}{189}$

Exercise 3

Given the function

$f(x, y, z) = -9 - x^2 + 6y - y^2 - z^2$ defined over the domain $D \equiv \frac{x^2}{9} + \frac{y^2}{9} + \frac{z^2}{16} \leqslant 1$, compute its absolute maxima and minima.

1) We have a maximum at {-0.6, ?, -0.3}

2) We have a maximum at {?, 4.5, 1.2}

3) We have a maximum at {0., 3., ?}

4) We have a maximum at {1.2, ?, 0.9}

5) We have a maximum at {?, 2.7, -0.6}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 28

Exercise 1

Given the functions

$f(x, y) = (-1 - x + 2x^2 + y + xy + 2y^2, -x + 3x^2 + y + 3xy, 1 - x + 2x^2 - 2y - 2xy - 2y^2, -2 + 3x - 2y + 2xy + 2y^2)$

and

$g(u_1, u_2, u_3, u_4) = (u_2 u_3, 2u_1 u_3 - 2u_2 u_4)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (-1, -1)$.

1) -6153.07

2) -3049.22

3) -3608.

4) -3020.52

5) -6174.38

Exercise 2

Given the system

$-v^2 + u^2 x + 2vx^2 + 3v^2 y + xy^2 == -136$

$3uvx - 2v^2 y - vy^2 - 3xy^2 == 99$

determine if it is possible to solve for variables x, y in terms of variables u, v arround the point $p = (x, y, u, v) = (-1, -4, -3, 3)$. Compute if possible $\frac{\partial x}{\partial v}(-3, 3)$.

1) $\frac{\partial x}{\partial v}(-3, 3) = \frac{70}{2391}$

2) $\frac{\partial x}{\partial v}(-3, 3) = \frac{23}{797}$

3) $\frac{\partial x}{\partial v}(-3, 3) = \frac{67}{2391}$

4) $\frac{\partial x}{\partial v}(-3, 3) = \frac{71}{2391}$

5) $\frac{\partial x}{\partial v}(-3, 3) = \frac{68}{2391}$

Exercise 3

Given the function

$f(x, y, z) = 1 - 2x + x^2 - 2y + y^2 + z^2$ defined over the domain D≡ $\frac{x^2}{4} + \frac{y^2}{25} + \frac{z^2}{16} \leqslant 1$, compute its absolute maxima and minima.

1) We have a minimum at {?, 1, 0}

2) We have a minimum at {0.7, ?, -0.1}

3) We have a minimum at {0.6, ?, -0.3}

4) We have a minimum at {?, 1.4, -0.3}

5) We have a minimum at {0.7, 0.7, ?}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 29

Exercise 1

Given the functions

$f(x, y) = (-2x + x^2 - 2y + 2xy + 3y^2, -2 + x - 3x^2 - 3y - xy - 3y^2)$

and

$g(u, v) = (-3 - 3u + uv + v^2, 2 - 2u + 3u^2 + 3v - 2uv + 2v^2)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (1, 0)$.

1) -0.893766

2) -0.804749

3) 0.791515

4) $0.$

5) -0.575111

Exercise 2

Given the system

$-3u + 2u^2 - 3uy - 3u^2 y - xy == -25$
$3u - u^3 + 2ux + 3u^2 x - 2x^2 + 3ux^2 + 3uxy - y^2 + uy^2 == 34$

determine if it is possible to solve for variables x, y in terms of variable u arround the point $p = (x, y, u) = (2, 3, 1)$. Compute if possible $\frac{\partial x}{\partial u}(1)$.

1) $\frac{\partial x}{\partial u}(1) = -\frac{139}{63}$

2) $\frac{\partial x}{\partial u}(1) = -\frac{47}{21}$

3) $\frac{\partial x}{\partial u}(1) = -\frac{142}{63}$

4) $\frac{\partial x}{\partial u}(1) = -\frac{20}{9}$

5) $\frac{\partial x}{\partial u}(1) = -\frac{46}{21}$

Exercise 3

Given the function

$f(x, y, z) = -21 + 4x - x^2 + 2y - y^2 + 6z - z^2$ defined over the domain D≡ $\frac{x^2}{4} + \frac{y^2}{4} + \frac{z^2}{9} \leq 1$, compute its absolute maxima and minima.

1) We have a minimum at {-0.653107, -0.476554, ?}

2) We have a minimum at {-0.953107, ?, -2.55299}

3) We have a minimum at {?, -0.376554, -2.95299}

4) We have a minimum at {2, 1, ?}

5) We have a minimum at {-0.553107, -0.276554, ?}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 30

Exercise 1

Given the functions

$f(x, y) = (-2 + 3y - 3y^2, 1 - x - y + 2xy + 3y^2, -1 + 3x - 2x^2 + 2y + 2xy + y^2, 3 - 3x - 2x^2 - 2y - 2xy + 2y^2)$

and

$g(u_1, u_2, u_3, u_4) = (2u_1^2 - 2u_1u_3 + u_2u_3 - u_2u_4 + 2u_3u_4, -u_3^2 + 3u_4 + u_3u_4)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (-2, -3)$.

1) 69411.1

2) 310308.

3) 416532.

4) 194318.

5) 122535.

Exercise 2

Given the system

$-x u_2 u_4 - y u_1 u_5 == -67$

$-2xyu_1 - 2y^2u_3 + 2xu_3u_5 == -104$

determine if it is possible to solve for variables x, y in terms of variables u_1, u_2, u_3, u_4, u_5 arround the point $p = (x, y, u_1, u_2, u_3, u_4, u_5) = (-1, 4, -4, 3, 3, -1, -4)$. Compute if possible $\frac{\partial x}{\partial u_5}(-4, 3, 3, -1, -4)$.

1) $\frac{\partial x}{\partial u_5}(-4, 3, 3, -1, -4) = -\frac{124}{5}$

2) $\frac{\partial x}{\partial u_5}(-4, 3, 3, -1, -4) = -\frac{123}{5}$

3) $\frac{\partial x}{\partial u_5}(-4, 3, 3, -1, -4) = -\frac{121}{5}$

4) $\frac{\partial x}{\partial u_5}(-4, 3, 3, -1, -4) = -24$

5) $\frac{\partial x}{\partial u_5}(-4, 3, 3, -1, -4) = -\frac{122}{5}$

Exercise 3

Given the function

$f(x, y, z) = -17 + 6x - x^2 + 4y - y^2 - z^2$ defined over the domain D≡

$\frac{x^2}{4} + \frac{y^2}{16} + \frac{z^2}{4} \leqslant 1$, compute its absolute maxima and minima.

1) We have a maximum at {?, 2.07779, -0.541948}

2) We have a maximum at {?, 2, 0}

3) We have a maximum at {?, 1.71649, 0.}

4) We have a maximum at {1.0839, ?, -0.722597}

5) We have a maximum at {1.98714, 0.813243, ?}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 31

Exercise 1

Given the functions

$f(x, y) = (3 - x + y - x y + 2 y^2, -1 + 2 x - 3 x^2 - 3 y + 2 x y - 2 y^2)$

and

$g(u, v) = (-3 - 3 u + u^2 - 2 v - 3 u v + v^2, 3 - 3 u + 2 u^2 + 2 v - 2 u v + v^2)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (-2, -1)$.

1) 3272.39

2) 2112.

3) 889.978

4) 953.741

5) 1148.52

Exercise 2

Given the system

$-2 u^2 v + v x + 3 v x y + 3 y^2 == -137$
$1 - 3 v^2 + 2 x - 3 x^2 - v^2 y + 3 y^2 + 2 y^3 == -27$

determine if it is possible to solve for variables x, y in terms of variables u, v arround the point $p = (x, y, u, v) = (-5, 3, -4, 2)$. Compute if possible $\frac{\partial y}{\partial u}(-4, 2)$.

1) $\frac{\partial y}{\partial u}(-4, 2) = \frac{68}{109}$

2) $\frac{\partial y}{\partial u}(-4, 2) = \frac{67}{109}$

3) $\frac{\partial y}{\partial u}(-4, 2) = \frac{65}{109}$

4) $\frac{\partial y}{\partial u}(-4, 2) = \frac{64}{109}$

5) $\frac{\partial y}{\partial u}(-4, 2) = \frac{66}{109}$

Exercise 3

Given the function

$f(x,y,z) = 15 - 2x + x^2 + y^2 - 4z + z^2$ defined over the domain D≡ $\frac{x^2}{4} + \frac{y^2}{4} + \frac{z^2}{25} \leqslant 1$, compute its absolute maxima and minima.

1) We have a minimum at {0., -1., ?}

2) We have a minimum at {?, 0.8, 1.4}

3) We have a minimum at {?, -0.2, 2.8}

4) We have a minimum at {?, 0.2, 2.4}

5) We have a minimum at {1, ?, 2}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 32

Exercise 1

Given the functions

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

and

$g(u, v) = (-3 + 2 u + u^2 + u v - v^2, -3 u^2 + v - 3 u v + 2 v^2, 2 - 2 u + u^2 + 2 v + 2 u v + 3 v^2)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (-3, 2, -2)$.

1) 0.

2) 0.157477

3) −0.737009

4) −0.684957

5) −0.644871

Exercise 2

Given the system

$$3 u y^2 - 3 x y^2 - 3 u y z + 2 u z^2 == 334$$
$$3 x^2 - u^2 y - 2 x y - 3 u y^2 == -138$$
$$2 + 3 u^2 y - 2 x y z + 2 z^2 - u z^2 == -78$$

determine if it is possible to solve for variables x, y, z in terms of variable u arround the point $p = (x, y, z, u) = (-2, -5, 1, 2)$. Compute if possible $\frac{\partial z}{\partial u}(2)$.

1) $\frac{\partial z}{\partial u}(2) = -\frac{58753}{17756}$

2) $\frac{\partial z}{\partial u}(2) = -\frac{58755}{17756}$

3) $\frac{\partial z}{\partial u}(2) = -\frac{58757}{17756}$

4) $\frac{\partial z}{\partial u}(2) = -\frac{14689}{4439}$

5) $\frac{\partial z}{\partial u}(2) = -\frac{29377}{8878}$

Exercise 3

Given the function

$f(x, y, z) = -2 + 2x - x^2 - y^2 + 4z - z^2$ defined over the domain $D \equiv \frac{x^2}{25} + \frac{y^2}{25} + \frac{z^2}{25} \leqslant 1$, compute its absolute maxima and minima.

1) We have a maximum at {?, -0.4, 2.4}

2) We have a maximum at {0.8, -0.2, ?}

3) We have a maximum at {1, 0, ?}

4) We have a maximum at {?, 0.6, 2.4}

5) We have a maximum at {0.8, -1., ?}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 33

Exercise 1

Given the functions

$f(x_1, x_2, x_3, x_4) = (3 - x_1 x_2 + x_2 x_3 + 2 x_3^2 - 2 x_4^2, 1 - 2 x_2 + x_3 - 3 x_2 x_3 - x_3 x_4 - 2 x_4^2, -3 x_1 - 2 x_2^2 - x_4^2, 2 + x_3^2)$

and

$g(u_1, u_2, u_3, u_4) = (-3 u_1 u_4 + u_4^2, 1 - 3 u_2 - 2 u_3^2, -2 u_1 - 2 u_1^2 + u_2 u_3 - u_1 u_4, -2 u_1 - 3 u_2 u_4 - 2 u_3 u_4)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (3, 0, 0, -1)$.

1) 0.599457

2) 0.407771

3) 0.

4) -0.537133

5) 0.765744

Exercise 2

Given the system

$-x_3 x_4 == -6$
$-3 x_1 x_4 == -9$
$3 v w + v w x_2 + x_2 x_4 == 7$
$2 w x_1 x_3 == -8$

determine if it is possible to solve for variables x_1, x_2, x_3, x_4 in terms of variables u, v, w arround the point $p = (x_1, x_2, x_3, x_4, u, v, w) = (-1, -5, -2, -3, 5, -2, -2)$. Compute if possible $\frac{\partial x_3}{\partial w}(5, -2, -2)$.

1) $\frac{\partial x_3}{\partial w}(5, -2, -2) = 1$

2) $\frac{\partial x_3}{\partial w}(5, -2, -2) = 0$

3) $\frac{\partial x_3}{\partial w}(5, -2, -2) = \frac{1}{2}$

4) $\frac{\partial x_3}{\partial w}(5, -2, -2) = -\frac{1}{2}$

5) $\frac{\partial x_3}{\partial w}(5, -2, -2) = \frac{3}{2}$

Exercise 3

Given the function

$f(x, y, z) = 10 - 2x + x^2 + y^2 - 4z + z^2$ defined over the domain D≡ $\frac{x^2}{16} + \frac{y^2}{16} + \frac{z^2}{25} \leqslant 1$, compute its absolute maxima and minima.

1) We have a minimum at {1.6, ?, 1.}

2) We have a minimum at {1.4, -0.8, ?}

3) We have a minimum at {?, 0.2, 2.8}

4) We have a minimum at {0.2, ?, 3.}

5) We have a minimum at {1, ?, 2}

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Exercise 1

Given the functions

$f(x, y) = (-3 + x + x^2 + 2y + xy + 3y^2, -1 + 3x - 3x^2 + 2y - 3xy + 3y^2)$

and

$g(u, v) = (3 - 2u + 2u^2 - 2v + 3uv - v^2, 2 + 3u - 3u^2 + 2v - uv - 3v^2)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (-3, 0)$.

1) 683 286.

2) 481 096.

3) 819 502.

4) 920 599.

5) 1.20535×10^6

Exercise 2

Given the system

$u^2 - 3u^3 - 2ux - 2x^3 - y + 3uy + 2u^2y + 3xy + 2uxy - 3uy^2 == -26$

$-3 + ux^2 + x^3 - 2x^2y + 3y^2 + 2uy^2 == 22$

determine if it is possible to solve for variables x, y in terms of variable u arround the point $p = (x, y, u) = (-1, 2, 2)$. Compute if possible $\frac{\partial x}{\partial u}(2)$.

1) $\frac{\partial x}{\partial u}(2) = \frac{231}{115}$

2) $\frac{\partial x}{\partial u}(2) = \frac{233}{115}$

3) $\frac{\partial x}{\partial u}(2) = \frac{47}{23}$

4) $\frac{\partial x}{\partial u}(2) = \frac{232}{115}$

5) $\frac{\partial x}{\partial u}(2) = \frac{234}{115}$

Exercise 3

Given the function

$f(x, y, z) = 10 - 2x + x^2 - 2y + y^2 - 6z + z^2$ defined over the domain $D \equiv \frac{x^2}{4} + \frac{y^2}{4} + \frac{z^2}{4} \leqslant 1$, compute its absolute maxima and minima.

1) We have a maximum at {?, 1, 3}

2) We have a maximum at {?, -0.703023, -2.20907}

3) We have a maximum at {?, -0.103023, -1.40907}

4) We have a maximum at {-0.603023, ?, -1.80907}

5) We have a maximum at {-0.503023, -0.403023, ?}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 35

Exercise 1

Given the functions

$f(x_1, x_2, x_3, x_4) = (-2 x_1^2 + 3 x_1 x_4, -3 x_1 x_3 - 3 x_2 x_4 + x_4^2, 2 x_1 x_2 - x_2^2 + 3 x_3 - 2 x_1 x_4)$

and

$g(u, v, w) = (2 u^2 - 3 v^2 - 3 v w, v + 2 u v - 3 w - u w + 2 v w, 2 u^2 - u w + 2 w^2, -1 - u - 3 w + 3 w^2)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (1, 2, -2, -3)$.

1) 0.124178

2) 0.634291

3) -0.498302

4) 0.

5) -0.207715

Exercise 2

Given the system

$$u + 3 v^2 x_3 + 2 x_2 x_4^2 == -16$$
$$-2 u x_3 x_4 == 20$$
$$-3 x_1^2 x_3 + 3 x_3^2 x_4 == -390$$
$$2 u v + u v x_3 + x_2 x_4^2 == -23$$

determine if it is possible to solve for variables x_1, x_2, x_3, x_4 in terms of variables u, v arround the point $p = (x_1, x_2, x_3, x_4, u, v) = (4, -4, 5, -2, 1, -1)$. Compute if possible $\frac{\partial x_2}{\partial v}(1, -1)$.

1) $\frac{\partial x_2}{\partial v}(1, -1) = -\frac{1361}{100}$

2) $\frac{\partial x_2}{\partial v}(1, -1) = -\frac{68}{5}$

3) $\frac{\partial x_2}{\partial v}(1, -1) = -\frac{681}{50}$

4) $\frac{\partial x_2}{\partial v}(1, -1) = -\frac{1363}{100}$

5) $\frac{\partial x_2}{\partial v}(1, -1) = -\frac{1359}{100}$

Exercise 3

Given the function

$f(x, y, z) = -5 + 2x - x^2 - y^2 + 4z - z^2$ defined over the domain $D \equiv \frac{x^2}{25} + \frac{y^2}{25} + \frac{z^2}{16} \leqslant 1$, compute its absolute maxima and minima.

1) We have a minimum at {?, -0.4, -2.34434}

2) We have a minimum at {1, 0, ?}

3) We have a minimum at {?, -0.1, -1.64434}

4) We have a minimum at {-4.12082, ?, -1.64434}

5) We have a minimum at {-4.22082, 0., ?}

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Exercise 1

Given the functions

$f(x, y) = (2 + x + 3x^2 + 3y - y^2, -2 + x - x^2 + y - xy - 3y^2, 1 - 3x + 3x^2 + 2y - 2xy - 3y^2, 2 - x + 3x^2 + y^2)$

and

$g(u_1, u_2, u_3, u_4) = (2u_2u_3, -1 - u_1 + 3u_1^2 - u_2 - 3u_1u_3 + 3u_2u_3 + 3u_1u_4)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (-3, 2)$.

1) $-375\,840$.

2) $-201\,945$.

3) $-653\,496$.

4) $-297\,289$.

5) $-123\,477$.

Exercise 2

Given the system

$3xyu_1 == 24$
$3y^2 + xu_1 + 2u_2^3 + xu_3^2 - 3yu_3^2 == 86$

determine if it is possible to solve for variables x, y in terms of variables u_1, u_2, u_3, u_4 arround the point $p = (x, y, u_1, u_2, u_3, u_4) = (-4, 1, -2, 5, -5, 0)$. Compute if possible $\frac{\partial y}{\partial u_4}(-2, 5, -5, 0)$.

1) $\frac{\partial y}{\partial u_4}(-2, 5, -5, 0) = 0$

2) $\frac{\partial y}{\partial u_4}(-2, 5, -5, 0) = 3$

3) $\frac{\partial y}{\partial u_4}(-2, 5, -5, 0) = 1$

4) $\frac{\partial y}{\partial u_4}(-2, 5, -5, 0) = 2$

5) $\frac{\partial y}{\partial u_4}(-2, 5, -5, 0) = 4$

Exercise 3

Given the function

$f(x, y, z) = 19 - 6x + x^2 - 4y + y^2 - 2z + z^2$ defined over the domain D≡ $\frac{x^2}{4} + \frac{y^2}{16} + \frac{z^2}{16} \leqslant 1$, compute its absolute maxima and minima.

1) We have a minimum at {2.11162, ?, 1.55406}

2) We have a minimum at {?, 2.05231, 0.498249}

3) We have a minimum at {2.63952, ?, 1.55406}

4) We have a minimum at {1.75968, ?, 0.850186}

5) We have a minimum at {3, ?, 1}

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Exercise 1

Given the functions

$f(x_1, x_2, x_3, x_4) = (1 + 2 x_1 x_2 + x_2^2 + x_3 + x_1 x_3 - x_2 x_3 - x_2 x_4, -3 x_3 x_4, -3 - 3 x_1 x_3 - x_3^2 - 2 x_2 x_4, -3 x_2 - 3 x_2 x_3 - 2 x_3^2 + x_4)$

and

$g(u_1, u_2, u_3, u_4) = (u_1 + u_1 u_2 + 3 u_2^2 + u_2 u_3 + u_4 + 2 u_1 u_4, u_2 - 2 u_1 u_2 - u_2 u_3 + 2 u_4 + u_1 u_4 + u_2 u_4, 2 u_1 + u_1 u_2 - u_3 u_4, -2 u_1 + u_2 u_3 - 2 u_1 u_4 + u_3 u_4)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p=(3, 2, 3, 3)$.

1) 2.75122×10^{10}

2) 5.64834×10^{10}

3) 1.03528×10^{11}

4) 4.1007×10^{10}

5) 8.63976×10^{10}

Exercise 2

Given the system

$2 x_1^2 x_2 - 2 x_3^2 - 2 v x_1 x_4 == -56$
$3 x_1 x_3^2 == 36$
$3 x_1 x_2 x_3 == -36$
$-3 w x_2^2 - w x_4 == -14$

determine if it is possible to solve for variables x_1, x_2, x_3, x_4 in terms of variables u, v, w arround the point $p=(x_1, x_2, x_3, x_4, u, v, w)=(3, -2, 2, 2, 0, 1, 1)$. Compute if possible $\frac{\partial x_3}{\partial v}(0, 1, 1)$.

1) $\frac{\partial x_3}{\partial v}(0, 1, 1) = \frac{9}{65}$

2) $\frac{\partial x_3}{\partial v}(0, 1, 1) = \frac{2}{13}$

3) $\frac{\partial x_3}{\partial v}(0, 1, 1) = \frac{8}{65}$

4) $\frac{\partial x_3}{\partial v}(0, 1, 1) = \frac{7}{65}$

5) $\frac{\partial x_3}{\partial v}(0, 1, 1) = \frac{6}{65}$

Exercise 3

Given the function

$f(x, y, z) = 9 - 2x + x^2 - 2y + y^2 - 6z + z^2$ defined over the domain D≡ $\frac{x^2}{16} + \frac{y^2}{16} + \frac{z^2}{16} \leqslant 1$, compute its absolute maxima and minima.

1) We have a minimum at {?, -0.5, 3.3}

2) We have a minimum at {1.6, 1.6, ?}

3) We have a minimum at {-0.2, 0.7, ?}

4) We have a minimum at {?, 1.6, 3.9}

5) We have a minimum at {1, 1, ?}

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Exercise 1

Given the functions

$f(x, y) = (-2x^2 + y + 2y^2, 1 - 2x - x^2 + 3y - 3xy - 3y^2, 1 + x + x^2 + 3y - 2xy, 1 + x - 2x^2 + y + xy + y^2)$

and

$g(u_1, u_2, u_3, u_4) = (-3 + 3u_1 + 3u_2^2, u_1 - 2u_1u_2 + 3u_2^2 + 2u_3^2 + u_4 + 2u_4^2)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (3, 2)$.

1) 7.09162×10^6

2) 2.05809×10^6

3) 1.17026×10^6

4) 7.55102×10^6

5) 4.73754×10^6

Exercise 2

Given the system

$2xu_3^2 + yu_1u_4 == -116$
$3y^2u_3 + 3xu_2u_5 + 2u_1u_4u_5 == -105$

determine if it is possible to solve for variables x, y in terms of variables u_1, u_2, u_3, u_4, u_5 arround the point $p = (x, y, u_1, u_2, u_3, u_4, u_5) = (-3, 1, 5, -1, -4, -4, 3)$. Compute if possible $\frac{\partial x}{\partial u_4}(5, -1, -4, -4, 3)$.

1) $\frac{\partial x}{\partial u_4}(5, -1, -4, -4, 3) = \frac{42}{79}$

2) $\frac{\partial x}{\partial u_4}(5, -1, -4, -4, 3) = \frac{43}{79}$

3) $\frac{\partial x}{\partial u_4}(5, -1, -4, -4, 3) = \frac{41}{79}$

4) $\frac{\partial x}{\partial u_4}(5, -1, -4, -4, 3) = \frac{40}{79}$

5) $\frac{\partial x}{\partial u_4}(5, -1, -4, -4, 3) = \frac{44}{79}$

Exercise 3

Given the function

$f(x, y, z) = -17 + 6x - x^2 - y^2 + 4z - z^2$ defined over the domain D≡ $\frac{x^2}{4} + \frac{y^2}{16} + \frac{z^2}{9} \leqslant 1$, compute its absolute maxima and minima.

1) We have a minimum at {-0.5, -0.294872, ?}

2) We have a minimum at {?, -0.294872, -2.67143}

3) We have a minimum at {-1., -0.494872, ?}

4) We have a minimum at {-1.3, ?, -2.17143}

5) We have a minimum at {?, 0, 2}

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Exercise 1

Given the functions

$f(x, y) = (2x - 3x^2 - 2y - 3xy + y^2, -1 + 2x + 2x^2 + 3y - 3xy + 2y^2)$

and

$g(u, v) = (2 - 2u - v + 3v^2, 1 + 2u + 2u^2 - v - uv + 2v^2)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (-2, -3)$.

1) 157752.

2) 91473.5

3) 248373.

4) 68361.

5) 99466.4

Exercise 2

Given the system

$3y + x u_2 u_3 + y u_2 u_4 == 0$

$-y^2 - 3xy u_1 + 2xy u_3 + 2y u_2 u_4 + 2y u_3 u_4 + 3 u_2 u_3 u_4 == 76$

determine if it is possible to solve for variables x, y in terms of variables u_1, u_2, u_3, u_4 arround the point $p = (x, y, u_1, u_2, u_3, u_4) = (-2, -1, -5, -3, -1, 3)$. Compute if possible $\frac{\partial y}{\partial u_1}(-5, -3, -1, 3)$.

1) $\frac{\partial y}{\partial u_1}(-5, -3, -1, 3) = 0$

2) $\frac{\partial y}{\partial u_1}(-5, -3, -1, 3) = -\frac{2}{37}$

3) $\frac{\partial y}{\partial u_1}(-5, -3, -1, 3) = -\frac{1}{37}$

4) $\frac{\partial y}{\partial u_1}(-5, -3, -1, 3) = \frac{1}{37}$

5) $\frac{\partial y}{\partial u_1}(-5, -3, -1, 3) = -\frac{3}{37}$

Exercise 3

Given the function

$f(x, y, z) = -25 + 6x - x^2 + 6y - y^2 + 6z - z^2$ defined over the domain D≡ $\frac{x^2}{4} + \frac{y^2}{25} + \frac{z^2}{4} \leqslant 1$, compute its absolute maxima and minima.

1) We have a maximum at {?, 3.66177, 0.990083}

2) We have a maximum at {0.0136128, 1.70882, ?}

3) We have a maximum at {3, 3, ?}

4) We have a maximum at {1.2342, 2.44118, ?}

5) We have a maximum at {1.72244, ?, 0.501848}

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Exercise 1

Given the functions

$f(x, y) = (2x - 3x^2 - 3y - xy + 3y^2, -1 + 3x - 3x^2 - 3xy)$

and

$g(u, v) = (-2u - 3u^2 + v - 2uv, -3 + 3u + u^2 + 3uv + 2v^2)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (-1, 0)$.

1) $-101714.$

2) -82218.1

3) $-62916.$

4) -46986.1

5) -22679.9

Exercise 2

Given the system

$-x y^2 - 3 y^2 u_2 == -128$
$-2 x y^2 == 32$

determine if it is possible to solve for variables x, y in terms of variables u_1, u_2, u_3, u_4, u_5 arround the point $p = (x, y, u_1, u_2, u_3, u_4, u_5) = (-1, -4, 2, 3, 0, -1, 0)$. Compute if possible $\frac{\partial x}{\partial u_2}(2, 3, 0, -1, 0)$.

1) $\frac{\partial x}{\partial u_2}(2, 3, 0, -1, 0) = -\frac{1}{3}$

2) $\frac{\partial x}{\partial u_2}(2, 3, 0, -1, 0) = \frac{2}{3}$

3) $\frac{\partial x}{\partial u_2}(2, 3, 0, -1, 0) = \frac{1}{3}$

4) $\frac{\partial x}{\partial u_2}(2, 3, 0, -1, 0) = 1$

5) $\frac{\partial x}{\partial u_2}(2, 3, 0, -1, 0) = 0$

Exercise 3

Given the function

$f(x, y, z) = 1 + x^2 - 2y + y^2 - 4z + z^2$ defined over the domain $D \equiv \frac{x^2}{4} + \frac{y^2}{25} + \frac{z^2}{25} \leqslant 1$, compute its absolute maxima and minima.

1) We have a minimum at {?, 1, 2}

2) We have a minimum at {0.2, 1.8, ?}

3) We have a minimum at {-0.8, 1.8, ?}

4) We have a minimum at {0.8, ?, 1.6}

5) We have a minimum at {?, 0.8, 1.4}

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Exercise 1

Given the functions

$f(x, y, z) = (-3z, -x + 3x^2 - z)$

and

$g(u, v) = (3 + u + u^2 - v - uv - 2v^2, 1 + 2u + 2u^2 - 2v - 2uv - 3v^2, 1 - 3u - 3u^2 + v - uv + 2v^2)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (3, 1, 1)$.

1) 0.314638

2) −0.270382

3) 0.

4) −0.23471

5) −0.61457

Exercise 2

Given the system

$-2x^2 y - 3uy^2 + uz + u^2 z - 3xz == -66$
$3u - 2uxz - 2uyz == 21$
$-3u + 2u^2 - u^2 x + x^3 + u^2 y + uxz - uyz == 15$

determine if it is possible to solve for variables x, y, z in terms of variable u arround the point $p = (x, y, z, u) = (3, -4, 2, 3)$. Compute if possible $\frac{\partial y}{\partial u}(3)$.

1) $\frac{\partial y}{\partial u}(3) = \frac{9}{40}$

2) $\frac{\partial y}{\partial u}(3) = \frac{47}{200}$

3) $\frac{\partial y}{\partial u}(3) = \frac{23}{100}$

4) $\frac{\partial y}{\partial u}(3) = \frac{11}{50}$

5) $\frac{\partial y}{\partial u}(3) = \frac{43}{200}$

Exercise 3

Given the function

$f(x, y, z) = -1 + 4x - x^2 + 4y - y^2 - z^2$ defined over the domain D≡ $\frac{x^2}{9} + \frac{y^2}{4} + \frac{z^2}{4} \leqslant 1$, compute its absolute maxima and minima.

1) We have a minimum at {-2.4095, -1.20133, ?}

2) We have a minimum at {-2.6095, ?, 0.2}

3) We have a minimum at {?, -0.801334, -0.4}

4) We have a minimum at {-2.8095, -0.701334, ?}

5) We have a minimum at {?, 2, 0}

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Exercise 1

Given the functions

$f(x_1, x_2, x_3, x_4) = (1 - 2x_1^2 - 2x_1x_2 + 3x_2x_3 + x_1x_4 + x_2x_4, -2x_1 - 2x_4 - 3x_2x_4)$

and

$g(u, v) = (-3 + 3u^2 + 3v + 2uv - 2v^2, 3u - u^2 + 3v + 3uv + 2v^2, -1 - 3u + v - uv - v^2, 2 - 3u - 2u^2 - 2v + 2uv + 2v^2)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (-1, -1, 1, -3)$.

1) 0.608628

2) -0.654774

3) 0.

4) 0.404806

5) 0.407934

Exercise 2

Given the system

$-u x_2 x_4 + 3 u x_4^2 == 24$
$2 u x_1 x_2 - x_1 x_4 - x_1^2 x_4 - 2 x_1 x_2 x_4 + 3 x_2 x_3 x_4 - 3 x_1 x_4^2 + 3 x_2 x_4^2 == 151$
$-x_2 - 2 x_2^2 - 3 x_2^3 + x_1 x_3 + u x_2 x_3 + 3 u x_4 == -9$
$3 u^2 - 3 x_2^2 - 2 x_3^3 == -128$

determine if it is possible to solve for variables x_1, x_2, x_3, x_4 in terms of variable u arround the point $p = (x_1, x_2, x_3, x_4, u) = (-4, 1, 4, 3, 1)$. Compute if possible $\frac{\partial x_2}{\partial u}(1)$.

1) $\frac{\partial x_2}{\partial u}(1) = \frac{22549}{13151}$

2) $\frac{\partial x_2}{\partial u}(1) = \frac{67645}{39453}$

3) $\frac{\partial x_2}{\partial u}(1) = \frac{67648}{39453}$

4) $\frac{\partial x_2}{\partial u}(1) = \frac{67649}{39453}$

5) $\frac{\partial x_2}{\partial u}(1) = \frac{67646}{39453}$

Exercise 3

Given the function

$f(x, y, z) = -13 + 6x - x^2 - y^2 + 4z - z^2$ defined over the domain D≡ $\frac{x^2}{25} + \frac{y^2}{25} + \frac{z^2}{16} \leqslant 1$, compute its absolute maxima and minima.

1) We have a minimum at {-4.73368, 0., ?}

2) We have a minimum at {-5.23368, 0.1, ?}

3) We have a minimum at {?, 0.4, -1.68804}

4) We have a minimum at {?, 0.3, -0.888042}

5) We have a minimum at {3, ?, 2}

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Exercise 1

Given the functions

$f(x, y, z) = (-2y + 2xy, 2y, 3x + 2x^2)$

and

$g(u, v, w) = (1 + v^2 + 2w^2, -uv - w + 3uw, v^2)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (0, 1, 2)$.

1) −0.671579

2) 0.

3) −0.484398

4) −0.626653

5) −0.527676

Exercise 2

Given the system

$-u^3 - 3vx + 2vxy + vz + xz^2 + 2z^3 == 42$

$x^2 z == 12$

$2 - 2v^3 - 2yz == -44$

determine if it is possible to solve for variables x, y, z in terms of variables u, v arround the point $p = (x, y, z, u, v) = (2, 5, 3, 4, 2)$. Compute if possible $\frac{\partial x}{\partial u}(4, 2)$.

1) $\frac{\partial x}{\partial u}(4, 2) = -\frac{14}{47}$

2) $\frac{\partial x}{\partial u}(4, 2) = -\frac{12}{47}$

3) $\frac{\partial x}{\partial u}(4, 2) = -\frac{15}{47}$

4) $\frac{\partial x}{\partial u}(4, 2) = -\frac{13}{47}$

5) $\frac{\partial x}{\partial u}(4, 2) = -\frac{16}{47}$

Exercise 3

Given the function

$f(x, y, z) = -12 - x^2 + 6y - y^2 - z^2$ defined over the domain D≡ $\frac{x^2}{9} + \frac{y^2}{9} + \frac{z^2}{25} \leqslant 1$, compute its absolute maxima and minima.

1) We have a minimum at {−0.1, −2.0875, ?}

2) We have a minimum at {0.4, ?, −3.93399}

3) We have a minimum at {0., ?, −4.13399}

4) We have a minimum at {−0.1, −1.9875, ?}

5) We have a minimum at {0, 3, ?}

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Exercise 1

Given the functions

$f(x, y) = (-2 - y + 2xy - 3y^2, -2 + 3x + 2y + 2xy + y^2, -1 - 2xy + y^2)$

and

$g(u, v, w) = (-u - 3u^2 + 2uv + 2v^2 + uw + 2vw - w^2, 3 + 2w + 3vw)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (0, 0)$.

1) -74.3267

2) $-54.$

3) -33.1729

4) -81.1377

5) -42.4694

Exercise 2

Given the system

$2x^2 y - 3u_2 u_3 == 169$
$-3y + x u_4 == -19$

determine if it is possible to solve for variables x, y in terms of variables u_1, u_2, u_3, u_4 arround the point $p = (x, y, u_1, u_2, u_3, u_4) = (-4, 5, 3, -1, 3, 1)$. Compute if possible $\frac{\partial x}{\partial u_1}(3, -1, 3, 1)$.

1) $\frac{\partial x}{\partial u_1}(3, -1, 3, 1) = 3$

2) $\frac{\partial x}{\partial u_1}(3, -1, 3, 1) = 4$

3) $\frac{\partial x}{\partial u_1}(3, -1, 3, 1) = 1$

4) $\frac{\partial x}{\partial u_1}(3, -1, 3, 1) = 2$

5) $\frac{\partial x}{\partial u_1}(3, -1, 3, 1) = 0$

Exercise 3

Given the function

$f(x, y, z) = 10 + x^2 - 2y + y^2 - 6z + z^2$ defined over the domain $D \equiv \frac{x^2}{25} + \frac{y^2}{25} + \frac{z^2}{25} \leqslant 1$, compute its absolute maxima and minima.

1) We have a minimum at {-1.2, 0.4, ?}

2) We have a minimum at {-0.6, ?, 3.6}

3) We have a minimum at {1.5, ?, 3.9}

4) We have a minimum at {0.6, 0.1, ?}

5) We have a minimum at {0, ?, 3}

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Exercise 1

Given the functions

$f(x,y) = (-1 - 2x^2 - 2y + xy - 2y^2, -3 - x + 3x^2 - y + xy - y^2, -3 - 3x + y - xy)$

and

$g(u,v,w) = (1 - 2w^2, 2u^2 - 3v^2 + 3w + 2w^2)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (1,1)$.

1) $-9216.$

2) -15033.5

3) -13113.4

4) -1126.89

5) -4401.33

Exercise 2

Given the system

$-3 + uv - 2w - 3vwx + vwy + 2xy == 11$
$2u^2x - 3uvy == -112$

determine if it is possible to solve for variables x, y in terms of variables u, v, w arround the point $p = (x, y, u, v, w) = (4, 4, -4, -5, -1)$. Compute if possible $\frac{\partial y}{\partial w}(-4, -5, -1)$.

1) $\frac{\partial y}{\partial w}(-4, -5, -1) = 304$

2) $\frac{\partial y}{\partial w}(-4, -5, -1) = 307$

3) $\frac{\partial y}{\partial w}(-4, -5, -1) = 305$

4) $\frac{\partial y}{\partial w}(-4, -5, -1) = 306$

5) $\frac{\partial y}{\partial w}(-4, -5, -1) = 308$

Exercise 3

Given the function

$f(x, y, z) = 19 - 2x + x^2 - 6y + y^2 + z^2$ defined over the domain D≡ $\frac{x^2}{4} + \frac{y^2}{9} + \frac{z^2}{9} \leqslant 1$, compute its absolute maxima and minima.

1) We have a maximum at {0.216152, -3.46963, ?}

2) We have a maximum at {?, -2.96963, 0.}

3) We have a maximum at {0.216152, ?, -0.1}

4) We have a maximum at {1, 3, ?}

5) We have a maximum at {-0.383848, -2.66963, ?}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 46

Exercise 1

Given the functions

$f(x,y,z)=(z, x^2, x^2-3y^2+3z)$

and

$g(u,v,w)=(2v^2+3vw, -2u-3u^2-3v+3w+w^2, 3-uw)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p=(0,-2,-2)$.

1) 0.866882

2) −0.147264

3) −0.41283

4) 0.

5) 0.412278

Exercise 2

Given the system

$$2yzu_2+yu_4^2==17$$
$$xyz-u_1u_3u_4==-48$$
$$-2x^2u_3+z^2u_4==148$$

determine if it is possible to solve for variables x, y, z in terms of variables u_1, u_2, u_3, u_4 arround the point $p=(x,y,z,u_1,u_2,u_3,u_4)=(-4,1,2,-2,-2,-4,5)$. Compute if possible $\frac{\partial z}{\partial u_2}(-2,-2,-4,5)$.

1) $\frac{\partial z}{\partial u_2}(-2,-2,-4,5)=\frac{259}{715}$

2) $\frac{\partial z}{\partial u_2}(-2,-2,-4,5)=\frac{256}{715}$

3) $\frac{\partial z}{\partial u_2}(-2,-2,-4,5)=\frac{258}{715}$

4) $\frac{\partial z}{\partial u_2}(-2,-2,-4,5)=\frac{257}{715}$

5) $\frac{\partial z}{\partial u_2}(-2,-2,-4,5)=\frac{4}{11}$

Exercise 3

Given the function

$f(x, y, z) = -7 - x^2 - y^2 + 2z - z^2$ defined over the domain D≡ $\frac{x^2}{9} + \frac{y^2}{25} + \frac{z^2}{9} \leqslant 1$, compute its absolute maxima and minima.

1) We have a minimum at {0.491132, ?, 0.419765}

2) We have a minimum at {?, 0, 1}

3) We have a minimum at {0., 4.91132, ?}

4) We have a minimum at {?, 2.45566, -1.05363}

5) We have a minimum at {0.491132, ?, -1.05363}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 47

Exercise 1

Given the functions

$f(x, y) = (1 - 2x - 2x^2 + 3y - 3y^2,$
$-3x - 3x^2 + y - 3xy + 3y^2, 3 + 3x - y + xy + y^2, 1 - 3x + 2x^2 - y + 2xy + y^2)$

and

$g(u_1, u_2, u_3, u_4) = (-u_1^2 + u_3 - 2u_1u_4 + 2u_4^2, u_1 + 2u_1u_2 - u_2u_4 + 3u_4^2),$

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (2, 2)$.

1) $-132918.$

2) -1.12061×10^6

3) $-721513.$

4) $-548125.$

5) -1.16454×10^6

Exercise 2

Given the system

$uv + 3u^2v - 2uv^2 + 2ux - 3x^3 - 2xy == 50$
$-3 - 3u^2 + 3uv^2 + u^2x - 2vx^2 - xy^2 == -33$

determine if it is possible to solve for variables x, y in terms of variables u, v arround the point $p = (x, y, u, v) = (-2, -4, -3, 1)$. Compute if possible $\frac{\partial y}{\partial u}(-3, 1)$.

1) $\frac{\partial y}{\partial u}(-3, 1) = \frac{367}{180}$

2) $\frac{\partial y}{\partial u}(-3, 1) = \frac{551}{270}$

3) $\frac{\partial y}{\partial u}(-3, 1) = \frac{55}{27}$

4) $\frac{\partial y}{\partial u}(-3, 1) = \frac{1099}{540}$

5) $\frac{\partial y}{\partial u}(-3, 1) = \frac{1103}{540}$

Exercise 3

Given the function

$f(x, y, z) = -21 + 4x - x^2 + 2y - y^2 + 6z - z^2$ defined over the domain D≡ $\frac{x^2}{25} + \frac{y^2}{4} + \frac{z^2}{16} \leqslant 1$, compute its absolute maxima and minima.

1) We have a maximum at {?, 0.4, 2.7}

2) We have a maximum at {0.8, 1.6, ?}

3) We have a maximum at {2.3, ?, 3.6}

4) We have a maximum at {2.6, 0.7, ?}

5) We have a maximum at {2, ?, 3}

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Exercise 1

Given the functions

$f(x_1, x_2, x_3, x_4) = (-3 x_1 x_2 + 3 x_3 - x_2 x_3, 2 + 3 x_2 - 3 x_1 x_2)$

and

$g(u, v) = (-3 u - u^2 + v - v^2, -2 u - 2 u^2 - v - 2 u v + 3 v^2, 2 + 2 u + u^2 + 2 v - 3 v^2, -3 + 3 u - u^2 + 3 v - 2 u v - 3 v^2),$

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (-3, 1, -2, 2)$.

1) -0.787323

2) $0.$

3) -0.868412

4) -0.268413

5) 0.715378

Exercise 2

Given the system

$3 x_1 + x_2^2 x_4 == -11$
$x_2 x_3^2 == 25$
$3 x_1^3 - 3 x_1 x_2 + u^2 x_4 - x_4^2 == -340$
$3 x_1^2 x_2 + x_1 x_2^2 + 3 x_2^2 x_3 - 2 x_3^2 x_4 == -115$

determine if it is possible to solve for variables x_1, x_2, x_3, x_4 in terms of variable u arround the point $p = (x_1, x_2, x_3, x_4, u) = (-5, 1, 5, 4, 3)$. Compute if possible $\frac{\partial x_4}{\partial u}(3)$.

1) $\frac{\partial x_4}{\partial u}(3) = \frac{4780}{27221}$

2) $\frac{\partial x_4}{\partial u}(3) = \frac{4776}{27221}$

3) $\frac{\partial x_4}{\partial u}(3) = \frac{4779}{27221}$

4) $\frac{\partial x_4}{\partial u}(3) = \frac{4778}{27221}$

5) $\frac{\partial x_4}{\partial u}(3) = \frac{4777}{27221}$

Exercise 3

Given the function

$f(x, y, z) = 4 - 4x + x^2 - 4y + y^2 - 2z + z^2$ defined over the domain D≡ $\frac{x^2}{16} + \frac{y^2}{4} + \frac{z^2}{25} \leqslant 1$, compute its absolute maxima and minima.

1) We have a minimum at {?, 2.67054, 0.206098}

2) We have a minimum at {1.72708, 1.13535, ?}

3) We have a minimum at {2, 2, ?}

4) We have a minimum at {?, 1.71105, 0.973691}

5) We have a minimum at {2.68658, ?, 0.589894}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 49

Exercise 1

Given the functions

$f(x_1, x_2, x_3, x_4) = (1 - 2x_1 - 3x_1^2 + 3x_2x_4 + 2x_3x_4 - 3x_4^2, 3 + 3x_1^2 + 3x_4 + 2x_2x_4 - 2x_3x_4, -x_3 - 2x_3x_4)$

and

$g(u, v, w) = (2v^2, 3v + 3v^2, -3u - u^2 - 2uv + 2v^2 + 3w - 2w^2, -2u - 2v - uw)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (-3, -2, -3, 2)$.

1) −0.541302

2) 0.499604

3) 0.

4) 0.187252

5) −0.668377

Exercise 2

Given the system

$$-u^2 v - 2uv^2 - 3vx_1x_3 == 236$$
$$3x_2^2x_3 + 3x_3x_4^2 == -102$$
$$-3ux_1^2 + 3ux_4^2 == -75$$
$$2vx_3 + 2x_2x_4 == -22$$

determine if it is possible to solve for variables x_1, x_2, x_3, x_4 in terms of variables u, v arround the point $p = (x_1, x_2, x_3, x_4, u, v) = (2, -5, -1, 3, -5, -4)$. Compute if possible $\frac{\partial x_4}{\partial u}(-5, -4)$.

1) $\frac{\partial x_4}{\partial u}(-5, -4) = -\frac{1633}{554}$

2) $\frac{\partial x_4}{\partial u}(-5, -4) = -\frac{1631}{554}$

3) $\frac{\partial x_4}{\partial u}(-5, -4) = -\frac{816}{277}$

4) $\frac{\partial x_4}{\partial u}(-5, -4) = -\frac{815}{277}$

5) $\frac{\partial x_4}{\partial u}(-5, -4) = -\frac{1629}{554}$

Exercise 3

Given the function

$f(x, y, z) = -13 + 2x - x^2 + 4y - y^2 + 2z - z^2$ defined over the domain D≡ $\frac{x^2}{16} + \frac{y^2}{25} + \frac{z^2}{25} \leqslant 1$, compute its absolute maxima and minima.

1) We have a maximum at {2., ?, 2.}

2) We have a maximum at {1, 2, ?}

3) We have a maximum at {0., ?, 0.6}

4) We have a maximum at {?, 2.4, 0.8}

5) We have a maximum at {0.8, ?, 2.}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 50

Exercise 1

Given the functions

$f(x_1, x_2, x_3, x_4) = (-2 x_2^2 + 2 x_1 x_4, 2 x_1 x_2 + 2 x_3 + x_3^2 + 3 x_4, 3 x_1 + x_3)$

and

$g(u, v, w) = (-2 v + u v - u w - 3 v w, 3 - v^2 - w - 3 v w, -2 + 3 u^2 + u w, u^2 - v^2 + 3 v w)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (3, 1, 0, 0)$.

1) 0.

2) 0.62988

3) 0.388417

4) 0.635628

5) 0.102694

Exercise 2

Given the system

$-u x_2 x_4 - 3 x_3 x_4 == 9$
$3 u x_2^2 + 3 x_2 x_3 - 2 x_1^2 x_4 == -81$
$3 v + 3 x_1^2 x_2 + u x_3 + x_1 x_3^2 == -96$
$-3 v x_1 x_2 + v x_3 x_4 == -72$

determine if it is possible to solve for variables x_1, x_2, x_3, x_4 in terms of variables u, v arround the point $p = (x_1, x_2, x_3, x_4, u, v) = (-3, -3, -3, 3, -2, 2)$. Compute if possible $\frac{\partial x_4}{\partial u}(-2, 2)$.

1) $\frac{\partial x_4}{\partial u}(-2, 2) = \frac{106}{239}$

2) $\frac{\partial x_4}{\partial u}(-2, 2) = \frac{109}{239}$

3) $\frac{\partial x_4}{\partial u}(-2, 2) = \frac{107}{239}$

4) $\frac{\partial x_4}{\partial u}(-2, 2) = \frac{108}{239}$

5) $\frac{\partial x_4}{\partial u}(-2, 2) = \frac{105}{239}$

Exercise 3

Given the function

$f(x,y,z) = -1 - 4x + x^2 - 4y + y^2 + z^2$ defined over the domain D≡ $\frac{x^2}{16} + \frac{y^2}{25} + \frac{z^2}{9} \leqslant 1$, compute its absolute maxima and minima.

1) We have a minimum at {2.8, 1.4, ?}

2) We have a minimum at {?, 2, 0}

3) We have a minimum at {1., 2.4, ?}

4) We have a minimum at {1.2, ?, 0.6}

5) We have a minimum at {2.4, ?, 0.8}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 51

Exercise 1

Given the functions

$f(x, y) = (2 + 2x + x^2 + 3xy, -2 + x + x^2 - 2y + 2xy + 2y^2, 2x + 3x^2 - y + 3xy)$

and

$g(u, v, w) = (-1 - 2uw - vw, 2w - 3uw - 3w^2)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (3, -3)$.

1) -23970.5

2) -28417.2

3) -65622.6

4) $-34677.$

5) -12863.7

Exercise 2

Given the system

$-3xu_1u_2 + u_2^2 - 2yu_1u_4 == 328$
$-2xyu_4 == 120$

determine if it is possible to solve for variables x, y in terms of variables u_1, u_2, u_3, u_4 arround the point $p = (x, y, u_1, u_2, u_3, u_4) = (-4, 5, -4, -4, 4, 3)$. Compute if possible $\frac{\partial x}{\partial u_2}(-4, -4, 4, 3)$.

1) $\frac{\partial x}{\partial u_2}(-4, -4, 4, 3) = -3$

2) $\frac{\partial x}{\partial u_2}(-4, -4, 4, 3) = -\frac{28}{9}$

3) $\frac{\partial x}{\partial u_2}(-4, -4, 4, 3) = -\frac{25}{9}$

4) $\frac{\partial x}{\partial u_2}(-4, -4, 4, 3) = -\frac{8}{3}$

5) $\frac{\partial x}{\partial u_2}(-4, -4, 4, 3) = -\frac{26}{9}$

Exercise 3

Given the function

$f(x, y, z) = 21 - 4x + x^2 - 4y + y^2 - 6z + z^2$ defined over the domain D≡ $\frac{x^2}{25} + \frac{y^2}{4} + \frac{z^2}{9} \leqslant 1$, compute its absolute maxima and minima.

1) We have a maximum at {2, 2, ?}

2) We have a maximum at {-5.06535, -0.0522282, ?}

3) We have a maximum at {-4.26535, ?, -0.710581}

4) We have a maximum at {-4.66535, -0.252228, ?}

5) We have a maximum at {-4.36535, ?, -1.51058}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 52

Exercise 1

Given the functions

$f(x, y) = (-1 + x - 2y + xy - 2y^2, 1 - x + 2y + 2xy - 3y^2, -3x + 3x^2 - y + 3xy - y^2)$

and

$g(u, v, w) = (3w - 2vw + 3w^2, -u - 3v + 2uw)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (0, 1)$.

1) 431.

2) 662.454

3) 680.03

4) 358.621

5) 613.76

Exercise 2

Given the system

$2x - 2y == -10$
$3u^2 v + 2wx + x^2 y + wy^2 - y^3 == -333$

determine if it is possible to solve for variables x, y in terms of variables u, v, w arround the point $p = (x, y, u, v, w) = (0, 5, -3, -4, -4)$. Compute if possible $\frac{\partial x}{\partial u}(-3, -4, -4)$.

1) $\frac{\partial x}{\partial u}(-3, -4, -4) = \frac{28}{41}$

2) $\frac{\partial x}{\partial u}(-3, -4, -4) = \frac{27}{41}$

3) $\frac{\partial x}{\partial u}(-3, -4, -4) = \frac{24}{41}$

4) $\frac{\partial x}{\partial u}(-3, -4, -4) = \frac{26}{41}$

5) $\frac{\partial x}{\partial u}(-3, -4, -4) = \frac{25}{41}$

Exercise 3

Given the function

$f(x, y, z) = -6 + 2x - x^2 - y^2 + 2z - z^2$ defined over the domain $D \equiv \frac{x^2}{25} + \frac{y^2}{4} + \frac{z^2}{9} \leqslant 1$, compute its absolute maxima and minima.

1) We have a maximum at {0.5, 0.2, ?}

2) We have a maximum at {?, 0.1, 0.6}

3) We have a maximum at {1, ?, 1}

4) We have a maximum at {1.4, ?, 1.2}

5) We have a maximum at {1.3, ?, 1.4}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 53

Exercise 1

Given the functions

$f(x, y, z) = (y^2 - 2z^2, -z, 3y^2 + 3xz)$

and

$g(u, v, w) = (3 + 3u - uv, 3 - 3v^2, -3 - 3u - 3v - 2v^2 + 2uw + 2vw)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (-1, 3, 2)$.

1) 6421.2

2) 2430.4

3) 4320.

4) 7715.71

5) 3398.69

Exercise 2

Given the system

$2y + uz^2 == -22$
$u^2 v - 2ux + ux^2 - 2vxz == 39$
$-2uz + 2xyz == 72$

determine if it is possible to solve for variables x, y, z in terms of variables u, v arround the point $p = (x, y, z, u, v) = (-3, -5, 2, -3, 4)$. Compute if possible $\frac{\partial y}{\partial v}(-3, 4)$.

1) $\frac{\partial y}{\partial v}(-3, 4) = -13$

2) $\frac{\partial y}{\partial v}(-3, 4) = -\frac{103}{8}$

3) $\frac{\partial y}{\partial v}(-3, 4) = -\frac{101}{8}$

4) $\frac{\partial y}{\partial v}(-3, 4) = -\frac{105}{8}$

5) $\frac{\partial y}{\partial v}(-3, 4) = -\frac{51}{4}$

Exercise 3

Given the function

$f(x, y, z) = 13 - 4x + x^2 - 6y + y^2 - 4z + z^2$ defined over the domain D≡ $\frac{x^2}{25} + \frac{y^2}{9} + \frac{z^2}{9} \leq 1$, compute its absolute maxima and minima.

1) We have a maximum at {-4.57863, ?, -0.668641}

2) We have a maximum at {-4.87863, -0.702961, ?}

3) We have a maximum at {2, 3, ?}

4) We have a maximum at {-5.07863, ?, -0.268641}

5) We have a maximum at {-4.07863, ?, -0.968641}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 54

Exercise 1

Given the functions

$f(x,y)=(2-x+3x^2-3xy-y^2, -3-x-3x^2+2y-3y^2, -3+x-2x^2-2y-3xy+y^2)$

and

$g(u,v,w)=(-2uv+2v^2, 3u^2+2v^2)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p=(-3,-2)$.

1) 2.45474×10^6

2) 1.55427×10^6

3) 442027.

4) 236367.

5) 1.31862×10^6

Exercise 2

Given the system

$xy^2+yu_2^2+2u_2^3+3u_1u_3+3u_3^3==19$
$2x^3-3yu_1^2+u_3^2-u_3^3+3u_4^3==-55$

determine if it is possible to solve for variables x, y in terms of variables u_1, u_2, u_3, u_4 arround the point $p=(x,y,u_1,u_2,u_3,u_4)=(-2,2,-2,-3,3,1)$. Compute if possible $\frac{\partial y}{\partial u_2}(-2,-3,3,1)$.

1) $\frac{\partial y}{\partial u_2}(-2,-3,3,1)=-13$

2) $\frac{\partial y}{\partial u_2}(-2,-3,3,1)=-10$

3) $\frac{\partial y}{\partial u_2}(-2,-3,3,1)=-14$

4) $\frac{\partial y}{\partial u_2}(-2,-3,3,1)=-12$

5) $\frac{\partial y}{\partial u_2}(-2,-3,3,1)=-11$

Exercise 3

Given the function

$f(x, y, z) = 9 - 4x + x^2 - 6y + y^2 - 2z + z^2$ defined over the domain D≡ $\frac{x^2}{4} + \frac{y^2}{9} + \frac{z^2}{16} \leqslant 1$, compute its absolute maxima and minima.

1) We have a minimum at {?, 2.31334, 0.856925}

2) We have a minimum at {0.967811, 3.23868, ?}

3) We have a minimum at {?, 3, 1}

4) We have a minimum at {1.43048, ?, 0.62559}

5) We have a minimum at {?, 2.77601, 0.162922}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 55

Exercise 1

Given the functions

$f(x_1, x_2, x_3, x_4) = (2 + 3x_2 - x_1 x_2 - x_1 x_3 - 3x_3^2 - x_2 x_4 + 3x_4^2, -2 - 2x_2 - 3x_1 x_3 - 3x_3^2 + 3x_1 x_4 + 2x_4^2)$

and

$g(u, v) = (-2 + 2u + 3v - uv + 2v^2, 1 - 3u + 3u^2 + uv - 3v^2, 3 + 2u + u^2 + 3v - 3uv + 3v^2, -2 - u + u^2 + 2v + 2uv - v^2)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (-3, 3, 3, -3)$.

1) 0.

2) 0.108197

3) 0.520785

4) 0.324004

5) 0.6204

Exercise 2

Given the system

$-2u^2 x_1 - 3x_2^2 + 3x_3^2 == 73$

$-2x_1^2 x_2 + 3x_1^2 x_3 + 2x_3^2 x_4 == -40$

$2x_2 x_4^2 - 3x_3 x_4^2 == 8$

$-2x_1 - x_2^2 + 2u x_2^2 == -5$

determine if it is possible to solve for variables x_1, x_2, x_3, x_4 in terms of variable u arround the point $p = (x_1, x_2, x_3, x_4, u) = (-2, 1, -2, -1, -4)$. Compute if possible $\frac{\partial x_2}{\partial u}(-4)$.

1) $\frac{\partial x_2}{\partial u}(-4) = \frac{800}{1677}$

2) $\frac{\partial x_2}{\partial u}(-4) = \frac{803}{1677}$

3) $\frac{\partial x_2}{\partial u}(-4) = \frac{268}{559}$

4) $\frac{\partial x_2}{\partial u}(-4) = \frac{802}{1677}$

5) $\frac{\partial x_2}{\partial u}(-4) = \frac{267}{559}$

Exercise 3

Given the function

$f(x, y, z) = -18 + 4x - x^2 + 6y - y^2 + 2z - z^2$ defined over the domain D≡ $\frac{x^2}{25} + \frac{y^2}{16} + \frac{z^2}{4} \leqslant 1$, compute its absolute maxima and minima.

1) We have a maximum at {?, 3, 1}

2) We have a maximum at {2.9, ?, 2.2}

3) We have a maximum at {0.8, ?, 1.9}

4) We have a maximum at {3.2, ?, 2.2}

5) We have a maximum at {2.6, ?, 1.9}

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Exercise 1

Given the functions

$f(x_1, x_2, x_3, x_4) = (2 x_4 - x_1 x_4 + 2 x_2 x_4 + 2 x_4^2,$
$-2 x_1 x_2 - 2 x_2^2 + 2 x_3^2 - 2 x_4 + 2 x_2 x_4, -3 x_1^2 - 3 x_2 + 3 x_2 x_3 - 2 x_3^2 + 3 x_3 x_4)$

and

$g(u, v, w) = (-3 + 2 u - 3 v + 2 u v - w + 3 v w, -3 + u, 3 - 2 u v - w + u w - 3 v w, 2 v + u w + v w),$

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (-3, -2, 0, -3)$.

1) 0.818768

2) 0.34795

3) 0.

4) 0.155416

5) −0.888758

Exercise 2

Given the system

$3 v x_3 - 3 u x_2 x_3 - 2 x_3^2 x_4 == 28$
$-2 u x_2 x_3 == 20$
$3 x_1 x_2 x_4 + x_1 x_4^2 == -500$
$-v^3 + x_2^3 - 2 x_1 x_2 x_4 == 189$

determine if it is possible to solve for variables x_1, x_2, x_3, x_4 in terms of variables u, v arround the point $p = (x_1, x_2, x_3, x_4, u, v) = (-5, -5, 1, -5, 2, -4)$. Compute if possible $\frac{\partial x_3}{\partial v}(2, -4)$.

1) $\frac{\partial x_3}{\partial v}(2, -4) = \frac{12}{145}$

2) $\frac{\partial x_3}{\partial v}(2, -4) = \frac{59}{725}$

3) $\frac{\partial x_3}{\partial v}(2, -4) = \frac{121}{1450}$

4) $\frac{\partial x_3}{\partial v}(2, -4) = \frac{119}{1450}$

5) $\frac{\partial x_3}{\partial v}(2, -4) = \frac{117}{1450}$

Exercise 3

Given the function

$f(x, y, z) = -4 + 4x - x^2 + 2y - y^2 + 2z - z^2$ defined over the domain D≡ $\frac{x^2}{16} + \frac{y^2}{9} + \frac{z^2}{4} \leqslant 1$, compute its absolute maxima and minima.

1) We have a maximum at {2.4, 2., ?}

2) We have a maximum at {2.6, ?, 0.2}

3) We have a maximum at {?, 1, 1}

4) We have a maximum at {?, 1.8, 2.}

5) We have a maximum at {2.8, ?, 2.}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 57

Exercise 1

Given the functions

$f(x_1, x_2, x_3, x_4) = (1 - x_1 - 3x_2 - 2x_3 - x_3 x_4, 3x_1 + 3x_3 - 2x_2 x_4 + 3x_4^2, -3x_2 x_3 - 2x_3 x_4)$

and

$g(u, v, w) = (-u - 2u^2 + 3uv - w + uw, 2 + 2u^2 + 3w - uw + 3vw - 2w^2, -3v + vw, 2u^2 - v - 2uv - 3w)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (-3, 1, -3, -1)$.

1) 0.44874

2) 0.452251

3) −0.817619

4) −0.162687

5) 0.

Exercise 2

Given the system

$-3 v x_1 x_4 == 180$
$u x_1 + 2 v x_1 + 3 x_1 x_2 x_3 - 2 v x_4^2 == -43$
$-u x_3 x_4 == -8$
$3 x_1^2 x_2 + 2 x_1^2 x_4 == 63$

determine if it is possible to solve for variables x_1, x_2, x_3, x_4 in terms of variables u, v arround the point $p = (x_1, x_2, x_3, x_4, u, v) = (3, 5, 2, -4, -1, 5)$. Compute if possible $\frac{\partial x_4}{\partial v}(-1, 5)$.

1) $\frac{\partial x_4}{\partial v}(-1, 5) = \frac{656}{1975}$

2) $\frac{\partial x_4}{\partial v}(-1, 5) = \frac{653}{1975}$

3) $\frac{\partial x_4}{\partial v}(-1, 5) = \frac{654}{1975}$

4) $\frac{\partial x_4}{\partial v}(-1, 5) = \frac{131}{395}$

5) $\frac{\partial x_4}{\partial v}(-1, 5) = \frac{652}{1975}$

Exercise 3

Given the function

$f(x, y, z) = -14 + 4x - x^2 + 2y - y^2 - z^2$ defined over the domain D≡ $\frac{x^2}{25} + \frac{y^2}{16} + \frac{z^2}{9} \leqslant 1$, compute its absolute maxima and minima.

1) We have a minimum at {2, 1, ?}

2) We have a minimum at {−5.29056, −0.632303, ?}

3) We have a minimum at {−4.89056, −0.832303, ?}

4) We have a minimum at {?, −0.332303, −0.1}

5) We have a minimum at {−4.49056, −0.932303, ?}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 58

Exercise 1

Given the functions

$f(x_1, x_2, x_3, x_4) = (2x_1^2 + x_2^2 + 2x_3,$
$3x_1x_2 + x_3 + 3x_3^2 - 2x_1x_4 - 3x_3x_4 - 3x_4^2, -3x_2x_3, 3 - 3x_1 - 2x_1^2 - x_2x_4)$

and

$g(u_1, u_2, u_3, u_4) = (3u_1 - 2u_1u_2 + 2u_2^2 + 3u_3u_4, -3 - 2u_1 - u_1^2 - 2u_1u_2 - u_4 + 2u_3u_4$
$, -2u_1 + 2u_1^2 + 2u_1u_2 + u_1u_4 + 2u_2u_4, -u_1 + u_2 + 3u_1u_2 - 2u_3 - u_1u_3 - 2u_4^2),$

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (-2, -3, 0, 1)$.

1) 5.7587×10^8

2) 3.04269×10^8

3) 7.50379×10^8

4) 3.8213×10^8

5) 2.81028×10^8

Exercise 2

Given the system

$-2u x_1^2 + 3w x_2^2 + v x_2 x_4 == -56$
$x_1 x_3^2 == -5$
$-2x_1^3 - u x_3 == 252$
$-2x_1 x_2 x_4 == -80$

determine if it is possible to solve for variables x_1, x_2, x_3, x_4 in terms of variables u, v, w arround the point $p = (x_1, x_2, x_3, x_4, u, v, w) = (-5, -2, -1, 4, 2, 2, 5)$. Compute if possible $\frac{\partial x_1}{\partial v}(2, 2, 5)$.

1) $\frac{\partial x_1}{\partial v}(2, 2, 5) = 1$

2) $\frac{\partial x_1}{\partial v}(2, 2, 5) = 0$

3) $\frac{\partial x_1}{\partial v}(2, 2, 5) = 4$

4) $\frac{\partial x_1}{\partial v}(2, 2, 5) = 3$

5) $\frac{\partial x_1}{\partial v}(2, 2, 5) = 2$

Exercise 3

Given the function

$f(x, y, z) = -19 + 4x - x^2 + 4y - y^2 + 6z - z^2$ defined over the domain D≡ $\frac{x^2}{25} + \frac{y^2}{16} + \frac{z^2}{16} \leqslant 1$, compute its absolute maxima and minima.

1) We have a minimum at {-3.79714, ?, -2.1653}

2) We have a minimum at {-3.49714, ?, -2.0653}

3) We have a minimum at {-4.29714, -1.84353, ?}

4) We have a minimum at {-3.39714, ?, -1.6653}

5) We have a minimum at {?, 2, 3}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 59

Exercise 1

Given the functions

$f(x_1, x_2, x_3, x_4) = (-x_1 + 2 x_1 x_2 + 2 x_4 + x_3 x_4, 2 x_1 + x_2^2 + 2 x_2 x_4)$

and

$g(u, v) = (1 - 2 u + 3 v + 2 u v, -3 - 2 u - 3 u^2 + 3 v - u v - 2 v^2, -3 - 3 u - u^2 + v + 2 v^2, -u + 3 u^2 + 2 v - 3 u v),$

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (-1, -2, 3, 0)$.

1) -0.744611

2) -0.449005

3) 0.562369

4) -0.336581

5) 0.

Exercise 2

Given the system

$-u - 2 x_4^2 - x_2 x_4^2 == -55$
$-2 u x_2 x_3 == -40$
$-2 x_1 x_2 + 2 x_1 x_3 x_4 + 2 x_4^2 - 3 u x_4^2 - 3 x_3 x_4^2 == -144$
$-u x_3 + x_1 x_3^2 - u x_4^2 == -14$

determine if it is possible to solve for variables x_1, x_2, x_3, x_4 in terms of variable u arround the point $p = (x_1, x_2, x_3, x_4, u) = (0, 4, 5, -3, 1)$. Compute if possible $\frac{\partial x_2}{\partial u}(1)$.

1) $\frac{\partial x_2}{\partial u}(1) = -\frac{884}{563}$

2) $\frac{\partial x_2}{\partial u}(1) = -\frac{882}{563}$

3) $\frac{\partial x_2}{\partial u}(1) = -\frac{883}{563}$

4) $\frac{\partial x_2}{\partial u}(1) = -\frac{881}{563}$

5) $\frac{\partial x_2}{\partial u}(1) = -\frac{880}{563}$

Exercise 3

Given the function

$f(x, y, z) = -8 + 4x - x^2 - y^2 + 2z - z^2$ defined over the domain D≡ $\frac{x^2}{16} + \frac{y^2}{4} + \frac{z^2}{25} \leqslant 1$, compute its absolute maxima and minima.

1) We have a maximum at {2.4, -1., ?}

2) We have a maximum at {?, -0.8, 0.}

3) We have a maximum at {1., -1., ?}

4) We have a maximum at {2.6, 1., ?}

5) We have a maximum at {2, ?, 1}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 60

Exercise 1

Given the functions

$f(x, y, z) = (2 + x - x^2 - x y + z, 2 x + 3 x^2 - 2 y + z, 2 + 2 x y + 2 y^2 + 2 z^2)$

and

$g(u, v, w) = (v + v^2 - 2 u w - w^2, 3 v, 3 u - v + v^2)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (-1, -3, 3)$.

1) 20592.

2) 27094.1

3) 34371.9

4) 33109.3

5) 37884.3

Exercise 2

Given the system

$-3 v x + 3 y^2 - v y^2 == -3$
$v y^2 + x y^2 - v y z - 2 u z^2 == -83$
$2 x y + x y z - u z^2 == 11$

determine if it is possible to solve for variables x, y, z in terms of variables u, v arround the point $p = (x, y, z, u, v) = (-5, -3, -1, 4, -5)$. Compute if possible $\frac{\partial z}{\partial u}(4, -5)$.

1) $\frac{\partial z}{\partial u}(4, -5) = \frac{57}{971}$

2) $\frac{\partial z}{\partial u}(4, -5) = \frac{58}{971}$

3) $\frac{\partial z}{\partial u}(4, -5) = \frac{117}{1942}$

4) $\frac{\partial z}{\partial u}(4, -5) = \frac{113}{1942}$

5) $\frac{\partial z}{\partial u}(4, -5) = \frac{115}{1942}$

Exercise 3

Given the function

$f(x, y, z) = -19 + 4x - x^2 + 6y - y^2 + 2z - z^2$ defined over the domain $D \equiv \frac{x^2}{25} + \frac{y^2}{9} + \frac{z^2}{9} \leqslant 1$, compute its absolute maxima and minima.

1) We have a minimum at {-5.17369, -0.811305, ?}

2) We have a minimum at {-4.67369, -1.0113, ?}

3) We have a minimum at {-4.47369, ?, 0.0628984}

4) We have a minimum at {?, -0.811305, 0.0628984}

5) We have a minimum at {2, ?, 1}

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Exercise 1

Given the functions

$f(x_1, x_2, x_3, x_4) = (2 - 3x_1 + 2x_1x_3 - 2x_2x_3 + 3x_4^2, 2x_3 + x_1x_4, -2x_1 + x_2 - 2x_1x_2 - 2x_3)$

and

$g(u, v, w) = (-3 - v + 2uv, u^2 + 3v - 3v^2, -2 + 3v^2 + 3uw + w^2, 2uw - 2vw)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (-1, 0, 3, 0)$.

1) 0.603615

2) −0.558376

3) −0.222412

4) 0.762514

5) 0.

Exercise 2

Given the system

$-2v^3 + 2x_2x_3 == -130$
$2x_3x_4^2 == 2$
$3x_1^2 - ux_1x_4 == 1$
$x_1^3 - 2x_2 - vx_2^2 - 2x_1x_3 + x_4^2 == -2$

determine if it is possible to solve for variables x_1, x_2, x_3, x_4 in terms of variables u, v arround the point $p = (x_1, x_2, x_3, x_4, u, v) = (1, -1, 1, 1, 2, 4)$. Compute if possible $\frac{\partial x_3}{\partial u}(2, 4)$.

1) $\frac{\partial x_3}{\partial u}(2, 4) = \frac{3}{11}$

2) $\frac{\partial x_3}{\partial u}(2, 4) = \frac{1}{11}$

3) $\frac{\partial x_3}{\partial u}(2, 4) = \frac{2}{11}$

4) $\frac{\partial x_3}{\partial u}(2, 4) = -\frac{1}{11}$

5) $\frac{\partial x_3}{\partial u}(2, 4) = 0$

Exercise 3

Given the function

$f(x, y, z) = -6 + 6x - x^2 + 2y - y^2 - z^2$ defined over the domain $D \equiv \frac{x^2}{16} + \frac{y^2}{9} + \frac{z^2}{16} \leqslant 1$, compute its absolute maxima and minima.

1) We have a minimum at {-3.45061, -0.969973, ?}

2) We have a minimum at {?, -0.969973, 0.1}

3) We have a minimum at {?, 1, 0}

4) We have a minimum at {-3.45061, -0.669973, ?}

5) We have a minimum at {-3.95061, ?, 0.}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 62

Exercise 1

Given the functions

$f(x_1, x_2, x_3, x_4) = (-3x_1^2 + 3x_1x_2 + 2x_1x_3 - 3x_2x_3, 2 + 3x_1x_3 + 2x_4 + 2x_3x_4)$

and

$g(u, v) = (-1 + 2u + 2u^2 + 3v - 2v^2, 3 + 3u - 3u^2 + 2v + uv, -2 + 2u - 3v + 3uv - 2v^2, -3 + u + 2v - 2uv - 2v^2)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (-1, -1, 3, -1)$.

1) 0.

2) 0.79143

3) 0.232493

4) -0.870632

5) -0.115443

Exercise 2

Given the system

$2x_1^2 + 2x_3^2x_4 == 36$
$-2x_1x_3 + 2x_2^2x_4 == 100$
$x_2^3 - 3x_3 - 3x_2x_3^2 + x_1x_3x_4 == -1$
$x_2^3 - 2x_1x_2x_4 - 3x_2^2x_4 + 3x_2x_4^2 == 35$

determine if it is possible to solve for variables x_1, x_2, x_3, x_4 in terms of variable u arround the point $p = (x_1, x_2, x_3, x_4, u) = (0, 5, -3, 2, 2)$. Compute if possible $\frac{\partial x_1}{\partial u}(2)$.

1) $\frac{\partial x_1}{\partial u}(2) = 1$

2) $\frac{\partial x_1}{\partial u}(2) = 4$

3) $\frac{\partial x_1}{\partial u}(2) = 2$

4) $\frac{\partial x_1}{\partial u}(2) = 3$

5) $\frac{\partial x_1}{\partial u}(2) = 0$

Exercise 3

Given the function

$f(x, y, z) = -2 + x^2 + y^2 + z^2$ defined over the domain D≡ $\frac{x^2}{16} + \frac{y^2}{4} + \frac{z^2}{25} \leqslant 1$, compute its absolute maxima and minima.

1) We have a minimum at {-0.2, ?, -0.2}

2) We have a minimum at {-0.4, ?, 0.5}

3) We have a minimum at {0.5, -0.4, ?}

4) We have a minimum at {?, -0.2, 0.4}

5) We have a minimum at {0, 0, ?}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 63

Exercise 1

Given the functions

$f(x, y) = (2 - x - 2y + xy + 3y^2, -3 + 2x - 2x^2 - xy - 3y^2, -2 + 2x + 3x^2 + 2xy, 3 + 3x + x^2 - 2y - 2xy)$

and

$g(u_1, u_2, u_3, u_4) = (-u_1^2 - 3u_1u_3 + 2u_2u_3 - u_1u_4 + 2u_3u_4, 3u_1 + 2u_2^2 - 2u_3 - 3u_1u_3 - 2u_4 + 2u_4^2)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (1, 1)$.

1) −10 742.6

2) −1852.9

3) −12 238.

4) −2589.11

5) −2043.14

Exercise 2

Given the system

$-3u + 3u^2 + uv^2 - 2uvx + 3x^2 - y^2 == 17$
$3v^2 - 3uv^2 + uy - 3vy - 2xy + uxy == -332$

determine if it is possible to solve for variables x, y in terms of variables u, v arround the point $p = (x, y, u, v) = (-4, -4, 5, -5)$. Compute if possible $\frac{\partial y}{\partial v}(5, -5)$.

1) $\frac{\partial y}{\partial v}(5, -5) = -\frac{206}{19}$

2) $\frac{\partial y}{\partial v}(5, -5) = -\frac{207}{19}$

3) $\frac{\partial y}{\partial v}(5, -5) = -\frac{203}{19}$

4) $\frac{\partial y}{\partial v}(5, -5) = -\frac{204}{19}$

5) $\frac{\partial y}{\partial v}(5, -5) = -\frac{205}{19}$

Exercise 3

Given the function

$f(x, y, z) = 17 - 4x + x^2 - 4y + y^2 - 4z + z^2$ defined over the domain D≡ $\frac{x^2}{4} + \frac{y^2}{25} + \frac{z^2}{25} \leqslant 1$, compute its absolute maxima and minima.

1) We have a minimum at {?, 2.71488, 2.13312}

2) We have a minimum at {?, 1.55136, 1.55136}

3) We have a minimum at {1.67231, 1.9392, ?}

4) We have a minimum at {2.25408, 0.969602, ?}

5) We have a minimum at {?, 2, 2}

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Exercise 1

Given the functions

$f(x,y) = (-1 + 3x - 3x^2 - 3y + xy - 3y^2, 3 + 2x - 3x^2 + y + 3xy - 2y^2)$

and

$g(u,v) = (-3u - 3u^2 + v + 3v^2, 1 + 2u + 2u^2 - v - 2uv)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (2,3)$.

1) 99 987.7

2) 78 353.4

3) 158 675.

4) 248 210.

5) 241 128.

Exercise 2

Given the system

$-3x - 3vy - 3vxy == -33$
$-2vx - x^2 + vx^2 - v^2y + xy - 2y^2 - xy^2 == 83$

determine if it is possible to solve for variables x, y in terms of variables u, v arround the point $p = (x,y,u,v) = (-4,-5,-4,1)$. Compute if possible $\frac{\partial y}{\partial v}(-4,1)$.

1) $\frac{\partial y}{\partial v}(-4,1) = -84$

2) $\frac{\partial y}{\partial v}(-4,1) = -83$

3) $\frac{\partial y}{\partial v}(-4,1) = -86$

4) $\frac{\partial y}{\partial v}(-4,1) = -82$

5) $\frac{\partial y}{\partial v}(-4,1) = -85$

Exercise 3

Given the function

$f(x, y, z) = -6 - 2x + x^2 + y^2 + z^2$ defined over the domain D≡ $\frac{x^2}{4} + \frac{y^2}{25} + \frac{z^2}{4} \leqslant 1$, compute its absolute maxima and minima.

1) We have a maximum at {-0.390476, -4.87727, ?}

2) We have a maximum at {-0.690476, -4.87727, ?}

3) We have a maximum at {-0.690476, -4.87727, ?}

4) We have a maximum at {?, -4.97727, 0.}

5) We have a maximum at {?, 0, 0}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 65

Exercise 1

Given the functions

$f(x,y,z)=(3+3x-2yz,\ 3x+2y+2y^2-2yz)$

and

$g(u,v)=(1-3u+3v+2uv-3v^2,\ -2-u-2u^2+v-2uv-3v^2,\ 2-3u-2u^2+v+v^2)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p=(2,-2,-3)$.

1) -0.788658

2) $0.$

3) -0.414784

4) 0.356025

5) -0.552427

Exercise 2

Given the system

$3x^2-2ux^2+u^2y-2uxy+3uz+2yz-y^2z==18$

$x^2-u^2y-2u^2z+uxz+2x^2z+xz^2==32$

$-2ux-3x^3-3uy^2+xy^2+y^3+2u^2z-3x^2z==52$

determine if it is possible to solve for variables x,y,z in terms of variable u arround the point $p=(x,y,z,u)=(-3,3,2,-1)$. Compute if possible $\frac{\partial z}{\partial u}(-1)$.

1) $\frac{\partial z}{\partial u}(-1)=-\frac{1857}{2087}$

2) $\frac{\partial z}{\partial u}(-1)=-\frac{1858}{2087}$

3) $\frac{\partial z}{\partial u}(-1)=-\frac{1856}{2087}$

4) $\frac{\partial z}{\partial u}(-1)=-\frac{1855}{2087}$

5) $\frac{\partial z}{\partial u}(-1)=-\frac{1854}{2087}$

Exercise 3

Given the function

$f(x, y, z) = 4 - 2x + x^2 + y^2 - 4z + z^2$ defined over the domain $D \equiv \frac{x^2}{9} + \frac{y^2}{4} + \frac{z^2}{25} \leqslant 1$, compute its absolute maxima and minima.

1) We have a minimum at {1, 0, ?}

2) We have a minimum at {1.4, ?, 2.6}

3) We have a minimum at {?, -0.8, 1.8}

4) We have a minimum at {0.6, ?, 1.}

5) We have a minimum at {0.4, ?, 1.8}

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Exercise 1

Given the functions

$f(x_1, x_2, x_3, x_4) = (3x_1 + 2x_3 + 2x_1x_3, 2x_3 + 3x_1x_3 + 2x_2x_4, 3 - 3x_1 - 2x_1^2 + 3x_4)$

and

$g(u, v, w) = (-3w, 2 - 2u - 3u^2 - w, -2uv - 3w, 2v + 3uv + 2v^2 + 2w + uw)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (0, 3, -3, 2)$.

1) 0.534668

2) 0.412235

3) 0.

4) 0.198178

5) 0.736504

Exercise 2

Given the system

$2x_2x_3 - x_3^2 - 2x_1x_2x_4 == -12$
$2u^2x_3 - ux_2x_4 - 2x_3^2x_4 == -110$
$-x_2x_3 - x_1x_2x_3 + 3vx_2x_4 == -86$
$uvx_3 + 3x_2x_4 == 0$

determine if it is possible to solve for variables x_1, x_2, x_3, x_4 in terms of variables u, v arround the point $p = (x_1, x_2, x_3, x_4, u, v) = (0, 2, -2, -5, -5, 3)$. Compute if possible $\frac{\partial x_3}{\partial u}(-5, 3)$.

1) $\frac{\partial x_3}{\partial u}(-5, 3) = -\frac{84}{145}$

2) $\frac{\partial x_3}{\partial u}(-5, 3) = -\frac{421}{725}$

3) $\frac{\partial x_3}{\partial u}(-5, 3) = -\frac{1262}{2175}$

4) $\frac{\partial x_3}{\partial u}(-5, 3) = -\frac{1261}{2175}$

5) $\frac{\partial x_3}{\partial u}(-5, 3) = -\frac{1264}{2175}$

Exercise 3

Given the function

$f(x, y, z) = 7 - 2x + x^2 - 4y + y^2 - 6z + z^2$ defined over the domain $D \equiv \frac{x^2}{16} + \frac{y^2}{9} + \frac{z^2}{16} \leqslant 1$, compute its absolute maxima and minima.

1) We have a maximum at {-1.20808, -0.889145, ?}

2) We have a maximum at {?, -0.389145, -4.02423}

3) We have a maximum at {-1.10808, -0.489145, ?}

4) We have a maximum at {-1.00808, ?, -3.42423}

5) We have a maximum at {?, 2, 3}

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Exercise 1

Given the functions

$f(x, y, z) = (-3x - 3yz, -2x + 2y - 3xy - z, z + 2z^2)$

and

$g(u, v, w) = (-1 + 2v + uv + v^2, -2 - 3uv + 3v^2 + vw, -3u - v - 2uv + 2v^2 + vw + 3w^2)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (2, -1, -3)$.

1) -122211.

2) -514404.

3) -968527.

4) -945095.

5) -794800.

Exercise 2

Given the system

$u y z - u z^2 == 20$
$u v y + 3 x y^2 == 96$
$-2 u y + 3 u x y - 2 v z == -22$

determine if it is possible to solve for variables x, y, z in terms of variables u, v arround the point $p = (x, y, z, u, v) = (1, 4, -1, -4, -3)$. Compute if possible $\frac{\partial z}{\partial u}(-4, -3)$.

1) $\frac{\partial z}{\partial u}(-4, -3) = -\frac{14}{99}$

2) $\frac{\partial z}{\partial u}(-4, -3) = -\frac{13}{99}$

3) $\frac{\partial z}{\partial u}(-4, -3) = -\frac{16}{99}$

4) $\frac{\partial z}{\partial u}(-4, -3) = -\frac{5}{33}$

5) $\frac{\partial z}{\partial u}(-4, -3) = -\frac{4}{33}$

Exercise 3

Given the function

$f(x, y, z) = 1 + x^2 - 4y + y^2 + z^2$ defined over the domain $D \equiv \frac{x^2}{9} + \frac{y^2}{9} + \frac{z^2}{4} \leqslant 1$, compute its absolute maxima and minima.

1) We have a minimum at {-0.4, 1.4, ?}

2) We have a minimum at {-0.6, ?, -0.2}

3) We have a minimum at {?, 2.6, 0.6}

4) We have a minimum at {-0.4, 1.4, ?}

5) We have a minimum at {?, 2, 0}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 68

Exercise 1

Given the functions

$f(x, y, z) = (x y + z^2, -3 x^2 - y + 3 z - x z + y z, 3 x - 2 x z + z^2)$

and

$g(u, v, w) = (2 u + v + 3 v^2, -1 + 3 u v - 2 v w, 1 + u^2 + 2 w + 3 v w + 3 w^2)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (-1, 1, 3)$.

1) -3.79644×10^6

2) -2.49389×10^6

3) -2.35305×10^7

4) -1.43458×10^7

5) -1.35752×10^7

Exercise 2

Given the system

$3 u^2 v - 2 v^2 - u^2 x + u x^2 - 3 v y^2 + 2 x y^2 + 2 v x z == 184$
$2 u^2 x + v y + 3 v y z == -36$
$2 u v y + 2 u x z == -2$

determine if it is possible to solve for variables x, y, z in terms of variables u, v arround the point $p = (x, y, z, u, v) = (2, -5, -3, 1, -1)$. Compute if possible $\frac{\partial x}{\partial v}(1, -1)$.

1) $\frac{\partial x}{\partial v}(1, -1) = -\frac{8366}{5171}$

2) $\frac{\partial x}{\partial v}(1, -1) = -\frac{8370}{5171}$

3) $\frac{\partial x}{\partial v}(1, -1) = -\frac{8369}{5171}$

4) $\frac{\partial x}{\partial v}(1, -1) = -\frac{8368}{5171}$

5) $\frac{\partial x}{\partial v}(1, -1) = -\frac{8367}{5171}$

Exercise 3

Given the function

$f(x, y, z) = 2 + x^2 - 4y + y^2 - 2z + z^2$ defined over the domain D≡ $\frac{x^2}{9} + \frac{y^2}{9} + \frac{z^2}{4} \leqslant 1$, compute its absolute maxima and minima.

1) We have a maximum at {0, 2, ?}

2) We have a maximum at {0.5, −2.8509, ?}

3) We have a maximum at {0., −2.9509, ?}

4) We have a maximum at {0.2, ?, 0.139634}

5) We have a maximum at {0.3, ?, 0.0396343}

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Exercise 1

Given the functions

$f(x, y, z) = (2y + 3y^2 + yz, 2x^2 - y, -2x^2, -2xz + 2yz)$

and

$g(u_1, u_2, u_3, u_4) = (-3u_2 - 3u_1u_2 + 3u_3 + u_2u_3, -3u_2 - u_1u_2 + 3u_3, 3 + 3u_1^2 + 2u_3 - 2u_4)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (2, 1, -2)$.

1) 4713.86

2) 3624.52

3) 417.181

4) 4692.42

5) 3024.

Exercise 2

Given the system

$w^2 x + 2uvy == 152$
$-2xy == -20$
$3w^3 + 3uxy + vyz - 2yz^2 == 93$

determine if it is possible to solve for variables x, y, z in terms of variables u, v, w arround the point $p = (x, y, z, u, v, w) = (2, 5, 0, 3, 5, 1)$. Compute if possible $\frac{\partial x}{\partial w}(3, 5, 1)$.

1) $\frac{\partial x}{\partial w}(3, 5, 1) = \frac{4}{37}$

2) $\frac{\partial x}{\partial w}(3, 5, 1) = \frac{2}{37}$

3) $\frac{\partial x}{\partial w}(3, 5, 1) = \frac{5}{37}$

4) $\frac{\partial x}{\partial w}(3, 5, 1) = \frac{3}{37}$

5) $\frac{\partial x}{\partial w}(3, 5, 1) = \frac{6}{37}$

Exercise 3

Given the function

$f(x, y, z) = -1 + 4x - x^2 + 2y - y^2 + 4z - z^2$ defined over the domain D≡ $\frac{x^2}{25} + \frac{y^2}{9} + \frac{z^2}{16} \leqslant 1$, compute its absolute maxima and minima.

1) We have a maximum at {2, 1, ?}

2) We have a maximum at {1., 1.2, ?}

3) We have a maximum at {?, 1.6, 2.8}

4) We have a maximum at {1.6, 0., ?}

5) We have a maximum at {?, 1.6, 2.2}

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Exercise 1

Given the functions

$f(x, y) = (2 + x - 3y - 3xy, 2 - x + 3x^2 - 3y + 2xy - y^2)$

and

$g(u, v) = (-1 - u - 2u^2 + uv - v^2, 1 - u - u^2 + v - 2uv - v^2)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (-1, -2)$.

1) 5572.

2) 4487.41

3) 8336.19

4) 4681.66

5) 3842.36

Exercise 2

Given the system

$-3u^2 v + v^3 + 3vxy + 3uy^2 == -608$
$-2u - v + 3x^2 - 3y + 3xy + 3x^2 y == -134$

determine if it is possible to solve for variables x, y in terms of variables u, v arround the point $p = (x, y, u, v) = (3, -5, -4, 4)$. Compute if possible $\frac{\partial y}{\partial v}(-4, 4)$.

1) $\frac{\partial y}{\partial v}(-4, 4) = \frac{1}{3}$

2) $\frac{\partial y}{\partial v}(-4, 4) = \frac{429}{1288}$

3) $\frac{\partial y}{\partial v}(-4, 4) = \frac{1289}{3864}$

4) $\frac{\partial y}{\partial v}(-4, 4) = \frac{643}{1932}$

5) $\frac{\partial y}{\partial v}(-4, 4) = \frac{1285}{3864}$

Exercise 3

Given the function

$f(x, y, z) = 15 - 6x + x^2 - 6y + y^2 + z^2$ defined over the domain D≡ $\frac{x^2}{4} + \frac{y^2}{4} + \frac{z^2}{16} \leqslant 1$, compute its absolute maxima and minima.

1) We have a minimum at {?, 1.41421, 0.}

2) We have a minimum at {1.27279, ?, -0.424264}

3) We have a minimum at {1.55563, ?, -0.565685}

4) We have a minimum at {?, 3, 0}

5) We have a minimum at {0.707107, 0.707107, ?}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 71

Exercise 1

Given the functions

$f(x_1, x_2, x_3, x_4) = (2 + x_1^2 - 2x_2 - x_2^2 - 2x_3 + 2x_4 - x_3 x_4$
$, -2 - 2x_1 - x_3 - 3x_3^2 + 3x_4 - 3x_1 x_4 + x_2 x_4, 1 - 3x_2^2 + 3x_1 x_4)$

and

$g(u, v, w) = (-u^2, 1 + u^2 - 3v - uv + 3uw, 3u^2 - 3v - uv - v^2 + uw, -v + uv + 3v^2 - w + 3w^2),$

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (-3, -1, -2, -1)$.

1) -0.654162

2) 0.578378

3) 0.32783

4) 0.264902

5) 0.

Exercise 2

Given the system

$-v x_2 x_3 == 50$
$-3u x_1 + 3x_2^2 x_3 == 363$
$3v x_1^2 + 3u x_2 x_3 + 3u x_2 x_4 == 84$
$-3u x_2^2 - v x_4 - v^2 x_4 == 168$

determine if it is possible to solve for variables x_1, x_2, x_3, x_4 in terms of variables u, v arround the point $p = (x_1, x_2, x_3, x_4, u, v) = (-2, -5, 5, -3, -2, 2)$. Compute if possible $\frac{\partial x_2}{\partial u}(-2, 2)$.

1) $\frac{\partial x_2}{\partial u}(-2, 2) = -\frac{62}{97}$

2) $\frac{\partial x_2}{\partial u}(-2, 2) = -\frac{123}{194}$

3) $\frac{\partial x_2}{\partial u}(-2, 2) = -\frac{125}{194}$

4) $\frac{\partial x_2}{\partial u}(-2, 2) = -\frac{127}{194}$

5) $\frac{\partial x_2}{\partial u}(-2, 2) = -\frac{63}{97}$

Exercise 3

Given the function

$f(x, y, z) = 23 - 2x + x^2 - 4y + y^2 - 6z + z^2$ defined over the domain D≡ $\frac{x^2}{25} + \frac{y^2}{25} + \frac{z^2}{16} \leqslant 1$, compute its absolute maxima and minima.

1) We have a minimum at {-0.5, 2.3, ?}

2) We have a minimum at {0.1, ?, 4.2}

3) We have a minimum at {?, 2.9, 4.5}

4) We have a minimum at {1, ?, 3}

5) We have a minimum at {-0.5, 0.8, ?}

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Exercise 1

Given the functions

$f(x_1, x_2, x_3, x_4) = (x_1^2 + 3 x_2 + 2 x_4 + 2 x_1 x_4,$
$2 x_1^2 - 2 x_1 x_2 - 3 x_3^2 + 3 x_4 - x_3 x_4, -3 x_2 x_3 - 2 x_3^2 + 3 x_4 + x_3 x_4, -2 x_1^2 + 2 x_2^2 - x_1 x_3 + 3 x_1 x_4)$

and

$g(u_1, u_2, u_3, u_4) = (2 u_4 + 2 u_1 u_4, -2 u_1 + u_1^2 + 2 u_3 - 2 u_1 u_3 + 2 u_3^2 + u_1 u_4 + 2 u_4^2$
$, -3 u_1 - 2 u_2 + 3 u_2 u_3 - u_4, 1 + 2 u_2 - 3 u_1 u_2 + u_3^2 + u_1 u_4),$

compute the determinant of the Jacobian matrix of the composition gof at the point
$p = (-1, 1, -2, 1)$.

1) -342347.

2) -291663.

3) -252962.

4) -410400.

5) -283380.

Exercise 2

Given the system

$-3 v x_2 - 3 x_3^3 == -330$
$2 x_2 x_4^2 == 40$
$-2 u w x_4 + x_1 x_4^2 == 44$
$x_2 x_3 x_4 == -50$

determine if it is possible to solve for variables x_1, x_2, x_3, x_4
in terms of variables u, v, w arround the point $p = (x_1, x_2, x_3, x_4, u, v$
$, w) = (5, 5, 5, -2, -2, -3, -3)$. Compute if possible $\frac{\partial x_4}{\partial w}(-2, -3, -3)$.

1) $\frac{\partial x_4}{\partial w}(-2, -3, -3) = 3$

2) $\frac{\partial x_4}{\partial w}(-2, -3, -3) = 1$

3) $\frac{\partial x_4}{\partial w}(-2, -3, -3) = 4$

4) $\frac{\partial x_4}{\partial w}(-2, -3, -3) = 0$

5) $\frac{\partial x_4}{\partial w}(-2, -3, -3) = 2$

Exercise 3

Given the function

$f(x, y, z) = 26 - 6x + x^2 - 6y + y^2 + z^2$ defined over the domain D≡ $\frac{x^2}{16} + \frac{y^2}{16} + \frac{z^2}{25} \leqslant 1$, compute its absolute maxima and minima.

1) We have a maximum at {-2.62843, -3.32843, ?}

2) We have a maximum at {?, -2.82843, 0.}

3) We have a maximum at {-2.92843, -2.72843, ?}

4) We have a maximum at {3, 3, ?}

5) We have a maximum at {-2.72843, ?, 0.4}

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Exercise 1

Given the functions

$f(x, y) = (2 + 3x - 2x^2 - y + 3xy, -1 + x^2 + 2xy + 3y^2, 3 - x - 3x^2 + 3y - xy + 3y^2)$

and

$g(u, v, w) = (-2u^2, -3v^2)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (-2, 2)$.

1) $-392017.$

2) $-139158.$

3) $-594048.$

4) -1.11356×10^6

5) $-332370.$

Exercise 2

Given the system

$-x^2 + 3y^3 == -19$

$3x^2 y == -48$

determine if it is possible to solve for variables x, y in terms of variables u_1, u_2, u_3, u_4 arround the point $p = (x, y, u_1, u_2, u_3, u_4) = (-4, -1, 1, 4, 0, -3)$. Compute if possible $\frac{\partial y}{\partial u_3}(1, 4, 0, -3)$.

1) $\frac{\partial y}{\partial u_3}(1, 4, 0, -3) = 4$

2) $\frac{\partial y}{\partial u_3}(1, 4, 0, -3) = 0$

3) $\frac{\partial y}{\partial u_3}(1, 4, 0, -3) = 2$

4) $\frac{\partial y}{\partial u_3}(1, 4, 0, -3) = 1$

5) $\frac{\partial y}{\partial u_3}(1, 4, 0, -3) = 3$

Exercise 3

Given the function

$f(x, y, z) = 14 - 4x + x^2 - 4y + y^2 - 2z + z^2$ defined over the domain D≡ $\frac{x^2}{4} + \frac{y^2}{9} + \frac{z^2}{16} \leqslant 1$, compute its absolute maxima and minima.

1) We have a maximum at {?, -1.92172, -3.71351}

2) We have a maximum at {-0.375378, -1.42172, ?}

3) We have a maximum at {-0.475378, -1.52172, ?}

4) We have a maximum at {-0.0753781, ?, -3.51351}

5) We have a maximum at {?, 2, 1}

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Exercise 1

Given the functions

$f(x, y) = (-3 + 2x - 3x^2 + 3y - xy + 3y^2,$
$2 - x - 3x^2 + 2y + 2xy - y^2, -2 + x + 3y + 2y^2, -1 - x^2 + 2y - 2xy - 3y^2)$

and

$g(u_1, u_2, u_3, u_4) = (-u_1^2 - 2u_1u_2 - 3u_3^2 - 3u_3u_4 + 2u_4^2, -3u_1 - 2u_1^2 + 3u_2 - 3u_4^2),$

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (2, 0)$.

1) 81030.2

2) 261039.

3) 181331.

4) 266927.

5) 150298.

Exercise 2

Given the system

$-3x^2y == 24$
$-3xyu_4 == 60$

determine if it is possible to solve for variables x, y in terms of variables u_1, u_2, u_3, u_4, u_5 arround the point $p = (x, y, u_1, u_2, u_3, u_4, u_5) = (-2, -2, 0, 4, 3, -5, -4)$. Compute if possible $\frac{\partial x}{\partial u_1}(0, 4, 3, -5, -4)$.

1) $\frac{\partial x}{\partial u_1}(0, 4, 3, -5, -4) = 4$

2) $\frac{\partial x}{\partial u_1}(0, 4, 3, -5, -4) = 0$

3) $\frac{\partial x}{\partial u_1}(0, 4, 3, -5, -4) = 3$

4) $\frac{\partial x}{\partial u_1}(0, 4, 3, -5, -4) = 2$

5) $\frac{\partial x}{\partial u_1}(0, 4, 3, -5, -4) = 1$

Exercise 3

Given the function

$f(x, y, z) = 12 - 2x + x^2 - 4y + y^2 - 6z + z^2$ defined over the domain D≡ $\frac{x^2}{4} + \frac{y^2}{16} + \frac{z^2}{4} \leqslant 1$, compute its absolute maxima and minima.

1) We have a maximum at {1, 2, ?}

2) We have a maximum at {-0.395944, ?, -0.087832}

3) We have a maximum at {?, -4.00319, -0.987832}

4) We have a maximum at {?, -3.80319, -0.587832}

5) We have a maximum at {?, -3.90319, -0.287832}

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Exercise 1

Given the functions

$f(x, y) = (-3 + 2y - 2xy + y^2, -3 + 3x - 3x^2 + y + 2xy + y^2, 2 + 3x - 2x^2 + y - 3xy + 3y^2, -3 + 2x + x^2 + 2y)$

and

$g(u_1, u_2, u_3, u_4) = (3u_1^2 - 2u_1 u_2 - 3u_2^2 + u_4 + 2u_1 u_4, -2u_1^2 - 3u_1 u_2 + u_1 u_4 + u_2 u_4 - u_4^2)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (0, 0)$.

1) 4281.99

2) 3000.

3) 4605.5

4) 3567.67

5) 4382.7

Exercise 2

Given the system

$2xyu_3 == 200$
$-2x^2 u_1 + xyu_5 == -228$

determine if it is possible to solve for variables x, y in terms of variables u_1, u_2, u_3, u_4, u_5 arround the point $p = (x, y, u_1, u_2, u_3, u_4, u_5) = (4, 5, 4, -5, 5, -1, -5)$. Compute if possible $\frac{\partial x}{\partial u_3}(4, -5, 5, -1, -5)$.

1) $\frac{\partial x}{\partial u_3}(4, -5, 5, -1, -5) = \frac{5}{16}$

2) $\frac{\partial x}{\partial u_3}(4, -5, 5, -1, -5) = \frac{9}{16}$

3) $\frac{\partial x}{\partial u_3}(4, -5, 5, -1, -5) = \frac{7}{16}$

4) $\frac{\partial x}{\partial u_3}(4, -5, 5, -1, -5) = \frac{3}{8}$

5) $\frac{\partial x}{\partial u_3}(4, -5, 5, -1, -5) = \frac{1}{2}$

Exercise 3

Given the function

$f(x, y, z) = 9 + x^2 - 2y + y^2 - 2z + z^2$ defined over the domain $D \equiv \frac{x^2}{25} + \frac{y^2}{4} + \frac{z^2}{16} \leqslant 1$, compute its absolute maxima and minima.

1) We have a maximum at {6.68047, ?, −0.887048}

2) We have a maximum at {?, 1, 1}

3) We have a maximum at {?, −2.4173, −1.33241}

4) We have a maximum at {?, −0.190476, −1.77778}

5) We have a maximum at {?, 1.59098, −1.33241}

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Exercise 1

Given the functions

$f(x,y) = (2-3x+3x^2+3xy+2y^2,\ 1-2x-y-2xy-3y^2,\ 3x^2+xy-y^2,\ -2+x-2x^2-3xy-3y^2)$

and

$g(u_1,u_2,u_3,u_4) = (-2u_1^2+3u_1u_3-u_3^2,\ -u_1^2+2u_3^2+u_4-u_1u_4+3u_2u_4)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p=(2,-3)$.

1) -28130.3

2) $-292003.$

3) $-322366.$

4) $-172854.$

5) $-289486.$

Exercise 2

Given the system

$2xy - yu_2^2 + 3u_2u_3u_4 == 24$

$-3x^2u_3 - 3xyu_3 == 0$

determine if it is possible to solve for variables x, y in terms of variables u_1, u_2, u_3, u_4 arround the point $p=(x,y,u_1,u_2,u_3,u_4) = (2,-2,-4,4,-5,0)$. Compute if possible $\frac{\partial y}{\partial u_4}(-4,4,-5,0)$.

1) $\frac{\partial y}{\partial u_4}(-4,4,-5,0) = -\frac{13}{2}$

2) $\frac{\partial y}{\partial u_4}(-4,4,-5,0) = -\frac{15}{2}$

3) $\frac{\partial y}{\partial u_4}(-4,4,-5,0) = -\frac{11}{2}$

4) $\frac{\partial y}{\partial u_4}(-4,4,-5,0) = -6$

5) $\frac{\partial y}{\partial u_4}(-4,4,-5,0) = -7$

Exercise 3

Given the function

$f(x, y, z) = -23 + 6x - x^2 + 6y - y^2 + 2z - z^2$ defined over the domain D≡ $\frac{x^2}{4} + \frac{y^2}{16} + \frac{z^2}{16} \leqslant 1$, compute its absolute maxima and minima.

1) We have a minimum at {-0.679444, ?, -1.62803}

2) We have a minimum at {?, -4.08408, -0.928028}

3) We have a minimum at {?, -3.38408, -1.12803}

4) We have a minimum at {?, -3.68408, -1.22803}

5) We have a minimum at {3, ?, 1}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 77

Exercise 1

Given the functions

$f(x,y)=(2-x+3x^2+y-2xy+3y^2,\ -3-x+x^2+xy-2y^2)$

and

$g(u,v)=(-u+u^2-v-uv,\ 1+3u-3u^2-3uv-2v^2)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p=(-3,-1)$.

1) 101 115.

2) 23 379.1

3) 175 835.

4) 187 772.

5) 141 538.

Exercise 2

Given the system

$-x y^2 == 36$

$3 y u_2 u_3 + x u_1 u_5 == 16$

determine if it is possible to solve for variables x, y in terms of variables u_1, u_2, u_3, u_4, u_5 arround the point $p=(x, y, u_1, u_2, u_3, u_4, u_5) = (-4, 3, -1, 1, 4, 2, -5)$. Compute if possible $\frac{\partial x}{\partial u_2}(-1,1,4,2,-5)$.

1) $\frac{\partial x}{\partial u_2}(-1,1,4,2,-5) = -\frac{70}{19}$

2) $\frac{\partial x}{\partial u_2}(-1,1,4,2,-5) = -\frac{69}{19}$

3) $\frac{\partial x}{\partial u_2}(-1,1,4,2,-5) = -\frac{72}{19}$

4) $\frac{\partial x}{\partial u_2}(-1,1,4,2,-5) = -\frac{71}{19}$

5) $\frac{\partial x}{\partial u_2}(-1,1,4,2,-5) = -\frac{68}{19}$

Exercise 3

Given the function

$f(x, y, z) = 9 + x^2 - 4y + y^2 - 6z + z^2$ defined over the domain $D \equiv \frac{x^2}{4} + \frac{y^2}{25} + \frac{z^2}{25} \leqslant 1$, compute its absolute maxima and minima.

1) We have a maximum at {-0.3, ?, -4.06025}

2) We have a maximum at {0.5, ?, -4.56025}

3) We have a maximum at {?, 2, 3}

4) We have a maximum at {0., -2.7735, ?}

5) We have a maximum at {?, -2.9735, -3.86025}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 78

Exercise 1

Given the functions

$f(x, y, z) = (3x^2 - 2xz, -2yz + 3z^2)$

and

$g(u, v) = (-3 + 3u + u^2 - v - 3uv, -3 - 2u + 2u^2 - v - 3uv, 1 + 3u + u^2 + 3v - 3uv + 3v^2)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (0, -2, -3)$.

1) 0.231278

2) 0.535542

3) 0.709021

4) 0.

5) −0.594464

Exercise 2

Given the system

$x u_3 u_4 + y u_4^2 == 18$
$3x^2 u_1 - 2z^2 u_1 - 2y u_1^2 - 2z u_2^2 == -7$
$y^2 z - 2yz u_2 == 33$

determine if it is possible to solve for variables x, y, z in terms of variables u_1, u_2, u_3, u_4 arround the point $p = (x, y, z, u_1, u_2, u_3, u_4) = (-3, -3, 1, -5, 4, -5, 3)$. Compute if possible $\frac{\partial z}{\partial u_4}(-5, 4, -5, 3)$.

1) $\frac{\partial z}{\partial u_4}(-5, 4, -5, 3) = -5$

2) $\frac{\partial z}{\partial u_4}(-5, 4, -5, 3) = -3$

3) $\frac{\partial z}{\partial u_4}(-5, 4, -5, 3) = -4$

4) $\frac{\partial z}{\partial u_4}(-5, 4, -5, 3) = -6$

5) $\frac{\partial z}{\partial u_4}(-5, 4, -5, 3) = -7$

Exercise 3

Given the function

$f(x, y, z) = -17 + 4x - x^2 - y^2 + 6z - z^2$ defined over the domain D≡ $\frac{x^2}{9} + \frac{y^2}{25} + \frac{z^2}{4} \leq 1$, compute its absolute maxima and minima.

1) We have a maximum at {1.33464, ?, 2.42079}

2) We have a maximum at {?, -0.864567, 1.38331}

3) We have a maximum at {2, 0, ?}

4) We have a maximum at {?, 0.345827, 1.21039}

5) We have a maximum at {1.50755, ?, 1.72913}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 79

Exercise 1

Given the functions

$f(x, y, z) = (-1 - y^2, 1 + 2x^2, 3z + 3yz)$

and

$g(u, v, w) = (u + 2w + 2uw + w^2, -uv - w + 3uw - 2vw, 2uv - 3v^2)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (1, -2, -3)$.

1) -1.31754×10^6

2) $-846912.$

3) $-382352.$

4) $-390822.$

5) -91322.2

Exercise 2

Given the system

$-u x^2 + 3 y^2 z == -112$

$-2 v^2 x + x^2 + u y - v z + 3 x z^2 == 162$

$3 u x z == 24$

determine if it is possible to solve for variables x, y, z in terms of variables u, v arround the point $p = (x, y, z, u, v) = (-4, 4, -2, 1, -5)$. Compute if possible $\frac{\partial z}{\partial u}(1, -5)$.

1) $\frac{\partial z}{\partial u}(1, -5) = \frac{539}{437}$

2) $\frac{\partial z}{\partial u}(1, -5) = \frac{542}{437}$

3) $\frac{\partial z}{\partial u}(1, -5) = \frac{543}{437}$

4) $\frac{\partial z}{\partial u}(1, -5) = \frac{541}{437}$

5) $\frac{\partial z}{\partial u}(1, -5) = \frac{540}{437}$

Exercise 3

Given the function

$f(x, y, z) = -20 + 2x - x^2 + 6y - y^2 + 2z - z^2$ defined over the domain D≡ $\frac{x^2}{9} + \frac{y^2}{9} + \frac{z^2}{9} \leqslant 1$, compute its absolute maxima and minima.

1) We have a maximum at {0.904534, 2.7136, ?}

2) We have a maximum at {1, 3, ?}

3) We have a maximum at {?, 1.3568, 1.71861}

4) We have a maximum at {?, 2.44224, 0.361814}

5) We have a maximum at {0.633174, ?, -0.452267}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 80

Exercise 1

Given the functions

$f(x, y, z) = (-2x + xy - xz, -1 + 3x - y^2 - xz, z)$

and

$g(u, v, w) = (u + u^2 + v^2 - w + 2w^2, v^2 + 2w, -2u^2 - uv + 3w)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (1, 0, 3)$.

1) 0.823258

2) 0.

3) 0.369412

4) -0.722986

5) 0.824788

Exercise 2

Given the system

$2u^2 + 2v^2 x - 2u^2 y == 56$
$-1 + x - xy + 3yz^2 == -98$
$2u^2 x - 3y - 2u^2 y - 2v^2 z - uxz + 2vxz - 2yz^2 == 61$

determine if it is possible to solve for variables x, y, z in terms of variables u, v arround the point $p = (x, y, z, u, v) = (-4, -3, -3, -4, -3)$. Compute if possible $\frac{\partial x}{\partial v}(-4, -3)$.

1) $\frac{\partial x}{\partial v}(-4, -3) = \frac{11211}{5713}$

2) $\frac{\partial x}{\partial v}(-4, -3) = \frac{11208}{5713}$

3) $\frac{\partial x}{\partial v}(-4, -3) = \frac{11212}{5713}$

4) $\frac{\partial x}{\partial v}(-4, -3) = \frac{11209}{5713}$

5) $\frac{\partial x}{\partial v}(-4, -3) = \frac{11210}{5713}$

Exercise 3

Given the function

$f(x, y, z) = 18 - 4x + x^2 + y^2 - 4z + z^2$ defined over the domain D≡ $\frac{x^2}{25} + \frac{y^2}{9} + \frac{z^2}{9} \leqslant 1$, compute its absolute maxima and minima.

1) We have a minimum at {?, 0.6, 2.4}

2) We have a minimum at {?, -0.8, 1.}

3) We have a minimum at {2, ?, 2}

4) We have a minimum at {1.2, ?, 1.8}

5) We have a minimum at {1.2, ?, 1.2}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 81

Exercise 1

Given the functions

$f(x, y) = (2 - 3x - 2x^2 - 2y - xy, 1 + x - x^2 - 3xy - 2y^2, -2 + 3x - 3x^2 - y + 3xy + y^2, -3 - 2x + x^2 + 3y - y^2)$

and

$g(u_1, u_2, u_3, u_4) = (2u_2^2 - u_1 u_3 - 2u_3^2 + 2u_3 u_4, u_3 + 2u_4^2)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (-1, 2)$.

1) −1371.88

2) −2778.97

3) −5856.

4) −2238.

5) −1111.05

Exercise 2

Given the system

$-uv^2 + 2w^3 + 2wx + uvy == -164$
$2v^2 + 2vx^2 - y^3 == 2$

determine if it is possible to solve for variables x, y in terms of variables u, v, w arround the point $p = (x, y, u, v, w) = (2, 2, 4, -5, -2)$. Compute if possible $\frac{\partial y}{\partial v}(4, -5, -2)$.

1) $\frac{\partial y}{\partial v}(4, -5, -2) = \frac{124}{47}$

2) $\frac{\partial y}{\partial v}(4, -5, -2) = \frac{126}{47}$

3) $\frac{\partial y}{\partial v}(4, -5, -2) = \frac{127}{47}$

4) $\frac{\partial y}{\partial v}(4, -5, -2) = \frac{125}{47}$

5) $\frac{\partial y}{\partial v}(4, -5, -2) = \frac{123}{47}$

Exercise 3

Given the function

$f(x,y,z) = -2 - 4x + x^2 - 2y + y^2 - 2z + z^2$ defined over the domain D≡ $\frac{x^2}{4} + \frac{y^2}{16} + \frac{z^2}{16} \leqslant 1$, compute its absolute maxima and minima.

1) We have a minimum at {?, 1.92121, 0.233564}

2) We have a minimum at {1.87516, 0.983629, ?}

3) We have a minimum at {2.43771, 1.35866, ?}

4) We have a minimum at {2, 1, ?}

5) We have a minimum at {?, 1.92121, 1.17115}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 82

Exercise 1

Given the functions

$f(x, y) = (3 + 3x^2 - y - xy + 2y^2,$
$-3 + 2x - x^2 - y - 3xy + 3y^2, -2 + y + 2y^2, 1 - 2x - 3x^2 + 3y + 3xy + 3y^2)$

and

$g(u_1, u_2, u_3, u_4) = (-1 + 2u_1^2 + 3u_2 - 2u_2^2 - 2u_1u_3 - 2u_2u_3 + u_4^2, u_1u_2 - 2u_4 + 2u_2u_4 - 2u_3u_4 - 3u_4^2),$

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (1, 1)$.

1) -57715.4

2) $-32504.$

3) -58510.2

4) -53263.4

5) -4378.93

Exercise 2

Given the system

$3xu_4^2 - 2yu_1u_5 == 67$
$2xyu_4 == 6$

determine if it is possible to solve for variables x, y in terms of variables u_1, u_2, u_3, u_4, u_5 arround the point $p = (x, y, u_1, u_2, u_3, u_4, u_5) = (1, -1, -4, -1, 0, -3, -5)$. Compute if possible $\frac{\partial x}{\partial u_5}(-4, -1, 0, -3, -5)$.

1) $\frac{\partial x}{\partial u_5}(-4, -1, 0, -3, -5) = -\frac{8}{13}$

2) $\frac{\partial x}{\partial u_5}(-4, -1, 0, -3, -5) = -\frac{4}{13}$

3) $\frac{\partial x}{\partial u_5}(-4, -1, 0, -3, -5) = -\frac{5}{13}$

4) $\frac{\partial x}{\partial u_5}(-4, -1, 0, -3, -5) = -\frac{6}{13}$

5) $\frac{\partial x}{\partial u_5}(-4, -1, 0, -3, -5) = -\frac{7}{13}$

Exercise 3

Given the function

$f(x, y, z) = -17 - x^2 + 4y - y^2 + 4z - z^2$ defined over the domain D≡ $\frac{x^2}{4} + \frac{y^2}{16} + \frac{z^2}{25} \leqslant 1$, compute its absolute maxima and minima.

1) We have a maximum at {?, 1.6, 1.2}

2) We have a maximum at {-0.8, ?, 2.2}

3) We have a maximum at {-0.4, ?, 2.6}

4) We have a maximum at {0, 2, ?}

5) We have a maximum at {-0.8, ?, 1.}

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Exercise 1

Given the functions

$f(x, y) = (-2 + 3x^2 - y + y^2, 3 + 3x + 2x^2 + y - 3xy - y^2)$

and

$g(u, v) = (2u + u^2 + 2v + 2uv - 2v^2, 3 + 2u - 3u^2 - v + 3uv + 2v^2)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (3, 1)$.

1) -2.32934×10^6

2) -4.10759×10^6

3) -1.0947×10^6

4) -3.53819×10^6

5) $-315527.$

Exercise 2

Given the system

$$3u^2 - 2x - 2ux^2 + y + 3uy - 3y^2 - uy^2 + 3xy^2 + 3y^3 == -465$$
$$2u - 2u^2 - u^3 + 2x + 2ux - ux^2 - 3x^2y + uy^2 + 3y^3 == -105$$

determine if it is possible to solve for variables x, y in terms of variable u arround the point $p = (x, y, u) = (5, -5, 5)$. Compute if possible $\frac{\partial y}{\partial u}(5)$.

1) $\frac{\partial y}{\partial u}(5) = \frac{249}{607}$

2) $\frac{\partial y}{\partial u}(5) = \frac{997}{2428}$

3) $\frac{\partial y}{\partial u}(5) = \frac{2989}{7284}$

4) $\frac{\partial y}{\partial u}(5) = \frac{2987}{7284}$

5) $\frac{\partial y}{\partial u}(5) = \frac{1495}{3642}$

Exercise 3

Given the function

$f(x, y, z) = 15 + x^2 - 4y + y^2 - 4z + z^2$ defined over the domain D≡ $\frac{x^2}{4} + \frac{y^2}{25} + \frac{z^2}{4} \leqslant 1$, compute its absolute maxima and minima.

1) We have a maximum at {?, -4.85843, -0.557368}

2) We have a maximum at {0.5, -5.35843, ?}

3) We have a maximum at {?, -4.95843, -0.257368}

4) We have a maximum at {-0.4, ?, -0.657368}

5) We have a maximum at {0, ?, 2}

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Exercise 1

Given the functions

$f(x, y) = (-2 + x - 2x^2 - 2y + 3xy + y^2,$
$2 - 3x - 2x^2 + 3y - xy + 2y^2, 3 + x^2 + xy - y^2, 1 + 2x - x^2 - 3y + xy + y^2)$

and

$g(u_1, u_2, u_3, u_4) = (-2 + u_3 + 2u_1u_3 + u_2u_3 + u_1u_4 - 3u_4^2, -u_1^2 + 3u_2 + 3u_1u_2 - 3u_2^2 - 2u_3 + 2u_3^2),$

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (-1, 2)$.

1) −25 099.7

2) −46 286.5

3) −59 732.3

4) −69 742.

5) −109 941.

Exercise 2

Given the system

$-2u - 2v^2 + v^2x + 2vx^2 + wx^2 + 3xy^2 == -60$
$-2x + uvy + uxy - x^2y == 30$

determine if it is possible to solve for variables x, y in terms of variables u, v, w arround the point $p = (x, y, u, v, w) = (-1, 2, -3, -4, 2)$. Compute if possible $\frac{\partial x}{\partial u}(-3, -4, 2)$.

1) $\frac{\partial x}{\partial u}(-3, -4, 2) = \frac{19}{64}$

2) $\frac{\partial x}{\partial u}(-3, -4, 2) = \frac{39}{128}$

3) $\frac{\partial x}{\partial u}(-3, -4, 2) = \frac{5}{16}$

4) $\frac{\partial x}{\partial u}(-3, -4, 2) = \frac{37}{128}$

5) $\frac{\partial x}{\partial u}(-3, -4, 2) = \frac{41}{128}$

Exercise 3

Given the function

$f(x, y, z) = 16 - 4x + x^2 - 6y + y^2 - 4z + z^2$ defined over the domain D≡ $\frac{x^2}{25} + \frac{y^2}{25} + \frac{z^2}{4} \leqslant 1$, compute its absolute maxima and minima.

1) We have a minimum at {?, 2.83405, 1.46416}

2) We have a minimum at {0.472342, ?, 0.897346}

3) We have a minimum at {?, 3, 2}

4) We have a minimum at {3.02299, ?, 0.330536}

5) We have a minimum at {2.17277, 1.98383, ?}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 85

Exercise 1

Given the functions

$f(x, y, z) = (3 - 3x + yz, -z)$

and

$g(u, v) = (-2 + 2u + 2v + uv + v^2, -3 - 2u + v - 2uv + v^2, 3 + u - 2u^2 - 2v + 2uv - v^2)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (1, 3, -3)$.

1) 0.494319

2) 0.

3) −0.228499

4) −0.609678

5) 0.769484

Exercise 2

Given the system

$x z == 8$
$2 y^2 z == 128$
$-z u_1 - x u_4 == 0$

determine if it is possible to solve for variables x, y, z in terms of variables u_1, u_2, u_3, u_4 arround the point $p = (x, y, z, u_1, u_2, u_3, u_4) = (2, -4, 4, 1, 4, 5, -2)$. Compute if possible $\frac{\partial z}{\partial u_3}(1, 4, 5, -2)$.

1) $\frac{\partial z}{\partial u_3}(1, 4, 5, -2) = 2$

2) $\frac{\partial z}{\partial u_3}(1, 4, 5, -2) = 0$

3) $\frac{\partial z}{\partial u_3}(1, 4, 5, -2) = 4$

4) $\frac{\partial z}{\partial u_3}(1, 4, 5, -2) = 3$

5) $\frac{\partial z}{\partial u_3}(1, 4, 5, -2) = 1$

Exercise 3

Given the function

$f(x, y, z) = -4 + 6x - x^2 + 2y - y^2 + 2z - z^2$ defined over the domain D≡ $\frac{x^2}{9} + \frac{y^2}{25} + \frac{z^2}{4} \leqslant 1$, compute its absolute maxima and minima.

1) We have a minimum at {-1.35445, -4.12621, ?}

2) We have a minimum at {-1.05445, ?, -0.45081}

3) We have a minimum at {-1.25445, ?, -0.15081}

4) We have a minimum at {-0.75445, -4.82621, ?}

5) We have a minimum at {3, ?, 1}

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Exercise 1

Given the functions

$f(x_1, x_2, x_3, x_4) = (-x_1^2 - 2 x_1 x_2 + x_1 x_3,$
$-3 x_1 x_2 + x_1 x_3 + 2 x_3^2, -1 + 2 x_1 - 3 x_1^2 - 3 x_1 x_3, -2 + 2 x_1^2 + 3 x_1 x_2 - 2 x_3 + 3 x_4)$

and

$g(u_1, u_2, u_3, u_4) = (-u_2 + 2 u_2^2 + u_3^2 - 2 u_4 - 2 u_1 u_4 - u_3 u_4,$
$-2 u_1 u_3 + 2 u_1 u_4 - u_2 u_4, 3 u_2^2 - u_4 + 2 u_3 u_4 - 2 u_4^2, 3 u_1 - u_2 + 2 u_1 u_2 + 3 u_3 + 2 u_4^2),$

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (1, 2, 1, 0)$.

1) 1.67172×10^7

2) 1.23785×10^7

3) 2.48247×10^7

4) 2.34033×10^7

5) 2.15517×10^7

Exercise 2

Given the system

$-3 v^2 x_2 + 3 v w x_4 == 63$
$3 x_1^2 x_2 == -108$
$3 w x_1 x_3 + 2 x_1 x_2 x_4 == -114$
$-2 v x_1 x_3 == 36$

determine if it is possible to solve for variables x_1, x_2, x_3, x_4 in terms of variables u, v, w arround the point $p = (x_1, x_2, x_3, x_4, u, v, w) = (-3, -4, 2, -1, 1, 3, 5)$. Compute if possible $\frac{\partial x_3}{\partial v}(1, 3, 5)$.

1) $\frac{\partial x_3}{\partial v}(1, 3, 5) = -\frac{19}{29}$

2) $\frac{\partial x_3}{\partial v}(1, 3, 5) = -\frac{35}{58}$

3) $\frac{\partial x_3}{\partial v}(1, 3, 5) = -\frac{37}{58}$

4) $\frac{\partial x_3}{\partial v}(1, 3, 5) = -\frac{18}{29}$

5) $\frac{\partial x_3}{\partial v}(1, 3, 5) = -\frac{39}{58}$

Exercise 3

Given the function

$f(x, y, z) = 30 - 4x + x^2 - 6y + y^2 - 6z + z^2$ defined over the domain D≡ $\frac{x^2}{16} + \frac{y^2}{16} + \frac{z^2}{9} \leqslant 1$, compute its absolute maxima and minima.

1) We have a maximum at {-2.2371, -2.55565, ?}

2) We have a maximum at {-1.9371, ?, -1.38898}

3) We have a maximum at {?, -2.65565, -0.788978}

4) We have a maximum at {-2.0371, ?, -1.18898}

5) We have a maximum at {2, 3, ?}

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Exercise 1

Given the functions

$f(x, y) = (3 + x - x^2 + 3y - 2xy + y^2, -1 + 3x - x^2 + 2y - 2xy + y^2, 3 - 2x + 2x^2 + y - xy + y^2)$

and

$g(u, v, w) = (2 + 2u^2, v)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (-3, 3)$.

1) -6262.72

2) $-3348.$

3) -5768.59

4) -1636.96

5) -4732.39

Exercise 2

Given the system

$2 x u_2 u_3 - 3 y u_2 u_4 == 66$
$-u_1 - y u_1 - 3 x u_2^2 + u_1 u_2^2 == 1$

determine if it is possible to solve for variables x, y in terms of variables u_1, u_2, u_3, u_4 arround the point $p = (x, y, u_1, u_2, u_3, u_4) = (-1, -5, -2, -3, -4, -2)$. Compute if possible $\frac{\partial y}{\partial u_1}(-2, -3, -4, -2)$.

1) $\frac{\partial y}{\partial u_1}(-2, -3, -4, -2) = \frac{52}{73}$

2) $\frac{\partial y}{\partial u_1}(-2, -3, -4, -2) = \frac{54}{73}$

3) $\frac{\partial y}{\partial u_1}(-2, -3, -4, -2) = \frac{55}{73}$

4) $\frac{\partial y}{\partial u_1}(-2, -3, -4, -2) = \frac{56}{73}$

5) $\frac{\partial y}{\partial u_1}(-2, -3, -4, -2) = \frac{53}{73}$

Exercise 3

Given the function

$f(x, y, z) = -28 + 6x - x^2 + 4y - y^2 + 6z - z^2$ defined over the domain D≡ $\frac{x^2}{4} + \frac{y^2}{9} + \frac{z^2}{25} \leqslant 1$, compute its absolute maxima and minima.

1) We have a minimum at {?, -0.571454, -4.83914}

2) We have a minimum at {0.17122, -0.371454, ?}

3) We have a minimum at {?, -0.0714537, -4.63914}

4) We have a minimum at {-0.52878, ?, -4.53914}

5) We have a minimum at {3, ?, 3}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 88

Exercise 1

Given the functions

$f(x, y) = (-1 - 3x - x^2 + 2y - 2xy - 3y^2, 1 - 2x - 3x^2 + 2y + 3xy, 3x - 2x^2 + 3xy, x^2 - 2y + xy - y^2)$

and

$g(u_1, u_2, u_3, u_4) = (-u_1 u_3 - 2u_3^2 + 3u_4, 1 - 3u_1 + 2u_1 u_3 - 2u_3 u_4 - u_4^2)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (-2, -3)$.

1) 333.216

2) 1340.79

3) 946.

4) 418.452

5) 1072.16

Exercise 2

Given the system

$2xyu_1 == 96$
$-y^3 - 3x^2 u_1 - y^2 u_2 + 2u_1 u_4 == 12$

determine if it is possible to solve for variables x, y in terms of variables u_1, u_2, u_3, u_4 arround the point $p = (x, y, u_1, u_2, u_3, u_4) = (-3, -4, 4, -3, 5, 1)$. Compute if possible $\frac{\partial x}{\partial u_2}(4, -3, 5, 1)$.

1) $\frac{\partial x}{\partial u_2}(4, -3, 5, 1) = \frac{1}{7}$

2) $\frac{\partial x}{\partial u_2}(4, -3, 5, 1) = \frac{2}{7}$

3) $\frac{\partial x}{\partial u_2}(4, -3, 5, 1) = \frac{2}{21}$

4) $\frac{\partial x}{\partial u_2}(4, -3, 5, 1) = \frac{4}{21}$

5) $\frac{\partial x}{\partial u_2}(4, -3, 5, 1) = \frac{5}{21}$

Exercise 3

Given the function

$f(x, y, z) = 23 - 6x + x^2 - 4y + y^2 - 4z + z^2$ defined over the domain D≡ $\frac{x^2}{4} + \frac{y^2}{25} + \frac{z^2}{16} \leqslant 1$, compute its absolute maxima and minima.

1) We have a minimum at {3, 2, ?}

2) We have a minimum at {1.85066, 0.887407, ?}

3) We have a minimum at {?, 1.06489, 0.781696}

4) We have a minimum at {?, 1.24237, 1.31414}

5) We have a minimum at {1.67318, 1.77481, ?}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 89

Exercise 1

Given the functions

$f(x,y,z) = (-3y - 2y^2, -3 - y + 2z + 3xz + 2yz)$

and

$g(u,v) = (3 + 3u - 2u^2 + 3v, 1 - 2u + 3u^2 + 3v - 2uv + 3v^2, 1 + 3u + 2u^2 - v + uv - 3v^2)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p=(2,-1,3)$.

1) 0.284543

2) 0.427965

3) 0.

4) −0.295672

5) 0.6166

Exercise 2

Given the system

$$3x^2 - uy - 2y^3 - 2uz - 2xz + x^2 z - 2xyz - xz^2 == 129$$
$$3u^2 y + xy^2 - 2z^2 - 2uz^2 == -182$$
$$3u^3 - 3x^3 + u^2 y + 3yz - 3z^2 == -130$$

determine if it is possible to solve for variables x, y, z in terms of variable u arround the point $p=(x,y,z,u)=(1,-4,5,2)$. Compute if possible $\frac{\partial z}{\partial u}(2)$.

1) $\frac{\partial z}{\partial u}(2) = -\frac{10977}{56432}$

2) $\frac{\partial z}{\partial u}(2) = -\frac{686}{3527}$

3) $\frac{\partial z}{\partial u}(2) = -\frac{10975}{56432}$

4) $\frac{\partial z}{\partial u}(2) = -\frac{5487}{28216}$

5) $\frac{\partial z}{\partial u}(2) = -\frac{10973}{56432}$

Exercise 3

Given the function

$f(x,y,z) = 24 - 6x + x^2 + y^2 - 6z + z^2$ defined over the domain D≡ $\frac{x^2}{25} + \frac{y^2}{9} + \frac{z^2}{4} \leqslant 1$, compute its absolute maxima and minima.

1) We have a maximum at {-4.93088, ?, -0.331398}

2) We have a maximum at {-4.43088, -0.3, ?}

3) We have a maximum at {?, 0.3, -0.431398}

4) We have a maximum at {3, 0, ?}

5) We have a maximum at {?, -0.2, -0.731398}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 90

Exercise 1

Given the functions

$f(x, y, z) = (3 + 3x^2 + 3xy, -x^2 + y^2, -2 + 3x^2 - 3y^2 - 2z - 2z^2)$

and

$g(u, v, w) = (-3v + 2uv + 3v^2 - 2uw, -2u + 2uv - 3w - 2w^2, -1 + u + 2v - 3uv - 2v^2 + 2vw)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (0, 3, 0)$.

1) -1.22618×10^8

2) -8.82547×10^7

3) -7.56512×10^7

4) -8.33358×10^7

5) -1.33029×10^8

Exercise 2

Given the system

$-u^2 x - 3ux^2 + 2y^2 z - 3z^2 - vz^2 == 162$

$-3y + xz^2 == -39$

$-2x - 3z + 3x^2 z + yz^2 == 114$

determine if it is possible to solve for variables x, y, z in terms of variables u, v arround the point $p = (x, y, z, u, v) = (-3, 4, 3, -2, -3)$. Compute if possible $\frac{\partial z}{\partial v}(-2, -3)$.

1) $\frac{\partial z}{\partial v}(-2, -3) = -\frac{257}{8048}$

2) $\frac{\partial z}{\partial v}(-2, -3) = -\frac{65}{2012}$

3) $\frac{\partial z}{\partial v}(-2, -3) = -\frac{261}{8048}$

4) $\frac{\partial z}{\partial v}(-2, -3) = -\frac{259}{8048}$

5) $\frac{\partial z}{\partial v}(-2, -3) = -\frac{129}{4024}$

Exercise 3

Given the function

$f(x, y, z) = -18 + 2x - x^2 + 6y - y^2 - z^2$ defined over the domain D≡ $\frac{x^2}{9} + \frac{y^2}{9} + \frac{z^2}{25} \leqslant 1$, compute its absolute maxima and minima.

1) We have a minimum at {?, -1.9875, -4.22628}

2) We have a minimum at {-0.9625, -1.4875, ?}

3) We have a minimum at {?, -1.6875, -4.02628}

4) We have a minimum at {1, 3, ?}

5) We have a minimum at {-0.2625, ?, -4.42628}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 91

Exercise 1

Given the functions

$f(x, y, z) = (-3y + 2xz + z^2, -3 + x + xy - 2yz, 2x^2 + z - 3yz)$

and

$g(u, v, w) = (-3u^2 + v^2 + 3w + 2vw - w^2, 2u + 2u^2 - vw - 3w^2, -u^2 + v - 3uw + 3w^2)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (-1, 0, 3)$.

1) -680642.

2) -300364.

3) -710313.

4) -615417.

5) -860598.

Exercise 2

Given the system

$-u^2 x - 3x^2 y == -30$
$3u - 3v^3 + 3uy + v^2 y - uvz == 13$
$-3u^2 - 3u^3 + ux + 3uz^2 == -93$

determine if it is possible to solve for variables x, y, z in terms of variables u, v arround the point $p = (x, y, z, u, v) = (2, 1, 1, 3, 1)$. Compute if possible $\frac{\partial x}{\partial v}(3, 1)$.

1) $\frac{\partial x}{\partial v}(3, 1) = -\frac{10}{17}$

2) $\frac{\partial x}{\partial v}(3, 1) = -\frac{7}{17}$

3) $\frac{\partial x}{\partial v}(3, 1) = -\frac{9}{17}$

4) $\frac{\partial x}{\partial v}(3, 1) = -\frac{8}{17}$

5) $\frac{\partial x}{\partial v}(3, 1) = -\frac{6}{17}$

Exercise 3

Given the function

$f(x, y, z) = -3 + 4x - x^2 + 2y - y^2 - z^2$ defined over the domain D≡ $\frac{x^2}{9} + \frac{y^2}{9} + \frac{z^2}{16} \leqslant 1$, compute its absolute maxima and minima.

1) We have a maximum at {?, 1.8, 0.8}

2) We have a maximum at {3., 0.4, ?}

3) We have a maximum at {2.4, ?, -1.}

4) We have a maximum at {1.6, ?, 1.}

5) We have a maximum at {2, 1, ?}

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Exercise 1

Given the functions

$f(x, y, z) = (y^2 - 2z, -2y, -1 + 3y + z - 3z^2, 3xy - 2z - 2xz)$

and

$g(u_1, u_2, u_3, u_4) = (2 + 2u_1u_3 + u_4^2, u_2 - 3u_2^2 + 3u_3 - u_3u_4, u_1^2 - 3u_4)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (-1, 3, 0)$.

1) -260262.

2) -111129.

3) -325836.

4) -503380.

5) -398864.

Exercise 2

Given the system

$$2uvz - wxz == -1$$
$$-2w + 2uyz == -12$$
$$-wy^2 - 2z^2 == -27$$

determine if it is possible to solve for variables x, y, z in terms of variables u, v, w arround the point $p = (x, y, z, u, v, w) = (3, 5, -1, 1, 2, 1)$. Compute if possible $\frac{\partial x}{\partial w}(1, 2, 1)$.

1) $\frac{\partial x}{\partial w}(1, 2, 1) = -\frac{123}{46}$

2) $\frac{\partial x}{\partial w}(1, 2, 1) = -\frac{60}{23}$

3) $\frac{\partial x}{\partial w}(1, 2, 1) = -\frac{61}{23}$

4) $\frac{\partial x}{\partial w}(1, 2, 1) = -\frac{121}{46}$

5) $\frac{\partial x}{\partial w}(1, 2, 1) = -\frac{119}{46}$

Exercise 3

Given the function

$f(x, y, z) = -6 - x^2 + 4y - y^2 + 2z - z^2$ defined over the domain D≡ $\frac{x^2}{9} + \frac{y^2}{16} + \frac{z^2}{9} \leqslant 1$, compute its absolute maxima and minima.

1) We have a minimum at {?, -3.62091, -1.09361}

2) We have a minimum at {?, -3.92091, -0.593614}

3) We have a minimum at {0.1, -3.42091, ?}

4) We have a minimum at {-0.1, -3.72091, ?}

5) We have a minimum at {0, 2, ?}

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Exercise 1

Given the functions

$f(x_1, x_2, x_3, x_4) = (x_1 + 2x_2 - x_1 x_3 - 3x_3^2 + 2x_4^2, -3x_1^2 - 3x_3^2)$

and

$g(u, v) = (1 - 3u + 2u^2 - 2v - 3uv + v^2, -1 + 2u - 3u^2 + 3uv - 3v^2, -1 - u^2 + 2uv - v^2, -2 + u^2 + 2v - uv - 2v^2)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (1, -2, 2, -2)$.

1) 0.

2) 0.754714

3) -0.15255

4) -0.505568

5) -0.657501

Exercise 2

Given the system

$-x_2^2 x_3 == 20$
$-x_1 x_2 x_3 == 30$
$x_1 - x_2^2 + 2x_3^2 x_4 == 143$
$-2u^2 x_2 - 2x_1 x_2 x_4 + 3x_4^3 == 109$

determine if it is possible to solve for variables x_1, x_2, x_3, x_4 in terms of variable u arround the point $p = (x_1, x_2, x_3, x_4, u) = (-3, -2, -5, 3, -4)$. Compute if possible $\frac{\partial x_4}{\partial u}(-4)$.

1) $\frac{\partial x_4}{\partial u}(-4) = \frac{19552}{41759}$

2) $\frac{\partial x_4}{\partial u}(-4) = \frac{19554}{41759}$

3) $\frac{\partial x_4}{\partial u}(-4) = \frac{19553}{41759}$

4) $\frac{\partial x_4}{\partial u}(-4) = \frac{19555}{41759}$

5) $\frac{\partial x_4}{\partial u}(-4) = \frac{19556}{41759}$

Exercise 3

Given the function

$f(x, y, z) = -7 - x^2 - y^2 + 6z - z^2$ defined over the domain D≡ $\frac{x^2}{16} + \frac{y^2}{4} + \frac{z^2}{9} \leqslant 1$, compute its absolute maxima and minima.

1) We have a maximum at {?, 0.9, 2.4}

2) We have a maximum at {1.2, 0.9, ?}

3) We have a maximum at {?, 0., 3.}

4) We have a maximum at {−1.5, ?, 2.4}

5) We have a maximum at {−1.5, ?, 3.3}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 94

Exercise 1

Given the functions

$f(x,y,z) = (-x^2, 3x^2 - 3xy - 3yz, -2y + 3z)$

and

$g(u,v,w) = (2u - 2u^2 + 3vw, 3v^2 - 2w, v^2 + w^2)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (-1, -3, 0)$.

1) $-174645.$

2) $-198997.$

3) -39863.5

4) $-109999.$

5) $-147744.$

Exercise 2

Given the system

$-3 + 3xy^2 + uz == 103$

$u^2 + 3xy^2 - 2z^3 == 114$

$-3uvx - vy^2 + z^2 - 3uz^2 == 61$

determine if it is possible to solve for variables x, y, z in terms of variables u, v arround the point $p = (x, y, z, u, v) = (4, 3, -1, 2, -2)$. Compute if possible $\frac{\partial y}{\partial u}(2, -2)$.

1) $\frac{\partial y}{\partial u}(2, -2) = \frac{109}{80}$

2) $\frac{\partial y}{\partial u}(2, -2) = \frac{977}{720}$

3) $\frac{\partial y}{\partial u}(2, -2) = \frac{163}{120}$

4) $\frac{\partial y}{\partial u}(2, -2) = \frac{979}{720}$

5) $\frac{\partial y}{\partial u}(2, -2) = \frac{49}{36}$

Exercise 3

Given the function

$f(x, y, z) = 5 + 2x - x^2 + 2y - y^2 + 2z - z^2$ defined over the domain D≡ $\frac{x^2}{25} + \frac{y^2}{25} + \frac{z^2}{9} \leqslant 1$, compute its absolute maxima and minima.

1) We have a minimum at {?, -3.50567, -0.389083}

2) We have a minimum at {?, -3.40567, -0.689083}

3) We have a minimum at {?, -3.80567, -0.589083}

4) We have a minimum at {?, -3.40567, 0.0109168}

5) We have a minimum at {1, ?, 1}

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Exercise 1

Given the functions

$f(x_1, x_2, x_3, x_4) = (x_2 - x_1 x_2 - 3 x_2^2 - x_1 x_3 + x_2 x_3 - 2 x_4 + 2 x_1 x_4, 3 x_2 - 3 x_1 x_3, -3 x_1^2 - x_1 x_3 + 3 x_2 x_3 - 3 x_3^2 + 2 x_4 - x_2 x_4 + 2 x_3 x_4)$

and

$g(u, v, w) = (2 + u w, -3 u v + 3 w^2, -u^2 - 3 u v, 2 u v)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (-2, 2, -2, -2)$.

1) −0.14865

2) 0.

3) −0.689388

4) −0.683585

5) −0.681209

Exercise 2

Given the system

$-2 v x_2 x_4 + 2 u x_3 x_4 == -4$
$3 x_2 x_4 == -6$
$2 u^2 x_1 + 2 x_3 + 2 x_2 x_4 == -76$
$-2 v^2 x_1 + 2 x_1 x_2^2 == -24$

determine if it is possible to solve for variables x_1, x_2, x_3, x_4 in terms of variables u, v arround the point $p = (x_1, x_2, x_3, x_4, u, v) = (-4, -2, 0, 1, -3, -1)$. Compute if possible $\frac{\partial x_2}{\partial u}(-3, -1)$.

1) $\frac{\partial x_2}{\partial u}(-3, -1) = \frac{1}{2}$

2) $\frac{\partial x_2}{\partial u}(-3, -1) = 2$

3) $\frac{\partial x_2}{\partial u}(-3, -1) = \frac{3}{2}$

4) $\frac{\partial x_2}{\partial u}(-3, -1) = \frac{5}{2}$

5) $\frac{\partial x_2}{\partial u}(-3, -1) = 1$

Exercise 3

Given the function

$f(x, y, z) = 18 - 6x + x^2 + y^2 - 2z + z^2$ defined over the domain D≡ $\frac{x^2}{16} + \frac{y^2}{9} + \frac{z^2}{9} \leq 1$, compute its absolute maxima and minima.

1) We have a maximum at {?, 0.2, -0.169973}

2) We have a maximum at {?, -0.2, -0.569973}

3) We have a maximum at {-4.35061, -0.5, ?}

4) We have a maximum at {?, 0, 1}

5) We have a maximum at {?, 0., -0.469973}

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Exercise 1

Given the functions

$f(x, y, z) = (2x^2 - y + z^2, -x - 2x^2 + xy - 3y^2, -2y^2 + yz, 1 + x)$

and

$g(u_1, u_2, u_3, u_4) = (2 + u_1 u_3 + 3u_4 - 2u_2 u_4, 3 - 3u_1 u_4 - u_3 u_4, 2u_1^2 + 3u_3 + 2u_2 u_3 + u_1 u_4 - 3u_2 u_4)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (2, -1, 0)$.

1) $-352588.$

2) -53155.7

3) -44098.5

4) -53367.7

5) $-221841.$

Exercise 2

Given the system

$2yzu_3 == -16$
$3xyu_3 == 36$
$-2x^3 + 3yz == -60$

determine if it is possible to solve for variables x, y, z in terms of variables u_1, u_2, u_3, u_4 arround the point $p = (x, y, z, u_1, u_2, u_3, u_4) = (3, 1, -2, 4, -5, 4, 3)$. Compute if possible $\frac{\partial z}{\partial u_3}(4, -5, 4, 3)$.

1) $\frac{\partial z}{\partial u_3}(4, -5, 4, 3) = -\frac{1}{54}$

2) $\frac{\partial z}{\partial u_3}(4, -5, 4, 3) = 0$

3) $\frac{\partial z}{\partial u_3}(4, -5, 4, 3) = \frac{1}{27}$

4) $\frac{\partial z}{\partial u_3}(4, -5, 4, 3) = \frac{1}{54}$

5) $\frac{\partial z}{\partial u_3}(4, -5, 4, 3) = \frac{1}{18}$

Exercise 3

Given the function

$f(x, y, z) = 1 - 4x + x^2 - 4y + y^2 - 2z + z^2$ defined over the domain $D \equiv \frac{x^2}{9} + \frac{y^2}{25} + \frac{z^2}{25} \leqslant 1$, compute its absolute maxima and minima.

1) We have a maximum at {?, -4.36405, -2.18203}

2) We have a maximum at {2, 2, ?}

3) We have a maximum at {-0.555565, ?, -2.38203}

4) We have a maximum at {-0.255565, -4.86405, ?}

5) We have a maximum at {-0.355565, -4.06405, ?}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 97

Exercise 1

Given the functions

$f(x_1, x_2, x_3, x_4) = (-1 - 3 x_1 x_2 - 3 x_3^2 + 2 x_4 - 3 x_2 x_4, -x_1 - x_1 x_2 + x_1 x_3 + x_3^2, x_1 x_2 - 2 x_3^2 - x_4 - x_4^2, 3 x_1 x_2 + 2 x_1 x_3 - 3 x_2 x_3 + 2 x_3^2)$

and

$g(u_1, u_2, u_3, u_4) = (-3 u_1 + 3 u_1 u_2 - 3 u_2^2 + 3 u_3^2 + u_4^2, u_2^2 + 3 u_2 u_4 - 3 u_4^2, -2 - u_1 u_3 - 2 u_2 u_3 + 2 u_3^2 - 3 u_2 u_4 + u_4^2, 2 + 3 u_2),$

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (3, -1, -2, -3)$.

1) -7.08459×10^8

2) -6.34128×10^8

3) -7.56728×10^7

4) -2.28804×10^8

5) -8.22832×10^8

Exercise 2

Given the system

$x_1 x_3^2 == 125$
$2 x_2 x_3^2 == -200$
$-3 v x_1 x_4 + 2 w x_1 x_4 == -300$
$2 x_1 x_2^2 == 160$

determine if it is possible to solve for variables x_1, x_2, x_3, x_4 in terms of variables u, v, w arround the point $p = (x_1, x_2, x_3, x_4, u, v, w) = (5, -4, -5, 4, -4, 3, -3)$. Compute if possible $\frac{\partial x_1}{\partial v}(-4, 3, -3)$.

1) $\frac{\partial x_1}{\partial v}(-4, 3, -3) = 1$

2) $\frac{\partial x_1}{\partial v}(-4, 3, -3) = 2$

3) $\frac{\partial x_1}{\partial v}(-4, 3, -3) = 3$

4) $\frac{\partial x_1}{\partial v}(-4, 3, -3) = 4$

5) $\frac{\partial x_1}{\partial v}(-4, 3, -3) = 0$

Exercise 3

Given the function

$f(x, y, z) = 6 - 2x + x^2 - 2y + y^2 - 2z + z^2$ defined over the domain D≡ $\frac{x^2}{16} + \frac{y^2}{25} + \frac{z^2}{16} \leqslant 1$, compute its absolute maxima and minima.

1) We have a minimum at {0.7, ?, 0.8}

2) We have a minimum at {0.6, ?, 1.3}

3) We have a minimum at {1, 1, ?}

4) We have a minimum at {?, 0.5, 1.1}

5) We have a minimum at {?, 1.4, 1.3}

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Exercise 1

Given the functions

$f(x, y) = (3 - 3x + 2x^2 - y - xy - y^2, 2 - 3x + 2x^2 - 3y - 3xy - y^2)$

and

$g(u, v) = (-3 + u + u^2 + 2uv - 3v^2, -1 + u - 2u^2 - 2v + 3uv - v^2)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (3, 3)$.

1) -1.33504×10^6

2) $-594617.$

3) $-947700.$

4) $-515763.$

5) $-802761.$

Exercise 2

Given the system

$u^2 v - 2v^2 + vx + 2u^2 y + 2vxy == 302$
$u^2 - 3u^3 - 3uv + 2x + u^2 x - uvx - 2v^2 x + uy^2 == 200$

determine if it is possible to solve for variables x, y in terms of variables u, v arround the point $p = (x, y, u, v) = (-5, 5, -5, -2)$. Compute if possible $\frac{\partial x}{\partial u}(-5, -2)$.

1) $\frac{\partial x}{\partial u}(-5, -2) = -\frac{1545}{47}$

2) $\frac{\partial x}{\partial u}(-5, -2) = -\frac{1548}{47}$

3) $\frac{\partial x}{\partial u}(-5, -2) = -\frac{1544}{47}$

4) $\frac{\partial x}{\partial u}(-5, -2) = -\frac{1546}{47}$

5) $\frac{\partial x}{\partial u}(-5, -2) = -\frac{1547}{47}$

Exercise 3

Given the function

$f(x, y, z) = 11 - 6x + x^2 + y^2 - 4z + z^2$ defined over the domain D≡ $\frac{x^2}{25} + \frac{y^2}{4} + \frac{z^2}{4} \leqslant 1$, compute its absolute maxima and minima.

1) We have a minimum at {3, 0, ?}

2) We have a minimum at {2.89507, 0., ?}

3) We have a minimum at {2.02655, ?, 2.20965}

4) We have a minimum at {2.31606, 0.289507, ?}

5) We have a minimum at {?, 1.15803, 3.07817}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 99

Exercise 1

Given the functions

$f(x, y) = (1 - x + 3x^2 + y + 2xy - 2y^2, -3 - x - 3x^2 - 3y + 2xy + 2y^2)$

and

$g(u, v) = (-3 + 3u + 2u^2 - 2v + 2uv + 2v^2, -3 + 3u + u^2 - 2v + 3uv - v^2)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (3, 3)$.

1) 1.15964×10^6

2) 2.36656×10^6

3) 1.18792×10^6

4) 3.62167×10^6

5) 1.47601×10^6

Exercise 2

Given the system

$-v^2 y + 3uxy + 2x^2 y == 10$
$u^3 - 2u^2 v + 2y - 3vy - 2xy == 124$

determine if it is possible to solve for variables x, y in terms of variables u, v arround the point $p = (x, y, u, v) = (-3, 5, -1, -5)$. Compute if possible $\frac{\partial x}{\partial v}(-1, -5)$.

1) $\frac{\partial x}{\partial v}(-1, -5) = \frac{108}{155}$

2) $\frac{\partial x}{\partial v}(-1, -5) = \frac{237}{341}$

3) $\frac{\partial x}{\partial v}(-1, -5) = \frac{1186}{1705}$

4) $\frac{\partial x}{\partial v}(-1, -5) = \frac{1184}{1705}$

5) $\frac{\partial x}{\partial v}(-1, -5) = \frac{1187}{1705}$

Exercise 3

Given the function

$f(x, y, z) = 4 + 2x - x^2 - y^2 - z^2$ defined over the domain $D \equiv \frac{x^2}{4} + \frac{y^2}{4} + \frac{z^2}{16} \leqslant 1$, compute its absolute maxima and minima.

1) We have a maximum at {?, 0.4, -0.1}

2) We have a maximum at {?, 0.1, -0.2}

3) We have a maximum at {1, ?, 0}

4) We have a maximum at {0.9, -0.2, ?}

5) We have a maximum at {?, 0.1, -0.3}

Further Mathematics - Degree in Engineering - 2024/2025 01-Multivariate Functions-Training computers exam for for serial number: 100

Exercise 1

Given the functions

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

and

$g(u, v) = (-2 u - u^2 - v + 3 u v + 3 v^2, -1 + u + 2 u^2 + 3 v - 3 u v - v^2, 1 - 3 u + 2 u^2 - 2 v + 2 v^2)$,

compute the determinant of the Jacobian matrix of the composition gof at the point $p = (0, -3, -2)$.

1) −0.780512

2) −0.898243

3) 0.229769

4) 0.206079

5) 0.

Exercise 2

Given the system

$$3 x + u x + 3 y - u y^2 + 2 y^3 + u^2 z - 3 u y z - z^2 == -101$$
$$-2 u x + 3 u^2 x - 2 u y^2 + u^2 z + 3 y^2 z + x z^2 == 24$$
$$-x - 2 u x y - 3 x y^2 - 3 u z + 2 u x z == 61$$

determine if it is possible to solve for variables x, y, z in terms of variable u arround the point $p = (x, y, z, u) = (-5, -4, 4, 2)$. Compute if possible $\frac{\partial z}{\partial u}(2)$.

1) $\frac{\partial z}{\partial u}(2) = \frac{913}{105}$

2) $\frac{\partial z}{\partial u}(2) = \frac{1823}{210}$

3) $\frac{\partial z}{\partial u}(2) = \frac{87}{10}$

4) $\frac{\partial z}{\partial u}(2) = \frac{365}{42}$

5) $\frac{\partial z}{\partial u}(2) = \frac{304}{35}$

Exercise 3

Given the function

$f(x, y, z) = -11 + 4x - x^2 - y^2 + 6z - z^2$ defined over the domain D≡ $\frac{x^2}{9} + \frac{y^2}{4} + \frac{z^2}{4} \leqslant 1$, compute its absolute maxima and minima.

1) We have a maximum at {2.02629, ?, 2.07496}

2) We have a maximum at {?, 0.691654, 1.38331}

3) We have a maximum at {2, 0, ?}

4) We have a maximum at {?, 0., 1.72913}

5) We have a maximum at {0.642985, 0.345827, ?}