Further Mathematics - Degree in Engineering - 2025/2026 03-04-Differential Geometry-Line/Surface integral-Computers training exam for serial number: 1

Exercise 1

Compute the maximum value of the Gauss curvature for $X(u,v) = \{2v + (1+v^2)\,\mathrm{Cos}[u] + 4(1+v^2)\,\mathrm{Sin}[u],\ v + 2(1+v^2)\,\mathrm{Sin}[u],\ v + (1+v^2)\,\mathrm{Sin}[u]\}$.

1) The maximum Gauss curvature is **4.****

2) The maximum Gauss curvature is **5.****

3) The maximum Gauss curvature is **1.****

4) The maximum Gauss curvature is **8.****

5) The maximum Gauss curvature is **0.****

Exercise 2

Compute the area of the domain whose boundary is the curve

$r:[0,\pi] \dashrightarrow R^2$
$r(t)=\{\sin(2t)(-\cos(t))(4\cos(t)+5),\ -(\sin(t)\sin(2t)(4\cos(t)+5))\}$

Indication: it is necessary to represent
the curve to check whether it has intersection points.

1) 43.4181 2) 3.41814 3) 25.9181 4) 23.4181

Exercise 3

Consider the vector field $F(x,y,z) = \{-3+\mathrm{Sin}[y^2],\ 6+\mathrm{Cos}[2x^2],\ 3+e^{-x^2+y^2}-4x\}$ and the surface

$$S \equiv \left(\frac{2+x}{4}\right)^2 + \left(\frac{-5+y}{6}\right)^2 + \left(\frac{-1+z}{7}\right)^2 = 1$$

Compute $\int_S F$.

Indication: Use Gauss' Theorem if it is necessary.

1) -1.6 2) -3.9 3) -0.5 4) 0.

Further Mathematics - Degree in Engineering - 2025/2026 03-04-Differential Geometry-Line/Surface integral-Computers training exam for serial number: 2

Exercise 1

Compute the maximum value of the Gauss curvature for $X(u,v) = \{2\,\text{Cos}[v] + 3\,\text{Cos}[u]\,\text{Sin}[v],\ 3\,\text{Cos}[v] + 6\,\text{Cos}[u]\,\text{Sin}[v] + 3\,\text{Sin}[u]\,\text{Sin}[v],\ -3\,\text{Cos}[v] - 6\,\text{Cos}[u]\,\text{Sin}[v]\}$.

1) The maximum Gauss curvature is **7.****

2) The maximum Gauss curvature is **1.****

3) The maximum Gauss curvature is **0.****

4) The maximum Gauss curvature is **2.****

5) The maximum Gauss curvature is **5.****

Exercise 2

Compute the area of the domain whose boundary is the curve

$r: [0,\pi] \dashrightarrow R^2$
$r(t) = \{(7t+9)\sin(2t)\,(4\cos(14t)+6),\ (4t+9)\sin(t)\}$

Indication: it is necessary to represent the curve to check whether it has intersection points.

1) 2468.11 2) 1234.11 3) 3208.51 4) 1974.51

Exercise 3

Consider the vector field $F(x,y,z) = \{7x^2,\ 5x,\ 4x^2y - 5x^2y^2\}$ and the surface

$$S \equiv \left(\frac{-2+x}{9}\right)^2 + \left(\frac{-4+y}{4}\right)^2 + \left(\frac{6+z}{8}\right)^2 = 1$$

Compute $\int_S F$.

Indication: Use Gauss' Theorem if it is necessary.

1) 33778.4 2) −43911. 3) 70934.2 4) 50667.4

Further Mathematics - Degree in Engineering - 2025/2026 03-04-Differential Geometry-Line/Surface integral-Computers training exam for serial number: 3

Exercise 1

Compute the maximum value of the Gauss curvature for $X(u,v) = \{4 \text{Cos}[u] \text{Sin}[v], -4 \text{Cos}[v] + 4 \text{Cos}[u] \text{Sin}[v] + 4 \text{Sin}[u] \text{Sin}[v], -6 \text{Cos}[v] + 8 \text{Cos}[u] \text{Sin}[v] + 8 \text{Sin}[u] \text{Sin}[v]\}$.

1) The maximum Gauss curvature is **8.****

2) The maximum Gauss curvature is **9.****

3) The maximum Gauss curvature is **6.****

4) The maximum Gauss curvature is **3.****

5) The maximum Gauss curvature is **0.****

Exercise 2

Compute the area of the domain whose boundary is the curve

$r: [0, 2\pi] \dashrightarrow R^2$

$$r(t) = \left\{ \frac{\left(-\frac{1}{2}\sqrt{3}\sin(t) - \frac{1}{2}\right)\cos(t)\,(8\cos(t)+8)}{\sin^2(t)+1}, \frac{\left(\frac{\sqrt{3}}{2} - \frac{\sin(t)}{2}\right)\cos(t)\,(8\cos(t)+8)}{\sin^2(t)+1} \right\}$$

Indication: it is necessary to represent the curve to check whether it has intersection points.

1) 107.138 2) 83.5381 3) 166.138 4) 118.938

Exercise 3

Consider the vector field $F(x,y,z) = \left\{e^{-y^2} + 8xy, e^{2x^2+z^2} + 8y, -4 + e^{2x^2-2y^2}\right\}$ and the surface

$$S \equiv \left(\frac{-1+x}{4}\right)^2 + \left(\frac{5+y}{6}\right)^2 + \left(\frac{3+z}{8}\right)^2 = 1$$

Compute $\int_S F$.

Indication: Use Gauss' Theorem if it is necessary.

1) −25735.9 2) −20588.7 3) −5147.13 4) −54045.5

Further Mathematics - Degree in Engineering - 2025/2026 03-04-Differential Geometry-Line/Surface integral-Computers training exam for serial number: 4

Exercise 1

Compute the maximum value of the Gauss curvature for $X(u,v)=\{u,\ 16+2u+4u^2-13v+4v^2,\ 8+u+2u^2-7v+2v^2\}$.

1) The maximum Gauss curvature is **0.****

2) The maximum Gauss curvature is **6.****

3) The maximum Gauss curvature is **3.****

4) The maximum Gauss curvature is **7.****

5) The maximum Gauss curvature is **9.****

Exercise 2

Compute the area of the domain whose boundary is the curve

$r:[0,2\pi]\text{----}\!\!\to R^2$

$$r(t)=\left\{-\frac{\sin(t)\cos(t)(4\cos(t)+5)}{\sin^2(t)+1},\ \frac{\cos(t)(4\cos(t)+5)}{\sin^2(t)+1}\right\}$$

Indication: it is necessary to represent the curve to check whether it has intersection points.

1) 19.7345 2) 23.5345 3) 38.7345 4) 46.3345

Exercise 3

Consider the vector field $F(x,y,z)=\left\{8+e^{2y^2+z^2}+6xy,\ e^{x^2+z^2}+yz,\ -4-3xy+\mathrm{Cos}\left[2x^2-2y^2\right]\right\}$ and the surface

$$S\equiv\left(\frac{6+x}{9}\right)^2+\left(\frac{4+y}{6}\right)^2+\left(\frac{1+z}{5}\right)^2=1$$

Compute $\int_S F$.

Indication: Use Gauss' Theorem if it is necessary.

1) −101789. 2) −28274.3 3) 19793.2 4) −87651.8

Further Mathematics - Degree in Engineering - 2025/2026 03-04-Differential Geometry-Line/Surface integral-Computers training exam for serial number: 5

Exercise 1

Compute the maximum value of the Gauss curvature for $X(u,v)=\{5\,\mathrm{Cos}[u]\,\mathrm{Sin}[v]+10\,\mathrm{Sin}[u]\,\mathrm{Sin}[v],\ -10\,\mathrm{Cos}[u]\,\mathrm{Sin}[v]-15\,\mathrm{Sin}[u]\,\mathrm{Sin}[v],\ 5\,\mathrm{Cos}[v]-5\,\mathrm{Cos}[u]\,\mathrm{Sin}[v]-10\,\mathrm{Sin}[u]\,\mathrm{Sin}[v]\}$.

1) The maximum Gauss curvature is **2.****

2) The maximum Gauss curvature is **5.****

3) The maximum Gauss curvature is **6.****

4) The maximum Gauss curvature is **8.****

5) The maximum Gauss curvature is **1.****

Exercise 2

Compute the area of the domain whose boundary is the curve

$r:[0,\pi]\dashrightarrow R^2$

$r(t)=\{(5t+4)\sin(2t)\ (9\cos(2t)+10),\ (8t+2)\sin(t)\}$

Indication: it is necessary to represent the curve to check whether it has intersection points.

1) 5499.29 2) 1222.29 3) 3055.29 4) 3971.79

Exercise 3

Consider the vector field $F(x,y,z)=\{6z^2+9yz^2,\ 3x^2y^2,\ 6xy\}$ and the surface

$$S\equiv\left(\frac{5+x}{8}\right)^2+\left(\frac{1+y}{2}\right)^2+\left(\frac{-3+z}{9}\right)^2=1$$

Compute $\int_S F$.

Indication: Use Gauss' Theorem if it is necessary.

1) −136 803. 2) 68 402. 3) −355 687. 4) 342 008.

Further Mathematics - Degree in Engineering - 2025/2026 03-04-Differential Geometry-Line/Surface integral-Computers training exam for serial number: 6

Exercise 1

Compute the maximum value of the Gauss curvature for $X(u,v) = \{5\,\mathrm{Cos}[u]\,\mathrm{Sin}[v] + 4\,\mathrm{Sin}[u]\,\mathrm{Sin}[v],\ -10\,\mathrm{Cos}[u]\,\mathrm{Sin}[v] - 6\,\mathrm{Sin}[u]\,\mathrm{Sin}[v],\ 2\,\mathrm{Cos}[v] - 5\,\mathrm{Cos}[u]\,\mathrm{Sin}[v] - 4\,\mathrm{Sin}[u]\,\mathrm{Sin}[v]\}$.

1) The maximum Gauss curvature is **1.****

2) The maximum Gauss curvature is **3.****

3) The maximum Gauss curvature is **2.****

4) The maximum Gauss curvature is **8.****

5) The maximum Gauss curvature is **0.****

Exercise 2

Compute the area of the domain whose boundary is the curve

$r:[0,2\pi] ----\to R^2$

$$r(t) = \left\{ \frac{\left(\frac{1+\sqrt{3}}{2\sqrt{2}} - \frac{(\sqrt{3}-1)\sin(t)}{2\sqrt{2}}\right)\cos(t)\,(7\cos(t)+10)}{\sin^2(t)+1},\ \frac{\left(\frac{(1+\sqrt{3})\sin(t)}{2\sqrt{2}} + \frac{\sqrt{3}-1}{2\sqrt{2}}\right)\cos(t)\,(7\cos(t)+10)}{\sin^2(t)+1} \right\}$$

Indication: it is necessary to represent the curve to check whether it has intersection points.

1) 255.662 2) 142.062 3) 99.462 4) 14.262

Exercise 3

Consider the vector field $F(x,y,z) = \{2 - 8x + \mathrm{Cos}[y^2 + z^2],\ 2z + \mathrm{Cos}[z^2],\ -3y + 6z + \mathrm{Cos}[2x^2 - y^2]\}$ and the surface

$$S \equiv \left(\frac{3+x}{5}\right)^2 + \left(\frac{-6+y}{1}\right)^2 + \left(\frac{-3+z}{7}\right)^2 = 1$$

Compute $\int_S F.$

Indication: Use Gauss' Theorem if it is necessary.

1) 882.785 2) 88.9847 3) 118.385 4) -293.215

Further Mathematics - Degree in Engineering - 2025/2026 03-04-Differential Geometry-Line/Surface integral-Computers training exam for serial number: 7

Exercise 1

Compute the maximum value of the Gauss curvature for $X(u,v) = \{2v + (1+3v^2)\,\mathrm{Cos}[u],\ 2v + 3(1+3v^2)\,\mathrm{Cos}[u] + (1+3v^2)\,\mathrm{Sin}[u],\ v\}$.

1) The maximum Gauss curvature is **2.****

2) The maximum Gauss curvature is **8.****

3) The maximum Gauss curvature is **3.****

4) The maximum Gauss curvature is **0.****

5) The maximum Gauss curvature is **4.****

Exercise 2

Compute the area of the domain whose boundary is the curve

$r:[0,\pi]\dashrightarrow R^2$
$r(t)=\{(2t+1)\sin(2t)\,(5\cos(11t)+8),\ (2t+7)\sin(t)\}$

Indication: it is necessary to represent the curve to check whether it has intersection points.

1) 512.965 2) 466.365 3) 745.965 4) 140.165

Exercise 3

Consider the vector field $F(x,y,z)=\{6x^2yz-6xz^2,\ 4xy,\ 6yz^2\}$ and the surface

$$S\equiv\left(\frac{-4+x}{9}\right)^2+\left(\frac{7+y}{6}\right)^2+\left(\frac{7+z}{2}\right)^2=1$$

Compute $\int_S F$.

Indication: Use Gauss' Theorem if it is necessary.

1) 3.24564×10^6 2) 1.80313×10^6 3) 1.20209×10^6 4) 480836.

Further Mathematics - Degree in Engineering - 2025/2026 03-04-Differential Geometry-Line/Surface integral-Computers training exam for serial number: 8

Exercise 1

Compute the maximum value of the Gauss curvature for $X(u,v) = \{-4 v - 3 (1 + 2 v^2) \cos[u] - 2 (1 + 2 v^2) \sin[u], 3 v + 4 (1 + 2 v^2) \cos[u] + (1 + 2 v^2) \sin[u], v + 2 (1 + 2 v^2) \cos[u]\}$.

1) The maximum Gauss curvature is **6.****

2) The maximum Gauss curvature is **8.****

3) The maximum Gauss curvature is **1.****

4) The maximum Gauss curvature is **2.****

5) The maximum Gauss curvature is **0.****

Exercise 2

Compute the area of the domain whose boundary is the curve

$r: [0,\pi] \longrightarrow R^2$

$r(t) = \{(7 t + 1) \sin(2 t) (3 \cos(5 t) + 5), (2 t + 9) \sin(t)\}$

Indication: it is necessary to represent the curve to check whether it has intersection points.

1) 667.145 2) 1111.54 3) 333.845 4) 1444.84

Exercise 3

Consider the vector field $F(x,y,z) = \{9 x y^2 z^2, -2 x^2 y^2, -7 y z + 3 x y^2 z^2\}$ and the surface

$$S \equiv \left(\frac{-6 + x}{8}\right)^2 + \left(\frac{-3 + y}{7}\right)^2 + \left(\frac{9 + z}{4}\right)^2 = 1$$

Compute $\int_S F$.

Indication: Use Gauss' Theorem if it is necessary.

1) 2.24235×10^7 2) -9.10953×10^6 3) 2.52264×10^7 4) 7.00733×10^6

Further Mathematics - Degree in Engineering - 2025/2026 03-04-Differential Geometry-Line/Surface integral-Computers training exam for serial number: 9

Exercise 1

Compute the maximum value of the Gauss curvature for $X(u,v) = \{u, 400 - 64u + 4u^2 - 47v + 4v^2, 2(500 - 79u + 5u^2 - 59v + 5v^2)\}$.

1) The maximum Gauss curvature is **2.****

2) The maximum Gauss curvature is **6.****

3) The maximum Gauss curvature is **5.****

4) The maximum Gauss curvature is **8.****

5) The maximum Gauss curvature is **4.****

Exercise 2

Compute the area of the domain whose boundary is the curve

$r: [0,\pi] \longrightarrow R^2$
$r(t) = \{(2t+8)\sin(2t)(4\cos(7t)+7), (6t+6)\sin(t)(4\cos(7t)+7)\}$

Indication: it is necessary to represent
the curve to check whether it has intersection points.

1) 5292.92 2) 18523.9 3) 13231.5 4) 15877.7

Exercise 3

Consider the vector field $F(x,y,z) = \{-5z + 3xyz^2, -4x^2yz, -3x^2\}$ and the surface

$$S \equiv \left(\frac{-8+x}{3}\right)^2 + \left(\frac{-5+y}{5}\right)^2 + \left(\frac{-5+z}{8}\right)^2 = 1$$

Compute $\int_S F$.

Indication: Use Gauss' Theorem if it is necessary.

1) −112946. 2) −376488. 3) −865924. 4) −263542.

Further Mathematics - Degree in Engineering - 2025/2026 03-04-Differential Geometry-Line/Surface integral-Computers training exam for serial number: 10

Exercise 1

Compute the maximum value of the Gauss curvature for $X(u,v) = \{(1+2v^2)\,\mathrm{Cos}[u],\ 2v + (1+2v^2)\,\mathrm{Sin}[u],\ 5v + 2(1+2v^2)\,\mathrm{Cos}[u] + 2(1+2v^2)\,\mathrm{Sin}[u]\}$.

1) The maximum Gauss curvature is **7.****

2) The maximum Gauss curvature is **8.****

3) The maximum Gauss curvature is **9.****

4) The maximum Gauss curvature is **3.****

5) The maximum Gauss curvature is **6.****

Exercise 2

Compute the area of the domain whose boundary is the curve

$r: [0,2\pi] \dashrightarrow R^2$

$$r(t) = \left\{ \frac{\left(-\frac{1}{2}\sqrt{3}\sin(t) - \frac{1}{2}\right)\cos(t)\,(3\cos(t)+7)}{\sin^2(t)+1},\ \frac{\left(\frac{\sqrt{3}}{2} - \frac{\sin(t)}{2}\right)\cos(t)\,(3\cos(t)+7)}{\sin^2(t)+1} \right\}$$

Indication: it is necessary to represent
  the curve to check whether it has intersection points.

1) 79.1257   2) 39.9257   3) 56.7257   4) 90.3257

Exercise 3

Consider the vector field $F(x,y,z) = \{x y - 2 x y z + \mathrm{Sin}[2 y^2],\ e^{2 z^2} + 7 x,\ e^{-2 x^2 + y^2} - 5 z\}$ and the surface

$$S \equiv \left(\frac{-6+x}{4}\right)^2 + \left(\frac{4+y}{2}\right)^2 + \left(\frac{5+z}{7}\right)^2 = 1$$

Compute $\int_S F$.

Indication: Use Gauss' Theorem if it is necessary.

1) −27587.   2) −37932.5   3) −24138.5   4) −11494.