

## Further Mathematics - Degree in Engineering - 2024/2025

### 03-Differential Geometry-Computers exam for serial number: 1

#### Exercise 1

Compute the torsion for  $C(t) = \{5 \cos[t] + 2 \sin[t], 2 \sin[t], -2 \sin[t]\}$  at the point  $t=3$ .

- 1)  $\tau(3) = 0$
- 2)  $\tau(3) = -2.9271$
- 3)  $\tau(3) = 1.75132$
- 4)  $\tau(3) = 3.02924$
- 5)  $\tau(3) = -3.3205$

#### Exercise 2

Compute the Gauss curvature for  $X(u,v) = \{\cos[u] (4 + 3 \cos[v]) - (4 + 3 \cos[v]) \sin[u], (4 + 3 \cos[v]) \sin[u] + \sin[v], -(4 + 3 \cos[v]) \sin[u]\}$  at the point  $(u,v) = (5, 6)$ .

- 1)  $K(5, 6) = 0.633551$
- 2)  $K(5, 6) = -2.81031$
- 3)  $K(5, 6) = 4.48707$
- 4)  $K(5, 6) = 4.35809$
- 5)  $K(5, 6) = -6.72849$

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### 03-Differential Geometry-Computers exam for serial number: 2

#### Exercise 1

Compute the torsion for  $C(t) =$

$\{\cos[t] - 2\sin[t], \sin[t], t + \cos[t] - 2\sin[t]\}$  at the point  $t=6$ .

1)  $\tau(6) = -1.05082$

2)  $\tau(6) = 2.99596$

3)  $\tau(6) = 0.202254$

4)  $\tau(6) = 3.51457$

5)  $\tau(6) = 4.75876$

#### Exercise 2

Compute the Gauss curvature for  $X(u,v) =$

$\{-3 - u^2 + u(5 - 4v) + 7v - 5v^2, v, -3 - u^2 - 4u(-1 + v) + 9v - 5v^2\}$  at the point  $(u,v) = (4, 0)$ .

1)  $K(4, 0) = 4.21814$

2)  $K(4, 0) = -1.05082$

3)  $K(4, 0) = 0.000064$

4)  $K(4, 0) = -2.04794$

5)  $K(4, 0) = 8.1641$

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03-Differential Geometry-Computers exam for serial number: 3

### Exercise 1

Compute the curvature for  $C(t) = \{-3 - 8t - 4t^2 - 2(-9 + 3t + 9t^2), -4t + 3(-3 - 7t - 4t^2) - 4(-9 + 3t + 9t^2), -9 + 3t + 9t^2\}$  at the point  $t = 8$ .

- 1)  $k(8) = -8.15181$
- 2)  $k(8) = -7.12903$
- 3)  $k(8) = 6.77145 \times 10^{-7}$
- 4)  $k(8) = -6.22308$
- 5)  $k(8) = -5.27523$

### Exercise 2

Compute the mean curvature for  $X(u,v) = \{3\cos[u] - \sin[u], -2\cos[u] + \sin[u], v - 2\cos[u]\}$  at the point  $(u,v) = (4, -6)$ .

- 1)  $H(4, -6) = 0.663875$
- 2)  $H(4, -6) = -5.21041$
- 3)  $H(4, -6) = 0.0103703$
- 4)  $H(4, -6) = -4.2878$
- 5)  $H(4, -6) = -8.15181$

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### 03-Differential Geometry-Computers exam for serial number: 4

#### Exercise 1

Compute the torsion for  $C(t) =$

$\{\cos[t] + 4 \sin[t], \cos[t] + 6 \sin[t], -\cos[t] + 2 \sin[t]\}$  at the point  $t=2$ .

1)  $\tau(2) = 6.85093$

2)  $\tau(2) = -7.22416$

3)  $\tau(2) = -1.54351$

4)  $\tau(2) = -5.32761$

5)  $\tau(2) = 0$

#### Exercise 2

Compute the Gauss curvature for  $X(u,v) =$

$\{v \cos[u], v \cos[u] + v \sin[u], v\}$  at the point  $(u,v) = (5, -9)$ .

1)  $K(5, -9) = -6.88161$

2)  $K(5, -9) = -2.25764$

3)  $K(5, -9) = -8.21793$

4)  $K(5, -9) = -5.50859$

5)  $K(5, -9) = 0$

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03-Differential Geometry-Computers exam for serial number: 5

### Exercise 1

Compute the curvature for  $C(t) = \{-4 + t - 4t^2, -5 - t - 2t^2, -4 - 4t^2\}$  at the point  $t=8$ .

- 1)  $k(8) = -7.88817$
- 2)  $k(8) = 0.0000188308$
- 3)  $k(8) = -1.53074$
- 4)  $k(8) = 5.96218$
- 5)  $k(8) = 5.42866$

### Exercise 2

Compute the mean curvature for  $X(u,v) =$

$\{\cos[u] (2 + \cos[v]), (2 + \cos[v]) \sin[u], -\cos[u] (2 + \cos[v]) + 2 (2 + \cos[v]) \sin[u] + \sin[v]\}$   
at the point  $(u,v) = (4, 5)$ .

- 1)  $H(4, 5) = -4.20983$
- 2)  $H(4, 5) = 0.23286$
- 3)  $H(4, 5) = -7.88817$
- 4)  $H(4, 5) = -7.79318$
- 5)  $H(4, 5) = 5.42866$

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### 03-Differential Geometry-Computers exam for serial number: 6

#### Exercise 1

Compute the curvature for  $C(t) = \{-\cos[t] + 4\sin[t], -\cos[t] + 2\sin[t], 0\}$  at the point  $t = 6$ .

- 1)  $k(6) = 0.0331739$
- 2)  $k(6) = 1.87994$
- 3)  $k(6) = 2.92978$
- 4)  $k(6) = 5.78186$
- 5)  $k(6) = -4.04314$

#### Exercise 2

Compute the Gauss curvature for  $X(u,v) =$

$\{v, 2v - 2\cos[u] - 3\sin[u], v - \cos[u] - 2\sin[u]\}$  at the point  $(u,v) = (4, 4)$ .

- 1)  $K(4, 4) = 0$
- 2)  $K(4, 4) = 5.78186$
- 3)  $K(4, 4) = 1.87994$
- 4)  $K(4, 4) = 4.25732$
- 5)  $K(4, 4) = 8.76909$

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### 03-Differential Geometry-Computers exam for serial number: 7

#### Exercise 1

Compute the torsion for  $C(t) = \{5 \cos[t] + 16 \sin[t], 4 \sin[t], -4 \sin[t]\}$  at the point  $t=1$ .

- 1)  $\tau(1) = 0$
- 2)  $\tau(1) = -3.83697$
- 3)  $\tau(1) = 6.27131$
- 4)  $\tau(1) = -3.65858$
- 5)  $\tau(1) = 4.64597$

#### Exercise 2

Compute the mean curvature for  $X(u,v) =$

$\{7u^2 + 7v(1+v) + 2u(5+v), v, -7u^2 - u(9+2v) - v(8+7v)\}$  at the point  $(u,v) = (-4, 9)$ .

- 1)  $H(-4, 9) = 0.212414$
- 2)  $H(-4, 9) = 5.70747$
- 3)  $H(-4, 9) = -1.37174$
- 4)  $H(-4, 9) = -4.72037$
- 5)  $H(-4, 9) = 3.83245$

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### 03-Differential Geometry-Computers exam for serial number: 8

#### Exercise 1

Compute the torsion for  $C(t) = \{4 \cos[t] - 4 \sin[t], \sin[t], 0\}$  at the point  $t=5$ .

- 1)  $\tau(5) = -7.98982$
- 2)  $\tau(5) = 8.18388$
- 3)  $\tau(5) = 1.36524$
- 4)  $\tau(5) = 0$
- 5)  $\tau(5) = -4.99104$

#### Exercise 2

Compute the Gauss curvature for  $X(u,v) =$

$$\{v + 3(1 + 3v^2) \cos[u] - (1 + 3v^2) \sin[u], -3v - 8(1 + 3v^2) \cos[u] + 3(1 + 3v^2) \sin[u], v\}$$

at the point  $(u,v) = (4, 8)$ .

- 1)  $K(4, 8) = -4.99104$
- 2)  $K(4, 8) = 4.72865$
- 3)  $K(4, 8) = -6.19871$
- 4)  $K(4, 8) = -5.1791 \times 10^{-9}$
- 5)  $K(4, 8) = -3.77361$

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03-Differential Geometry-Computers exam for serial number: 9

### Exercise 1

Compute the torsion for  $C(t) = \{-\cos[t] - 3\sin[t], -\sin[t], 2t + 2\sin[t]\}$  at the point  $t=6$ .

- 1)  $\tau(6) = 0.315102$
- 2)  $\tau(6) = 2.92919$
- 3)  $\tau(6) = -2.5683$
- 4)  $\tau(6) = -5.82072$
- 5)  $\tau(6) = -2.25564$

### Exercise 2

Compute the Gauss curvature for  $X(u,v) =$

$\{5\cos[u] - 2\sin[u], -2\cos[u] + \sin[u], v - 2\sin[u]\}$  at the point  $(u,v) = (6, 2)$ .

- 1)  $K(6, 2) = 0$
- 2)  $K(6, 2) = 1.86078$
- 3)  $K(6, 2) = -8.83064$
- 4)  $K(6, 2) = 1.70593$
- 5)  $K(6, 2) = 2.9478$

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### 03-Differential Geometry-Computers exam for serial number: 10

#### Exercise 1

Compute the torsion for  $C(t) = \{-5 + 8t + 5t^2, 5 - 7t - 5t^2, 1 - t\}$  at the point  $t = 3$ .

- 1)  $\tau(3) = 5.57298$
- 2)  $\tau(3) = 0$
- 3)  $\tau(3) = 0.559665$
- 4)  $\tau(3) = 4.08088$
- 5)  $\tau(3) = -2.45106$

#### Exercise 2

Compute the mean curvature for  $X(u,v) =$

$\{v \cos[u] - 2v \sin[u], v \sin[u], v + v \cos[u] + v \sin[u]\}$  at the point  $(u,v) = (5, -2)$ .

- 1)  $H(5, -2) = 5.57298$
- 2)  $H(5, -2) = 0.0505179$
- 3)  $H(5, -2) = -6.2344$
- 4)  $H(5, -2) = 4.08088$
- 5)  $H(5, -2) = -3.98454$

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03-Differential Geometry-Computers exam for serial number: 11

### Exercise 1

Compute the curvature for  $C(t) =$

$$\{-t - 2(1 + 2t^2), 9 - 10t + 8t^2 - 2(1 + 2t^2), 1 + t + 2t^2\} \text{ at the point } t=0.$$

- 1)  $k(0) = -2.41138$
- 2)  $k(0) = -5.87219$
- 3)  $k(0) = 0.0973834$
- 4)  $k(0) = 7.20074$
- 5)  $k(0) = -1.95044$

### Exercise 2

Compute the mean curvature for  $X(u,v) =$

$$\begin{aligned} &\{-23 \cos[u] (3 + 2 \cos[v]) - 8 (3 + 2 \cos[v]) \sin[u] - 4 \sin[v], \\ &3 \cos[u] (3 + 2 \cos[v]) + (3 + 2 \cos[v]) \sin[u], \\ &6 \cos[u] (3 + 2 \cos[v]) + 2 (3 + 2 \cos[v]) \sin[u] + \sin[v]\} \text{ at the point } (u,v) = (6, 6). \end{aligned}$$

- 1)  $H(6, 6) = 2.56752$
- 2)  $H(6, 6) = -3.79674$
- 3)  $H(6, 6) = 0.81748$
- 4)  $H(6, 6) = -1.95044$
- 5)  $H(6, 6) = -7.76158$

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### 03-Differential Geometry-Computers exam for serial number: 12

#### Exercise 1

Compute the torsion for  $C(t) =$

$$\{t, -2t - 2(4 + 2t - 6t^2) + 3(-9 - 8t + t^2), 2t + 3(4 + 2t - 6t^2) - 4(-9 - 8t + t^2)\}$$

at the point  $t = 5$ .

1)  $\tau(5) = -7.20902$

2)  $\tau(5) = 1.17206$

3)  $\tau(5) = -3.66418$

4)  $\tau(5) = -2.32647$

5)  $\tau(5) = 0$

#### Exercise 2

Compute the Gauss curvature for  $X(u,v) =$

$$\{u, 9 - 2u^2 + u(7 - 4v) + v + 6v^2, -9 + 2u^2 + 4u(-2 + v) - 6v^2\}$$
 at the point  $(u,v) = (1, 5)$ .

1)  $K(1, 5) = 7.00103$

2)  $K(1, 5) = -0.775071$

3)  $K(1, 5) = -2.32647$

4)  $K(1, 5) = -1.52536$

5)  $K(1, 5) = -1.00376 \times 10^{-6}$

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03-Differential Geometry-Computers exam for serial number: 13

### Exercise 1

Compute the torsion for  $C(t) = \{\cos[t], 2\cos[t] + 2\sin[t], -8\sin[t]\}$  at the point  $t=1$ .

- 1)  $\tau(1) = 3.70473$
- 2)  $\tau(1) = 0$
- 3)  $\tau(1) = -5.50661$
- 4)  $\tau(1) = -5.54545$
- 5)  $\tau(1) = -4.24878$

### Exercise 2

Compute the Gauss curvature for  $X(u,v) =$

$\{u - 2v, 3 - u^2 - 5v + 3v^2 + u(4 + 7v), 3 - u^2 - 2v + 3v^2 + u(3 + 7v)\}$  at the point  $(u,v) = (-8, -6)$ .

- 1)  $K(-8, -6) = -3.69079$
- 2)  $K(-8, -6) = -1.39825 \times 10^{-8}$
- 3)  $K(-8, -6) = -5.54545$
- 4)  $K(-8, -6) = -8.05139$
- 5)  $K(-8, -6) = 4.11858$

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### 03-Differential Geometry-Computers exam for serial number: 14

#### Exercise 1

Compute the curvature for  $C(t) = \{2 \cos[t], 2 \sin[t], -2 \cos[t] + 2 \sin[t]\}$  at the point  $t = 0$ .

- 1)  $k(0) = 4.59777$
- 2)  $k(0) = 0.976556$
- 3)  $k(0) = 0.306186$
- 4)  $k(0) = -0.876938$
- 5)  $k(0) = 7.22758$

#### Exercise 2

Compute the Gauss curvature for  $X(u,v) =$

$$\{\cos[u] (2 + \cos[v]) - 2 (2 + \cos[v]) \sin[u] + \sin[v], (2 + \cos[v]) \sin[u] - \sin[v], \cos[u] (2 + \cos[v]) - (2 + \cos[v]) \sin[u] + \sin[v]\} \text{ at the point } (u,v) = (0, 6).$$

- 1)  $K(0, 6) = 4.33027$
- 2)  $K(0, 6) = 7.13573$
- 3)  $K(0, 6) = 0.0751121$
- 4)  $K(0, 6) = 7.22758$
- 5)  $K(0, 6) = 3.70827$

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03-Differential Geometry-Computers exam for serial number: 15

### Exercise 1

Compute the torsion for  $C(t) =$

$$\{6 + 2t + t^2 - 4(9 - 5t - 7t^2), 6 + t + t^2 - 3(9 - 5t - 7t^2), 9 - 5t - 7t^2\} \text{ at the point } t=7.$$

1)  $\tau(7) = -5.28867$

2)  $\tau(7) = 0$

3)  $\tau(7) = 3.50483$

4)  $\tau(7) = 6.53162$

5)  $\tau(7) = 7.77859$

### Exercise 2

Compute the mean curvature for  $X(u,v) =$

$$\{7u + 2u^2 - 2(1 + 6v + 6v^2), -1 + 3u + u^2 - 6v - 6v^2, -1 + 6u + u^2 - 5v - 6v^2\}$$

at the point  $(u,v) = (-2, 5)$ .

1)  $H(-2, 5) = 7.51677$

2)  $H(-2, 5) = 0.000440799$

3)  $H(-2, 5) = -5.28867$

4)  $H(-2, 5) = 5.40088$

5)  $H(-2, 5) = 1.44778$

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### 03-Differential Geometry-Computers exam for serial number: 16

#### Exercise 1

Compute the torsion for  $C(t) = \{t - 2(-2 + 7t - 7t^2) - 5(-2 - 5t + 5t^2), 2 + 7t - 5t^2, -2 + 7t - 7t^2 + 2(-2 - 5t + 5t^2)\}$  at the point  $t=10$ .

- 1)  $\tau(10) = 0$
- 2)  $\tau(10) = -0.666959$
- 3)  $\tau(10) = -1.39851$
- 4)  $\tau(10) = 1.5243$
- 5)  $\tau(10) = 8.46941$

#### Exercise 2

Compute the Gauss curvature for  $X(u,v) = \{\cos[u](2 + \cos[v]) - (2 + \cos[v])\sin[u], \cos[u](2 + \cos[v]) + 2(2 + \cos[v])\sin[u] - \sin[v], -2(2 + \cos[v])\sin[u] + \sin[v]\}$  at the point  $(u,v) = (3, 4)$ .

- 1)  $K(3, 4) = -0.0117022$
- 2)  $K(3, 4) = -6.38232$
- 3)  $K(3, 4) = 3.79163$
- 4)  $K(3, 4) = 1.5243$
- 5)  $K(3, 4) = 1.17587$

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03-Differential Geometry-Computers exam for serial number: 17

### Exercise 1

Compute the torsion for  $C(t) =$

$$\{-9 + 2t + 5t^2, 9 - 5t - 5t^2 - 2(1 + 7t - 6t^2), 1 + 9t - 6t^2\} \text{ at the point } t = 9.$$

- 1)  $\tau(9) = 0$
- 2)  $\tau(9) = -0.986563$
- 3)  $\tau(9) = -8.06808$
- 4)  $\tau(9) = -6.22551$
- 5)  $\tau(9) = -6.71939$

### Exercise 2

Compute the mean curvature for  $X(u,v) =$

$$\{-v + 2(1 + 2v^2)\cos[u], (1 + 2v^2)\sin[u], v - (1 + 2v^2)\cos[u] - (1 + 2v^2)\sin[u]\}$$

at the point  $(u,v) = (1, -10)$ .

- 1)  $H(1, -10) = 5.09502 \times 10^{-6}$
- 2)  $H(1, -10) = -5.65894$
- 3)  $H(1, -10) = -6.22551$
- 4)  $H(1, -10) = -8.06808$
- 5)  $H(1, -10) = -7.41813$

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### 03-Differential Geometry-Computers exam for serial number: 18

#### Exercise 1

Compute the curvature for  $C(t) = \{3 \cos[t], 4 \sin[t], 6 \cos[t] - 4 \sin[t]\}$  at the point  $t=4$ .

- 1)  $k(4) = 0.0585168$
- 2)  $k(4) = 3.2848$
- 3)  $k(4) = 1.64276$
- 4)  $k(4) = -0.659448$
- 5)  $k(4) = 7.93774$

#### Exercise 2

Compute the Gauss curvature for  $X(u,v) =$

$\{v \cos[u], v \sin[u], v + v \cos[u] + 3 v \sin[u]\}$  at the point  $(u,v) = (5, -8)$ .

- 1)  $K(5, -8) = 0$
- 2)  $K(5, -8) = -6.96332$
- 3)  $K(5, -8) = 0.606312$
- 4)  $K(5, -8) = 0.834361$
- 5)  $K(5, -8) = -5.1865$

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03-Differential Geometry-Computers exam for serial number: 19

### Exercise 1

Compute the curvature for  $C(t) = \{\cos[t], \sin[t], 3t - \cos[t] - 2\sin[t]\}$  at the point  $t=6$ .

- 1)  $k(6) = -4.3359$
- 2)  $k(6) = -0.217429$
- 3)  $k(6) = -1.949$
- 4)  $k(6) = 1.54116$
- 5)  $k(6) = 0.63884$

### Exercise 2

Compute the Gauss curvature for  $X(u,v) =$

$\{-8 + u^2 + 3u(-1+v) + 7v + 3v^2, v, -8 + u^2 + 5v + 3v^2 + u(-4 + 3v)\}$  at the point  $(u,v) = (-7, -7)$ .

- 1)  $K(-7, -7) = -7.85124$
- 2)  $K(-7, -7) = -3.72495$
- 3)  $K(-7, -7) = 8.356$
- 4)  $K(-7, -7) = 7.29947$
- 5)  $K(-7, -7) = 2.64942 \times 10^{-7}$

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### 03-Differential Geometry-Computers exam for serial number: 20

#### Exercise 1

Compute the curvature for  $C(t) =$

$$\{t + 2(9 + 6t - 8t^2) + 2(2 + t + 6t^2), 2 + t + 6t^2, 11 + 7t - 2t^2\} \text{ at the point } t = 10.$$

- 1)  $k(10) = 8.44668$
- 2)  $k(10) = 0.0000736514$
- 3)  $k(10) = -5.38225$
- 4)  $k(10) = -8.90644$
- 5)  $k(10) = -0.924022$

#### Exercise 2

Compute the Gauss curvature for  $X(u,v) =$

$$\{2v + (1 + 2v^2) \cos[u], -v + (1 + 2v^2) \sin[u], -3v - (1 + 2v^2) \cos[u] + 2(1 + 2v^2) \sin[u]\}$$

at the point  $(u,v) = (2, 5)$ .

- 1)  $K(2, 5) = -0.924022$
- 2)  $K(2, 5) = -1.80795 \times 10^{-8}$
- 3)  $K(2, 5) = 4.52902$
- 4)  $K(2, 5) = -8.90644$
- 5)  $K(2, 5) = -5.4383$

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03-Differential Geometry-Computers exam for serial number: 21

### Exercise 1

Compute the torsion for  $C(t) = \{\cos[t], \sin[t], \cos[t] - \sin[t]\}$  at the point  $t = 4$ .

- 1)  $\tau(4) = 3.76098$
- 2)  $\tau(4) = 0$
- 3)  $\tau(4) = -1.54387$
- 4)  $\tau(4) = -0.824659$
- 5)  $\tau(4) = 6.02739$

### Exercise 2

Compute the Gauss curvature for  $X(u,v) =$

$\{-2v + (1+v^2)\cos[u], (1+v^2)\sin[u], v + 2(1+v^2)\sin[u]\}$  at the point  $(u,v) = (0, 7)$ .

- 1)  $K(0, 7) = 1.06432$
- 2)  $K(0, 7) = -7.69466 \times 10^{-8}$
- 3)  $K(0, 7) = -0.824659$
- 4)  $K(0, 7) = -1.54387$
- 5)  $K(0, 7) = -5.20499$

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### 03-Differential Geometry-Computers exam for serial number: 22

#### Exercise 1

Compute the torsion for  $C(t) = \{t, -9 + 8t - 2(-9 - 2t + 6t^2), -9 - 2t + 6t^2\}$  at the point  $t = 2$ .

- 1)  $\tau(2) = 5.06574$
- 2)  $\tau(2) = 4.20995$
- 3)  $\tau(2) = 0$
- 4)  $\tau(2) = -3.31211$
- 5)  $\tau(2) = -4.09764$

#### Exercise 2

Compute the mean curvature for  $X(u,v) =$

$$\{v \cos[u], -2v - 2v \cos[u] + v \sin[u], -5v - 2v \cos[u] + 3v \sin[u]\}$$

at the point  $(u,v) = (5, -7)$ .

- 1)  $H(5, -7) = -8.36963$
- 2)  $H(5, -7) = -1.20961$
- 3)  $H(5, -7) = 0.00270069$
- 4)  $H(5, -7) = -8.57229$
- 5)  $H(5, -7) = -8.80118$

Further Mathematics - Degree in Engineering - 2024/2025  
03-Differential Geometry-Computers exam for serial number: 23

### Exercise 1

Compute the torsion for  $C(t) = \{4 \cos[t], 10 \sin[t], -5 \sin[t]\}$  at the point  $t=0$ .

- 1)  $\tau(0) = -4.49123$
- 2)  $\tau(0) = 0$
- 3)  $\tau(0) = 1.93527$
- 4)  $\tau(0) = 7.23709$
- 5)  $\tau(0) = 2.33879$

### Exercise 2

Compute the Gauss curvature for  $X(u,v) =$

$\{v \cos[u], v \sin[u], v - 2v \sin[u]\}$  at the point  $(u,v) = (0, 9)$ .

- 1)  $K(0, 9) = 7.23709$
- 2)  $K(0, 9) = 0$
- 3)  $K(0, 9) = -4.2105$
- 4)  $K(0, 9) = -4.49123$
- 5)  $K(0, 9) = 2.33879$

## Further Mathematics - Degree in Engineering - 2024/2025

### 03-Differential Geometry-Computers exam for serial number: 24

#### Exercise 1

Compute the curvature for  $C(t) = \{6 \cos[t] + 4 \sin[t], -6 \cos[t], -3 \cos[t]\}$  at the point  $t = 6$ .

- 1)  $k(6) = 7.58334$
- 2)  $k(6) = 0.135631$
- 3)  $k(6) = 3.31191$
- 4)  $k(6) = -7.06098$
- 5)  $k(6) = 3.65296$

#### Exercise 2

Compute the mean curvature for  $X(u,v) =$

$\{\cos[u] (2 + \cos[v]) - 2 \sin[v], \cos[u] (2 + \cos[v]) + (2 + \cos[v]) \sin[u] - \sin[v], \sin[v]\}$   
at the point  $(u,v) = (2, 6)$ .

- 1)  $H(2, 6) = -4.43894$
- 2)  $H(2, 6) = 0.144364$
- 3)  $H(2, 6) = -3.10038$
- 4)  $H(2, 6) = 3.31191$
- 5)  $H(2, 6) = 3.65296$

Further Mathematics - Degree in Engineering - 2024/2025  
03-Differential Geometry-Computers exam for serial number: 25

### Exercise 1

Compute the torsion for  $C(t) = \{-3t + \cos[t] + \sin[t], \sin[t], 3t - 2\sin[t]\}$  at the point  $t=5$ .

- 1)  $\tau(5) = 0.202932$
- 2)  $\tau(5) = 6.70459$
- 3)  $\tau(5) = 5.5269$
- 4)  $\tau(5) = 4.92771$
- 5)  $\tau(5) = 8.68001$

### Exercise 2

Compute the mean curvature for  $X(u,v) = \{(1+v^2)\cos[u], -2v + (1+v^2)\sin[u], v\}$  at the point  $(u,v) = (3, -5)$ .

- 1)  $H(3, -5) = 0.00102289$
- 2)  $H(3, -5) = 7.04573$
- 3)  $H(3, -5) = 8.68001$
- 4)  $H(3, -5) = 4.92771$
- 5)  $H(3, -5) = 2.51618$

## Further Mathematics - Degree in Engineering - 2024/2025

### 03-Differential Geometry-Computers exam for serial number: 26

#### Exercise 1

Compute the torsion for  $C(t) = \{2 \cos[t], 3 \sin[t], 0\}$  at the point  $t=5$ .

1)  $\tau(5) = 5.10831$

2)  $\tau(5) = 1.99412$

3)  $\tau(5) = -3.3256$

4)  $\tau(5) = 0$

5)  $\tau(5) = -1.0128$

#### Exercise 2

Compute the mean curvature for  $X(u,v) =$

$\{-2v - 3v \cos[u], -v - 2v \cos[u] + v \sin[u], v + 2v \cos[u]\}$  at the point  $(u,v) = (4, -1)$ .

1)  $H(4, -1) = -0.764385$

2)  $H(4, -1) = -1.0128$

3)  $H(4, -1) = -8.47795$

4)  $H(4, -1) = 0.0252995$

5)  $H(4, -1) = -1.43143$

Further Mathematics - Degree in Engineering - 2024/2025  
03-Differential Geometry-Computers exam for serial number: 27

### Exercise 1

Compute the curvature for  $C(t) = \{3 \cos[t], 3 \sin[t], -6 \cos[t]\}$  at the point  $t=2$ .

- 1)  $k(2) = -6.21626$
- 2)  $k(2) = 0.0833793$
- 3)  $k(2) = 1.39359$
- 4)  $k(2) = 7.80305$
- 5)  $k(2) = 5.5099$

### Exercise 2

Compute the Gauss curvature for  $X(u,v) =$

$$\{2v + (1 + 3v^2) \cos[u], (1 + 3v^2) \sin[u], -v - (1 + 3v^2) \cos[u] - (1 + 3v^2) \sin[u]\}$$

at the point  $(u,v) = (5, -5)$ .

- 1)  $K(5, -5) = -6.21626$
- 2)  $K(5, -5) = -1.20455 \times 10^{-8}$
- 3)  $K(5, -5) = 1.39359$
- 4)  $K(5, -5) = 7.80305$
- 5)  $K(5, -5) = 5.5099$

## Further Mathematics - Degree in Engineering - 2024/2025

### 03-Differential Geometry-Computers exam for serial number: 28

#### Exercise 1

Compute the curvature for  $C(t) = \{2 \cos[t], 10 \cos[t] + \sin[t], \sin[t]\}$  at the point  $t=2$ .

- 1)  $k(2) = -3.76581$
- 2)  $k(2) = 0.0114205$
- 3)  $k(2) = 0.729566$
- 4)  $k(2) = 8.77863$
- 5)  $k(2) = 1.40438$

#### Exercise 2

Compute the mean curvature for  $X(u,v) =$

$$\{u + 5v, -8 + 14u^2 + 12v - 6v^2 - u(17 + 10v), -4 + 7u^2 + 3v - 3v^2 - u(9 + 5v)\}$$

at the point  $(u,v) = (6, -3)$ .

- 1)  $H(6, -3) = 8.77863$
- 2)  $H(6, -3) = 0.0000862411$
- 3)  $H(6, -3) = 8.75169$
- 4)  $H(6, -3) = -4.00361$
- 5)  $H(6, -3) = -3.76581$

Further Mathematics - Degree in Engineering - 2024/2025  
03-Differential Geometry-Computers exam for serial number: 29

### Exercise 1

Compute the torsion for  $C(t) = \{6t + \cos[t], \sin[t], 3t\}$  at the point  $t=1$ .

- 1)  $\tau(1) = -7.18185$
- 2)  $\tau(1) = -3.27012$
- 3)  $\tau(1) = -0.924503$
- 4)  $\tau(1) = -2.63743$
- 5)  $\tau(1) = 0.118143$

### Exercise 2

Compute the mean curvature for  $X(u,v) =$

$\{\cos[u] (4 + 2 \cos[v]) + (4 + 2 \cos[v]) \sin[u] + 3 \sin[v], (4 + 2 \cos[v]) \sin[u], \sin[v]\}$   
at the point  $(u,v) = (1, 3)$ .

- 1)  $H(1, 3) = 4.2705$
- 2)  $H(1, 3) = 7.89394$
- 3)  $H(1, 3) = -2.63743$
- 4)  $H(1, 3) = -2.76376$
- 5)  $H(1, 3) = -0.337861$

## Further Mathematics - Degree in Engineering - 2024/2025

### 03-Differential Geometry-Computers exam for serial number: 30

#### Exercise 1

Compute the curvature for  $C(t) = \{-6t + \cos[t], -6t - 3\cos[t] + \sin[t], 3t\}$  at the point  $t=1$ .

- 1)  $k(1) = 4.69121$
- 2)  $k(1) = 4.76007$
- 3)  $k(1) = 8.29221$
- 4)  $k(1) = 2.56754$
- 5)  $k(1) = 0.0144674$

#### Exercise 2

Compute the mean curvature for  $X(u,v) =$

$\{-v + v\cos[u], 2v - 4v\cos[u] + v\sin[u], v\}$  at the point  $(u,v) = (3, -4)$ .

- 1)  $H(3, -4) = 6.59221$
- 2)  $H(3, -4) = 3.39798$
- 3)  $H(3, -4) = -5.98753$
- 4)  $H(3, -4) = 5.59708$
- 5)  $H(3, -4) = 0.957996$

Further Mathematics - Degree in Engineering - 2024/2025  
03-Differential Geometry-Computers exam for serial number: 31

### Exercise 1

Compute the torsion for  $C(t) = \{4 \cos[t], 2 \sin[t], 8 \cos[t]\}$  at the point  $t=1$ .

- 1)  $\tau(1) = 7.2977$
- 2)  $\tau(1) = 0$
- 3)  $\tau(1) = 7.23626$
- 4)  $\tau(1) = 5.45976$
- 5)  $\tau(1) = 7.44489$

### Exercise 2

Compute the mean curvature for  $X(u,v) = \{u, -2u + v, 2 + 6u^2 + u(7 - 2v) + 7v - 4v^2\}$  at the point  $(u,v) = (6, 6)$ .

- 1)  $H(6, 6) = 2.58653$
- 2)  $H(6, 6) = 0.0288466$
- 3)  $H(6, 6) = 7.33559$
- 4)  $H(6, 6) = -7.24521$
- 5)  $H(6, 6) = 8.40394$

## Further Mathematics - Degree in Engineering - 2024/2025

### 03-Differential Geometry-Computers exam for serial number: 32

#### Exercise 1

Compute the torsion for  $C(t) = \{t, -4 + 6t + 3t^2, 5 + 7t + 2t^2\}$  at the point  $t=2$ .

- 1)  $\tau(2) = 7.68678$
- 2)  $\tau(2) = 3.85795$
- 3)  $\tau(2) = 0$
- 4)  $\tau(2) = -6.08682$
- 5)  $\tau(2) = -1.73454$

#### Exercise 2

Compute the Gauss curvature for  $X(u,v) =$

$\{v \cos[u], v \cos[u] + v \sin[u], v\}$  at the point  $(u,v) = (5, 5)$ .

- 1)  $K(5, 5) = -4.77746$
- 2)  $K(5, 5) = -8.94922$
- 3)  $K(5, 5) = 0$
- 4)  $K(5, 5) = 6.16566$
- 5)  $K(5, 5) = -1.73454$

Further Mathematics - Degree in Engineering - 2024/2025  
03-Differential Geometry-Computers exam for serial number: 33

### Exercise 1

Compute the curvature for  $C(t) =$

$\{t + 2(6 - 9t + 9t^2), 2t + 3(6 - 9t + 9t^2), 6 - 9t + 9t^2\}$  at the point  $t = 0$ .

- 1)  $k(0) = 8.48242$
- 2)  $k(0) = 5.77925$
- 3)  $k(0) = 8.23472$
- 4)  $k(0) = 0.0014048$
- 5)  $k(0) = 2.22734$

### Exercise 2

Compute the mean curvature for  $X(u,v) =$

$\{-2v + v \cos[u] + 2v \sin[u], 2v - 2v \cos[u] - 3v \sin[u], v\}$  at the point  $(u,v) = (1, 3)$ .

- 1)  $H(1, 3) = 2.56606$
- 2)  $H(1, 3) = 8.48242$
- 3)  $H(1, 3) = 3.06991$
- 4)  $H(1, 3) = 5.88978$
- 5)  $H(1, 3) = 1.8226$

## Further Mathematics - Degree in Engineering - 2024/2025

### 03-Differential Geometry-Computers exam for serial number: 34

#### Exercise 1

Compute the curvature for  $C(t) =$

$\{\cos[t], 2t - 5\cos[t] + 7\sin[t], t - 2\cos[t] + 3\sin[t]\}$  at the point  $t = 3$ .

- 1)  $k(3) = 0.0573775$
- 2)  $k(3) = 5.75285$
- 3)  $k(3) = -7.5538$
- 4)  $k(3) = -6.16464$
- 5)  $k(3) = 8.19738$

#### Exercise 2

Compute the Gauss curvature for  $X(u,v) =$

$\{\cos[u], 2\cos[u] + \sin[u], v + 2\cos[u] + 2\sin[u]\}$  at the point  $(u,v) = (6, -2)$ .

- 1)  $K(6, -2) = 0$
- 2)  $K(6, -2) = -5.75908$
- 3)  $K(6, -2) = -7.5538$
- 4)  $K(6, -2) = 7.01888$
- 5)  $K(6, -2) = 8.18136$

Further Mathematics - Degree in Engineering - 2024/2025  
 03-Differential Geometry-Computers exam for serial number: 35

### Exercise 1

Compute the curvature for  $C(t) =$

$$\{4 + 4t - 2t^2 - 2(4 + t + t^2), 2t - 3t^2, 4 + t + t^2\} \text{ at the point } t = 6.$$

- 1)  $k(6) = 3.51252$
- 2)  $k(6) = 5.01507$
- 3)  $k(6) = -4.01299$
- 4)  $k(6) = 0.000079884$
- 5)  $k(6) = -7.18136$

### Exercise 2

Compute the mean curvature for  $X(u,v) =$

$$\{-2 - 8u^2 + v - 5v^2 + u(4 + v), v + 2(-2 - 8u^2 + v - 5v^2 + u(4 + v)), -2 - 8u^2 + v - 5v^2 + u(3 + v)\}$$

at the point  $(u,v) = (-6, 6)$ .

- 1)  $H(-6, 6) = -2.39546$
- 2)  $H(-6, 6) = -7.18136$
- 3)  $H(-6, 6) = -7.40422$
- 4)  $H(-6, 6) = 0.0263761$
- 5)  $H(-6, 6) = 7.43592$

## Further Mathematics - Degree in Engineering - 2024/2025

### 03-Differential Geometry-Computers exam for serial number: 36

#### Exercise 1

Compute the curvature for  $C(t) =$

$\{-5 \cos[t] + 24 \sin[t], -5 \cos[t] + 12 \sin[t], 8 \sin[t]\}$  at the point  $t = 5$ .

- 1)  $k(5) = 4.25412$
- 2)  $k(5) = 2.21873$
- 3)  $k(5) = -0.595157$
- 4)  $k(5) = -0.1327$
- 5)  $k(5) = 4.34756$

#### Exercise 2

Compute the mean curvature for  $X(u,v) =$

$\{-\cos[u] (4 + 3 \cos[v]) - \sin[v], 10 \cos[u] (4 + 3 \cos[v]) + 3 (4 + 3 \cos[v]) \sin[u] + 2 \sin[v],$   
 $4 \cos[u] (4 + 3 \cos[v]) + (4 + 3 \cos[v]) \sin[u] + \sin[v]\}$  at the point  $(u,v) = (5, 6)$ .

- 1)  $H(5, 6) = -2.21553$
- 2)  $H(5, 6) = 0.11062$
- 3)  $H(5, 6) = 4.34756$
- 4)  $H(5, 6) = 5.52964$
- 5)  $H(5, 6) = 0.726684$

Further Mathematics - Degree in Engineering - 2024/2025  
03-Differential Geometry-Computers exam for serial number: 37

### Exercise 1

Compute the torsion for  $C(t) = \{4 \cos[t], -8 \cos[t] + \sin[t], 0\}$  at the point  $t = 6$ .

- 1)  $\tau(6) = 8.01241$
- 2)  $\tau(6) = -2.08174$
- 3)  $\tau(6) = -1.02093$
- 4)  $\tau(6) = -7.02681$
- 5)  $\tau(6) = 0$

### Exercise 2

Compute the Gauss curvature for  $X(u,v) =$

$\{-v, -v + (1 + 3v^2) \sin[u], 3v + (1 + 3v^2) \cos[u]\}$  at the point  $(u,v) = (2, -7)$ .

- 1)  $K(2, -7) = -2.08174$
- 2)  $K(2, -7) = 3.52216$
- 3)  $K(2, -7) = -4.83178$
- 4)  $K(2, -7) = 5.32047$
- 5)  $K(2, -7) = -1.06517 \times 10^{-8}$

## Further Mathematics - Degree in Engineering - 2024/2025

### 03-Differential Geometry-Computers exam for serial number: 38

#### Exercise 1

Compute the torsion for  $C(t) =$

$\{\cos[t] - \sin[t], \sin[t], 2t + \cos[t] - 2\sin[t]\}$  at the point  $t=2$ .

1)  $\tau(2) = -3.22433$

2)  $\tau(2) = -4.78496$

3)  $\tau(2) = 0.133341$

4)  $\tau(2) = 4.13548$

5)  $\tau(2) = -3.63905$

#### Exercise 2

Compute the mean curvature for  $X(u,v) =$

$\{v - (1 + 2v^2)\cos[u], v - (1 + 2v^2)\cos[u] + (1 + 2v^2)\sin[u], v - 2(1 + 2v^2)\cos[u]\}$

at the point  $(u,v) = (3, 7)$ .

1)  $H(3, 7) = -4.81687$

2)  $H(3, 7) = -3.22433$

3)  $H(3, 7) = 0.0000912885$

4)  $H(3, 7) = -5.79965$

5)  $H(3, 7) = -6.67906$

Further Mathematics - Degree in Engineering - 2024/2025  
03-Differential Geometry-Computers exam for serial number: 39

### Exercise 1

Compute the curvature for  $C(t) = \{\cos[t] - 4\sin[t], 2\sin[t], 2\sin[t]\}$  at the point  $t=1$ .

- 1)  $k(1) = -4.80615$
- 2)  $k(1) = 1.93302$
- 3)  $k(1) = 3.17266$
- 4)  $k(1) = -4.38782$
- 5)  $k(1) = 0.0739546$

### Exercise 2

Compute the mean curvature for  $X(u,v) =$

$$\{u + 16u^2 + 8uv + 2(-7 - 7v + 5v^2), -7 + 8u^2 - 6v + 5v^2 + u(-1 + 4v), -7 + u + 8u^2 - 7v + 4uv + 5v^2\}$$

at the point  $(u,v) = (5, 0)$ .

- 1)  $H(5, 0) = -2.33045$
- 2)  $H(5, 0) = -8.38599$
- 3)  $H(5, 0) = -7.18571$
- 4)  $H(5, 0) = 3.17266$
- 5)  $H(5, 0) = 0.0150556$

## Further Mathematics - Degree in Engineering - 2024/2025

### 03-Differential Geometry-Computers exam for serial number: 40

#### Exercise 1

Compute the curvature for  $C(t) = \{2 \cos[t], 4 \sin[t], 0\}$  at the point  $t=3$ .

- 1)  $k(3) = -7.69746$
- 2)  $k(3) = 1.75144$
- 3)  $k(3) = -2.22556$
- 4)  $k(3) = 0.127854$
- 5)  $k(3) = -8.91226$

#### Exercise 2

Compute the Gauss curvature for  $X(u,v) = \{-2v + 3(1+3v^2)\cos[u] + 4(1+3v^2)\sin[u], (1+3v^2)\sin[u], v - (1+3v^2)\cos[u] - 2(1+3v^2)\sin[u]\}$  at the point  $(u,v) = (2, -7)$ .

- 1)  $K(2, -7) = 1.75144$
- 2)  $K(2, -7) = -8.91226$
- 3)  $K(2, -7) = -7.26083$
- 4)  $K(2, -7) = 0$
- 5)  $K(2, -7) = -3.61706$

Further Mathematics - Degree in Engineering - 2024/2025  
03-Differential Geometry-Computers exam for serial number: 41

### Exercise 1

Compute the curvature for  $C(t) =$

$\{5 \cos[t] + 10 \sin[t], 5 \sin[t], -10 \cos[t] - 5 \sin[t]\}$  at the point  $t = 5$ .

- 1)  $k(5) = -3.04278$
- 2)  $k(5) = 0.0382824$
- 3)  $k(5) = -6.91167$
- 4)  $k(5) = 6.50995$
- 5)  $k(5) = -5.64143$

### Exercise 2

Compute the Gauss curvature for  $X(u,v) = \{-\cos[u] (2 + \cos[v]) - (2 + \cos[v]) \sin[u] - 4 \sin[v], 2 \cos[u] (2 + \cos[v]) + (2 + \cos[v]) \sin[u] + 6 \sin[v], \sin[v]\}$  at the point  $(u,v) = (3, 1)$ .

- 1)  $K(3, 1) = 5.1809$
- 2)  $K(3, 1) = 0.0137064$
- 3)  $K(3, 1) = 4.82954$
- 4)  $K(3, 1) = -6.01098$
- 5)  $K(3, 1) = -6.91167$

## Further Mathematics - Degree in Engineering - 2024/2025

### 03-Differential Geometry-Computers exam for serial number: 42

#### Exercise 1

Compute the curvature for  $C(t) = \{5 \cos[t] + 3 \sin[t], 3 \sin[t], 6 \sin[t]\}$  at the point  $t=2$ .

- 1)  $k(2) = -2.82096$
- 2)  $k(2) = 8.00435$
- 3)  $k(2) = 3.48584$
- 4)  $k(2) = 0.126032$
- 5)  $k(2) = 4.30096$

#### Exercise 2

Compute the Gauss curvature for  $X(u,v) =$

$$\left\{ -2v + 3(1+v^2) \cos[u] - 2(1+v^2) \sin[u], -v + (1+v^2) \cos[u] - (1+v^2) \sin[u], \right. \\ \left. v - 2(1+v^2) \cos[u] + 2(1+v^2) \sin[u] \right\} \text{ at the point } (u,v) = (2, -1).$$

- 1)  $K(2, -1) = -7.66983$
- 2)  $K(2, -1) = -7.20963$
- 3)  $K(2, -1) = 8.64725$
- 4)  $K(2, -1) = -0.00306772$
- 5)  $K(2, -1) = -4.72036$

Further Mathematics - Degree in Engineering - 2024/2025  
03-Differential Geometry-Computers exam for serial number: 43

### Exercise 1

Compute the curvature for  $C(t) =$

$\{-9t + \cos[t] + 3 \sin[t], \sin[t], -15t + 2 \cos[t] + 5 \sin[t]\}$  at the point  $t = 3$ .

1)  $k(3) = 0.000468078$

2)  $k(3) = 1.21751$

3)  $k(3) = 6.06081$

4)  $k(3) = 1.08625$

5)  $k(3) = 8.21035$

### Exercise 2

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

1)  $K(3, 1) = 0.00261169$

2)  $K(3, 1) = 0.741207$

3)  $K(3, 1) = 1.21751$

4)  $K(3, 1) = -6.03523$

5)  $K(3, 1) = -3.58157$

## Further Mathematics - Degree in Engineering - 2024/2025

### 03-Differential Geometry-Computers exam for serial number: 44

#### Exercise 1

Compute the torsion for  $C(t) = \{-t + 3 \cos[t] - 2 \sin[t], \sin[t], \cos[t]\}$  at the point  $t=2$ .

- 1)  $\tau(2) = 4.31191$
- 2)  $\tau(2) = 8.20426$
- 3)  $\tau(2) = 3.93404$
- 4)  $\tau(2) = 0.0532164$
- 5)  $\tau(2) = 7.10103$

#### Exercise 2

Compute the mean curvature for  $X(u,v) =$

$\{4v + (1+v^2) \cos[u], -4v - (1+v^2) \cos[u] + (1+v^2) \sin[u], v\}$  at the point  $(u,v) = (3, 0)$ .

- 1)  $H(3, 0) = 2.92095$
- 2)  $H(3, 0) = -8.79195$
- 3)  $H(3, 0) = -2.04847$
- 4)  $H(3, 0) = 0.236815$
- 5)  $H(3, 0) = 7.10103$

Further Mathematics - Degree in Engineering - 2024/2025  
 03-Differential Geometry-Computers exam for serial number: 45

### Exercise 1

Compute the curvature for  $C(t) = \{2 \cos[t], -2 \cos[t] + 2 \sin[t], -\sin[t]\}$  at the point  $t=4$ .

- 1)  $k(4) = 1.14353$
- 2)  $k(4) = 3.38886$
- 3)  $k(4) = -7.44599$
- 4)  $k(4) = -3.7203$
- 5)  $k(4) = 0.140447$

### Exercise 2

Compute the Gauss curvature for  $X(u,v) =$

$\{3u + 2v, u + v, -2 - 7u^2 - 7v + 2v^2 + 9u(1 + v)\}$  at the point  $(u,v) = (3, 8)$ .

- 1)  $K(3, 8) = 8.86041$
- 2)  $K(3, 8) = 0.957629$
- 3)  $K(3, 8) = 8.70067$
- 4)  $K(3, 8) = -7.44599$
- 5)  $K(3, 8) = -3.50272 \times 10^{-6}$

## Further Mathematics - Degree in Engineering - 2024/2025

### 03-Differential Geometry-Computers exam for serial number: 46

#### Exercise 1

Compute the curvature for  $C(t) = \{5 \cos[t] + \sin[t], \sin[t], -3 \sin[t]\}$  at the point  $t = 6$ .

- 1)  $k(6) = -4.36321$
- 2)  $k(6) = 2.66577$
- 3)  $k(6) = 0.278381$
- 4)  $k(6) = -1.00907$
- 5)  $k(6) = -6.86977$

#### Exercise 2

Compute the mean curvature for  $X(u,v) =$

$\{2v + 3v \cos[u] + 2v \sin[u], v \cos[u] + v \sin[u], v\}$  at the point  $(u,v) = (6, -4)$ .

- 1)  $H(6, -4) = -2.75273$
- 2)  $H(6, -4) = -1.58592$
- 3)  $H(6, -4) = 0.0256985$
- 4)  $H(6, -4) = -6.27573$
- 5)  $H(6, -4) = 2.65786$

Further Mathematics - Degree in Engineering - 2024/2025  
 03-Differential Geometry-Computers exam for serial number: 47

### Exercise 1

Compute the torsion for  $C(t) =$

$\{3 \cos[t] - 3 \sin[t], -2 \cos[t] + 3 \sin[t], -2 \cos[t] + 2 \sin[t]\}$  at the point  $t=4$ .

- 1)  $\tau(4) = 4.71226$
- 2)  $\tau(4) = 6.93351$
- 3)  $\tau(4) = -0.912055$
- 4)  $\tau(4) = 0$
- 5)  $\tau(4) = 6.23854$

### Exercise 2

Compute the mean curvature for  $X(u,v) =$

$\{-4v + v \cos[u] - 2v \sin[u], -6v + 2v \cos[u] - 3v \sin[u], v\}$  at the point  $(u,v) = (4, 2)$ .

- 1)  $H(4, 2) = 6.33167$
- 2)  $H(4, 2) = -0.903198$
- 3)  $H(4, 2) = 6.23854$
- 4)  $H(4, 2) = 0.133961$
- 5)  $H(4, 2) = -5.27836$

## Further Mathematics - Degree in Engineering - 2024/2025

### 03-Differential Geometry-Computers exam for serial number: 48

#### Exercise 1

Compute the curvature for  $C(t) = \{t, -4 + t + 2t^2, 3 + 4t + 5t^2\}$  at the point  $t = 3$ .

- 1)  $k(3) = 5.89916$
- 2)  $k(3) = 8.37377$
- 3)  $k(3) = 0.000255333$
- 4)  $k(3) = -2.49815$
- 5)  $k(3) = -3.92701$

#### Exercise 2

Compute the Gauss curvature for  $X(u,v) =$

$\{v + v \cos[u] - v \sin[u], -v + v \sin[u], v - 3v \cos[u]\}$  at the point  $(u,v) = (3, -5)$ .

- 1)  $K(3, -5) = -5.71761$
- 2)  $K(3, -5) = -6.19851$
- 3)  $K(3, -5) = 0$
- 4)  $K(3, -5) = 8.37377$
- 5)  $K(3, -5) = 8.26343$

Further Mathematics - Degree in Engineering - 2024/2025  
03-Differential Geometry-Computers exam for serial number: 49

### Exercise 1

Compute the torsion for  $C(t) =$

$\{-\cos[t] + 5 \sin[t], -2 \cos[t] + 5 \sin[t], 2 \cos[t] - 10 \sin[t]\}$  at the point  $t=2$ .

- 1)  $\tau(2) = 6.3359$
- 2)  $\tau(2) = -0.788372$
- 3)  $\tau(2) = -1.93629$
- 4)  $\tau(2) = -6.37992$
- 5)  $\tau(2) = 0$

### Exercise 2

Compute the mean curvature for  $X(u,v) =$

$\{160 + 256 u^2 + u(45 - 192 v) + 253 v - 96 v^2, -50 - 80 u^2 - 79 v + 30 v^2 + 2 u(-7 + 30 v), -40 u^2 + u(-7 + 30 v) + 5(-5 - 8 v + 3 v^2)\}$  at the point  $(u,v) = (8, 6)$ .

- 1)  $H(8, 6) = -8.07537$
- 2)  $H(8, 6) = -5.06581$
- 3)  $H(8, 6) = -7.54725$
- 4)  $H(8, 6) = 6.73703$
- 5)  $H(8, 6) = -0.00856394$

## Further Mathematics - Degree in Engineering - 2024/2025

### 03-Differential Geometry-Computers exam for serial number: 50

#### Exercise 1

Compute the curvature for  $C(t) = \{9 \cos[t] - 2 \sin[t], -4 \cos[t] + \sin[t], t\}$  at the point  $t=4$ .

- 1)  $k(4) = 0.00672284$
- 2)  $k(4) = 7.12839$
- 3)  $k(4) = -1.4554$
- 4)  $k(4) = 2.06724$
- 5)  $k(4) = -3.14292$

#### Exercise 2

Compute the mean curvature for  $X(u,v) =$

$$\{-6u^2 + u(7 + 4v) + 2(-5 - 7v + 6v^2), 5 + 3u^2 + 7v - 6v^2 - u(3 + 2v), -5 - 3u^2 - 6v + 6v^2 + 2u(1 + v)\}$$

at the point  $(u,v) = (4, -9)$ .

- 1)  $H(4, -9) = 0.00240385$
- 2)  $H(4, -9) = -1.4554$
- 3)  $H(4, -9) = 1.54749$
- 4)  $H(4, -9) = -1.7954$
- 5)  $H(4, -9) = 8.84322$

Further Mathematics - Degree in Engineering - 2024/2025  
 03-Differential Geometry-Computers exam for serial number: 51

### Exercise 1

Compute the curvature for  $C(t) =$

$$\{6 - 4t - 6t^2 + 2(2 + 3t + 6t^2), -6 + 5t + 6t^2, 2 + 3t + 6t^2\} \text{ at the point } t = 6.$$

- 1)  $k(6) = -5.37343$
- 2)  $k(6) = 4.8704$
- 3)  $k(6) = 0.0000202033$
- 4)  $k(6) = 2.17798$
- 5)  $k(6) = -8.27329$

### Exercise 2

Compute the Gauss curvature for  $X(u,v) =$

$$\{\cos[u](2 + \cos[v]) + 3\sin[v], 3\cos[u](2 + \cos[v]) + (2 + \cos[v])\sin[u] + 9\sin[v], \sin[v]\}$$

at the point  $(u,v) = (1, 6)$ .

- 1)  $K(1, 6) = -6.9679$
- 2)  $K(1, 6) = 7.67909$
- 3)  $K(1, 6) = 0.00553941$
- 4)  $K(1, 6) = 4.60258$
- 5)  $K(1, 6) = -2.56145$

## Further Mathematics - Degree in Engineering - 2024/2025

### 03-Differential Geometry-Computers exam for serial number: 52

#### Exercise 1

Compute the curvature for  $C(t) = \{\cos[t], 2\cos[t] + \sin[t], 3t - 2\cos[t]\}$  at the point  $t=5$ .

- 1)  $k(5) = -4.5303$
- 2)  $k(5) = -1.30152$
- 3)  $k(5) = -8.22475$
- 4)  $k(5) = 1.82696$
- 5)  $k(5) = 0.084877$

#### Exercise 2

Compute the Gauss curvature for  $X(u,v) =$

$$\{(1+3v^2)\cos[u] - (1+3v^2)\sin[u], -2v - 3(1+3v^2)\sin[u], v + 2(1+3v^2)\sin[u]\}$$

at the point  $(u,v) = (0, 9)$ .

- 1)  $K(0, 9) = -1.30152$
- 2)  $K(0, 9) = 1.82696$
- 3)  $K(0, 9) = -7.33613$
- 4)  $K(0, 9) = 6.26038$
- 5)  $K(0, 9) = 0$

Further Mathematics - Degree in Engineering - 2024/2025  
03-Differential Geometry-Computers exam for serial number: 53

### Exercise 1

Compute the torsion for  $C(t) = \{4 \cos[t] - 4 \sin[t], 12 \sin[t], -4 \sin[t]\}$  at the point  $t=2$ .

- 1)  $\tau(2) = 8.05465$
- 2)  $\tau(2) = -7.03147$
- 3)  $\tau(2) = 5.1625$
- 4)  $\tau(2) = 0$
- 5)  $\tau(2) = 5.6391$

### Exercise 2

Compute the Gauss curvature for  $X(u,v) =$

$\{(1+3v^2) \cos[u] + 2(1+3v^2) \sin[u], (1+3v^2) \sin[u], v\}$  at the point  $(u,v) = (6, -1)$ .

- 1)  $K(6, -1) = 5.68844$
- 2)  $K(6, -1) = 5.6391$
- 3)  $K(6, -1) = 6.34159$
- 4)  $K(6, -1) = -0.000860107$
- 5)  $K(6, -1) = 7.00186$

## Further Mathematics - Degree in Engineering - 2024/2025

### 03-Differential Geometry-Computers exam for serial number: 54

#### Exercise 1

Compute the torsion for  $C(t) =$

$\{-4t + \cos[t] + 2\sin[t], -4t + \sin[t], -2t + \sin[t]\}$  at the point  $t=3$ .

1)  $\tau(3) = 0.0707206$

2)  $\tau(3) = 5.81626$

3)  $\tau(3) = -2.51462$

4)  $\tau(3) = 6.99413$

5)  $\tau(3) = -2.59732$

#### Exercise 2

Compute the mean curvature for  $X(u,v) =$

$\{\cos[u](2 + \cos[v]) - \sin[v], -((2 + \cos[v])\sin[u]) + 3\sin[v],$   
 $-2(2 + \cos[v])\sin[u] + 5\sin[v]\}$  at the point  $(u,v) = (3, 5)$ .

1)  $H(3, 5) = 0.159977$

2)  $H(3, 5) = -0.994745$

3)  $H(3, 5) = -3.15171$

4)  $H(3, 5) = 5.81626$

5)  $H(3, 5) = -0.631055$

Further Mathematics - Degree in Engineering - 2024/2025  
03-Differential Geometry-Computers exam for serial number: 55

### Exercise 1

Compute the torsion for  $C(t) = \{t, 17 + 3t - 8t^2, -9 - 3t + 7t^2\}$  at the point  $t = 4$ .

- 1)  $\tau(4) = 0.663487$
- 2)  $\tau(4) = -3.29297$
- 3)  $\tau(4) = 0$
- 4)  $\tau(4) = -8.13621$
- 5)  $\tau(4) = 3.54957$

### Exercise 2

Compute the mean curvature for  $X(u,v) =$

$$\{(1 + 3v^2) \cos[u], v + 5(1 + 3v^2) \cos[u] + (1 + 3v^2) \sin[u], v + 4(1 + 3v^2) \cos[u]\}$$

at the point  $(u,v) = (5, -8)$ .

- 1)  $H(5, -8) = -1.29783$
- 2)  $H(5, -8) = 5.74133$
- 3)  $H(5, -8) = -0.0000150851$
- 4)  $H(5, -8) = 2.41452$
- 5)  $H(5, -8) = -7.85043$

## Further Mathematics - Degree in Engineering - 2024/2025

### 03-Differential Geometry-Computers exam for serial number: 56

#### Exercise 1

Compute the curvature for  $C(t) = \{-t, 7 + 5t - 2t^2, 8 + 4t + 7t^2\}$  at the point  $t = 9$ .

- 1)  $k(9) = 0.0000365376$
- 2)  $k(9) = 3.23887$
- 3)  $k(9) = 1.61375$
- 4)  $k(9) = -3.57232$
- 5)  $k(9) = -3.33614$

#### Exercise 2

Compute the mean curvature for  $X(u,v) =$

$$\{-v - 3(1 + 2v^2)\cos[u] + 2(1 + 2v^2)\sin[u], (1 + 2v^2)\cos[u] - (1 + 2v^2)\sin[u], v\}$$

at the point  $(u,v) = (5, -1)$ .

- 1)  $H(5, -1) = 0.0661999$
- 2)  $H(5, -1) = -3.57232$
- 3)  $H(5, -1) = -4.91205$
- 4)  $H(5, -1) = 8.44072$
- 5)  $H(5, -1) = -2.91687$

Further Mathematics - Degree in Engineering - 2024/2025  
03-Differential Geometry-Computers exam for serial number: 57

### Exercise 1

Compute the curvature for  $C(t) = \{\cos[t] + 2\sin[t], \sin[t], t\}$  at the point  $t=5$ .

- 1)  $k(5) = -0.858101$
- 2)  $k(5) = -2.96968$
- 3)  $k(5) = -5.42173$
- 4)  $k(5) = 0.340251$
- 5)  $k(5) = 2.99193$

### Exercise 2

Compute the mean curvature for  $X(u,v) =$

$$\left\{ 5(1+3v^2)\cos[u] + 2(1+3v^2)\sin[u], 2(1+3v^2)\cos[u] + (1+3v^2)\sin[u], \right. \\ \left. v + 2(1+3v^2)\cos[u] + (1+3v^2)\sin[u] \right\} \text{ at the point } (u,v) = (1,8).$$

- 1)  $H(1,8) = 3.46234$
- 2)  $H(1,8) = 0.941037$
- 3)  $H(1,8) = 2.99193$
- 4)  $H(1,8) = 0.000354072$
- 5)  $H(1,8) = 1.86517$

## Further Mathematics - Degree in Engineering - 2024/2025

### 03-Differential Geometry-Computers exam for serial number: 58

#### Exercise 1

Compute the curvature for  $C(t) = \{6t + \cos[t] - \sin[t], \cos[t], 2t\}$  at the point  $t=6$ .

- 1)  $k(6) = 0.631284$
- 2)  $k(6) = 6.0509$
- 3)  $k(6) = 0.0309519$
- 4)  $k(6) = 0.91853$
- 5)  $k(6) = -8.91202$

#### Exercise 2

Compute the Gauss curvature for  $X(u,v) =$

$$\{-4v + (1+v^2)\cos[u] + 2(1+v^2)\sin[u], -2v + (1+v^2)\sin[u], v + (1+v^2)\cos[u]\}$$

at the point  $(u,v) = (4, -3)$ .

- 1)  $K(4, -3) = 0.91853$
- 2)  $K(4, -3) = -8.91202$
- 3)  $K(4, -3) = -0.0000106186$
- 4)  $K(4, -3) = 2.96806$
- 5)  $K(4, -3) = -2.95864$

Further Mathematics - Degree in Engineering - 2024/2025  
03-Differential Geometry-Computers exam for serial number: 59

### Exercise 1

Compute the torsion for  $C(t) = \{4 \cos[t] + 5 \sin[t], 5 \sin[t], 0\}$  at the point  $t = 2$ .

- 1)  $\tau(2) = 0$
- 2)  $\tau(2) = -2.77727$
- 3)  $\tau(2) = 3.84275$
- 4)  $\tau(2) = -7.48297$
- 5)  $\tau(2) = -4.25741$

### Exercise 2

Compute the Gauss curvature for  $X(u,v) = \{\cos[u] - \sin[u], \sin[u], v\}$  at the point  $(u,v) = (0, -7)$ .

- 1)  $K(0, -7) = 0$
- 2)  $K(0, -7) = 4.67349$
- 3)  $K(0, -7) = 3.98309$
- 4)  $K(0, -7) = 3.77047$
- 5)  $K(0, -7) = 8.59345$

## Further Mathematics - Degree in Engineering - 2024/2025

### 03-Differential Geometry-Computers exam for serial number: 60

#### Exercise 1

Compute the torsion for  $C(t) =$

$\{-3 \sin[t], 4 \cos[t] + 3 \sin[t], -8 \cos[t] - 3 \sin[t]\}$  at the point  $t=0$ .

1)  $\tau(0) = -7.82865$

2)  $\tau(0) = 7.22876$

3)  $\tau(0) = -3.8473$

4)  $\tau(0) = 0$

5)  $\tau(0) = 6.80495$

#### Exercise 2

Compute the mean curvature for  $X(u,v) =$

$\{-2v + 3 \cos[u] + 4 \sin[u], -3v + \cos[u] + 4 \sin[u], v - \sin[u]\}$  at the point  $(u,v) = (4, -2)$ .

1)  $H(4, -2) = 2.65449$

2)  $H(4, -2) = -8.03175$

3)  $H(4, -2) = 1.73687$

4)  $H(4, -2) = 0.301581$

5)  $H(4, -2) = -8.74513$

Further Mathematics - Degree in Engineering - 2024/2025  
03-Differential Geometry-Computers exam for serial number: 61

### Exercise 1

Compute the curvature for  $C(t) = \{t - 2(-9 + 2t - 5t^2), 6 + 7t + 8t^2, -9 + 2t - 5t^2\}$  at the point  $t = 10$ .

- 1)  $k(10) = 7.00005$
- 2)  $k(10) = 7.39583$
- 3)  $k(10) = 0.0000101591$
- 4)  $k(10) = 6.5339$
- 5)  $k(10) = 4.32169$

### Exercise 2

Compute the Gauss curvature for  $X(u,v) = \{5 + 4u^2 + v - v^2 + u(-5 + 7v), -20 - 16u^2 + u(22 - 28v) - 3v + 4v^2, -20u^2 + u(26 - 35v) + 5(-5 - v + v^2)\}$  at the point  $(u,v) = (1, -5)$ .

- 1)  $K(1, -5) = 7.00005$
- 2)  $K(1, -5) = -8.99353$
- 3)  $K(1, -5) = -1.08756 \times 10^{-8}$
- 4)  $K(1, -5) = 7.39583$
- 5)  $K(1, -5) = -1.31442$

## Further Mathematics - Degree in Engineering - 2024/2025 03-Differential Geometry-Computers exam for serial number: 62

### Exercise 1

Compute the curvature for  $C(t) =$

$\{\cos[t], 2\cos[t] + 4\sin[t], 2\cos[t] + 4\sin[t]\}$  at the point  $t=1$ .

- 1)  $k(1) = -6.16121$
- 2)  $k(1) = -1.44747$
- 3)  $k(1) = 4.49549$
- 4)  $k(1) = -8.9193$
- 5)  $k(1) = 1.35002$

### Exercise 2

Compute the Gauss curvature for  $X(u,v) =$

$\{2v + v\cos[u] - 2v\sin[u], -v + v\sin[u], v\}$  at the point  $(u,v) = (1, 9)$ .

- 1)  $K(1, 9) = -8.9193$
- 2)  $K(1, 9) = -8.06506$
- 3)  $K(1, 9) = 0$
- 4)  $K(1, 9) = -6.16121$
- 5)  $K(1, 9) = 1.35002$

Further Mathematics - Degree in Engineering - 2024/2025  
03-Differential Geometry-Computers exam for serial number: 63

### Exercise 1

Compute the curvature for  $C(t) = \{\cos[t], 6\cos[t] + 3\sin[t], -6\sin[t]\}$  at the point  $t=2$ .

- 1)  $k(2) = 6.80949$
- 2)  $k(2) = 8.75902$
- 3)  $k(2) = 0.0976362$
- 4)  $k(2) = -6.97646$
- 5)  $k(2) = -3.30492$

### Exercise 2

Compute the Gauss curvature for  $X(u,v) =$

$$\{10 + 18u^2 - 23v + 14v^2 + u(-5 + 6v), v, -5 - 9u^2 - 3u(-1 + v) + 7v - 7v^2\}$$

at the point  $(u,v) = (3, -8)$ .

- 1)  $K(3, -8) = 6.80949$
- 2)  $K(3, -8) = -6.97646$
- 3)  $K(3, -8) = 5.28488 \times 10^{-7}$
- 4)  $K(3, -8) = -3.79382$
- 5)  $K(3, -8) = 1.9722$

## Further Mathematics - Degree in Engineering - 2024/2025

### 03-Differential Geometry-Computers exam for serial number: 64

#### Exercise 1

Compute the curvature for  $C(t) = \{21t + \cos[t], \sin[t], 3t\}$  at the point  $t=5$ .

- 1)  $k(5) = 0.00196063$
- 2)  $k(5) = -7.58903$
- 3)  $k(5) = -5.90068$
- 4)  $k(5) = 3.70978$
- 5)  $k(5) = -7.23494$

#### Exercise 2

Compute the mean curvature for  $X(u,v) =$

$$\{-3v + 2(1 + 2v^2)\cos[u], (1 + 2v^2)\sin[u], -4v + 3(1 + 2v^2)\cos[u] + 2(1 + 2v^2)\sin[u]\}$$

at the point  $(u,v) = (3, -9)$ .

- 1)  $H(3, -9) = 4.20892 \times 10^{-6}$
- 2)  $H(3, -9) = 3.70076$
- 3)  $H(3, -9) = -5.90068$
- 4)  $H(3, -9) = -7.23494$
- 5)  $H(3, -9) = 3.70978$

Further Mathematics - Degree in Engineering - 2024/2025  
03-Differential Geometry-Computers exam for serial number: 65

### Exercise 1

Compute the torsion for  $C(t) = \{-3 \sin[t], 3 \cos[t], -3 \cos[t] - 3 \sin[t]\}$  at the point  $t=5$ .

- 1)  $\tau(5) = 2.62795$
- 2)  $\tau(5) = 0.50688$
- 3)  $\tau(5) = 1.75182$
- 4)  $\tau(5) = 0$
- 5)  $\tau(5) = 1.62483$

### Exercise 2

Compute the mean curvature for  $X(u,v) =$

$\{\cos[u] (4 + 2 \cos[v]) + 2 (4 + 2 \cos[v]) \sin[u], (4 + 2 \cos[v]) \sin[u],$   
 $2 \cos[u] (4 + 2 \cos[v]) + 2 (4 + 2 \cos[v]) \sin[u] + \sin[v]\}$  at the point  $(u,v) = (5, 2)$ .

- 1)  $H(5, 2) = 6.92581$
- 2)  $H(5, 2) = 7.21379$
- 3)  $H(5, 2) = -5.74544$
- 4)  $H(5, 2) = 0.0353709$
- 5)  $H(5, 2) = 2.62795$

## Further Mathematics - Degree in Engineering - 2024/2025

### 03-Differential Geometry-Computers exam for serial number: 66

#### Exercise 1

Compute the curvature for  $C(t) = \{3 \cos[t] + 2 \sin[t], 2 \sin[t], 6 \sin[t]\}$  at the point  $t=1$ .

- 1)  $k(1) = -3.08111$
- 2)  $k(1) = 0.37166$
- 3)  $k(1) = -0.538747$
- 4)  $k(1) = -1.47691$
- 5)  $k(1) = 2.17633$

#### Exercise 2

Compute the mean curvature for  $X(u,v) =$

$\{u + 2v, v, 8 + 2v + 7v^2 + u(-8 + 3v)\}$  at the point  $(u,v) = (6, 0)$ .

- 1)  $H(6, 0) = 5.84173$
- 2)  $H(6, 0) = -0.0185024$
- 3)  $H(6, 0) = -2.26824$
- 4)  $H(6, 0) = -1.02729$
- 5)  $H(6, 0) = 3.00569$

## Further Mathematics - Degree in Engineering - 2024/2025

### 03-Differential Geometry-Computers exam for serial number: 67

#### Exercise 1

Compute the torsion for  $C(t) = \{\cos[t], 3\cos[t] + \sin[t], 3t - 2\sin[t]\}$  at the point  $t=3$ .

- 1)  $\tau(3) = 0.0127355$
- 2)  $\tau(3) = -8.42869$
- 3)  $\tau(3) = 4.53829$
- 4)  $\tau(3) = -2.66364$
- 5)  $\tau(3) = -1.91216$

#### Exercise 2

Compute the Gauss curvature for  $X(u,v) =$

$\{v + \cos[u] + \sin[u], v - 2\cos[u] - \sin[u], v\}$  at the point  $(u,v) = (4, 1)$ .

- 1)  $K(4, 1) = 0$
- 2)  $K(4, 1) = -2.66364$
- 3)  $K(4, 1) = -4.66195$
- 4)  $K(4, 1) = -0.990264$
- 5)  $K(4, 1) = 4.11402$

## Further Mathematics - Degree in Engineering - 2024/2025

### 03-Differential Geometry-Computers exam for serial number: 68

#### Exercise 1

Compute the curvature for  $C(t) = \{t + \cos[t], -\cos[t] + \sin[t], 2t + \cos[t]\}$  at the point  $t=3$ .

- 1)  $k(3) = -5.75468$
- 2)  $k(3) = -6.98009$
- 3)  $k(3) = 0.147767$
- 4)  $k(3) = 3.97908$
- 5)  $k(3) = -8.16433$

#### Exercise 2

Compute the mean curvature for  $X(u,v) =$

$$\{\cos[u] (4 + 3 \cos[v]), -2 \cos[u] (4 + 3 \cos[v]) + (4 + 3 \cos[v]) \sin[u] - \sin[v], \\ \cos[u] (4 + 3 \cos[v]) + \sin[v]\} \text{ at the point } (u,v) = (0, 2).$$

- 1)  $H(0, 2) = -5.75468$
- 2)  $H(0, 2) = -2.4333$
- 3)  $H(0, 2) = -0.0335211$
- 4)  $H(0, 2) = -4.94264$
- 5)  $H(0, 2) = -4.65504$

Further Mathematics - Degree in Engineering - 2024/2025  
 03-Differential Geometry-Computers exam for serial number: 69

### Exercise 1

Compute the torsion for  $C(t) =$

$\{-\cos[t] + 2\sin[t], -\cos[t] + \sin[t], 2t - 2\cos[t]\}$  at the point  $t=5$ .

- 1)  $\tau(5) = 1.4308$
- 2)  $\tau(5) = 6.40145$
- 3)  $\tau(5) = 3.82241$
- 4)  $\tau(5) = 2.43803$
- 5)  $\tau(5) = 8.4729$

### Exercise 2

Compute the mean curvature for  $X(u,v) =$

$\{-v + 3v\cos[u] - v\sin[u], 2v - 14v\cos[u] + 5v\sin[u], -v + 6v\cos[u] - 2v\sin[u]\}$   
 at the point  $(u,v) = (1, 6)$ .

- 1)  $H(1, 6) = 0.000362621$
- 2)  $H(1, 6) = 7.62261$
- 3)  $H(1, 6) = 3.12625$
- 4)  $H(1, 6) = 6.78557$
- 5)  $H(1, 6) = 2.43803$

## Further Mathematics - Degree in Engineering - 2024/2025

### 03-Differential Geometry-Computers exam for serial number: 70

#### Exercise 1

Compute the curvature for  $C(t) = \{4 \cos[t], -8 \cos[t] + 4 \sin[t], -8 \cos[t]\}$  at the point  $t=0$ .

- 1)  $k(0) = 2.88601$
- 2)  $k(0) = -6.33319$
- 3)  $k(0) = 7.89475$
- 4)  $k(0) = 0.559017$
- 5)  $k(0) = 7.46086$

#### Exercise 2

Compute the mean curvature for  $X(u,v) =$

$$\left\{ (1 + 2v^2) \cos[u], 2v - (1 + 2v^2) \cos[u] + (1 + 2v^2) \sin[u], v + (1 + 2v^2) \cos[u] \right\}$$

at the point  $(u,v) = (5, -8)$ .

- 1)  $H(5, -8) = 3.14508$
- 2)  $H(5, -8) = 6.81922$
- 3)  $H(5, -8) = 7.89475$
- 4)  $H(5, -8) = 0.0000241027$
- 5)  $H(5, -8) = 2.88601$

Further Mathematics - Degree in Engineering - 2024/2025  
03-Differential Geometry-Computers exam for serial number: 71

### Exercise 1

Compute the curvature for  $C(t) = \{\cos[t] - \sin[t], t + \sin[t], t\}$  at the point  $t=0$ .

- 1)  $k(0) = 0.152145$
- 2)  $k(0) = 5.33919$
- 3)  $k(0) = 2.24661$
- 4)  $k(0) = -2.27109$
- 5)  $k(0) = 2.40582$

### Exercise 2

Compute the mean curvature for  $X(u,v) =$

$\{u(5 - 10v) - 2(9 + 7v), -63 + u(16 - 35v) - 48v, -9 + u(2 - 5v) - 7v\}$   
at the point  $(u,v) = (8, 6)$ .

- 1)  $H(8, 6) = -0.0367499$
- 2)  $H(8, 6) = 2.38519$
- 3)  $H(8, 6) = 1.29617$
- 4)  $H(8, 6) = -2.27109$
- 5)  $H(8, 6) = -4.96509$

## Further Mathematics - Degree in Engineering - 2024/2025

### 03-Differential Geometry-Computers exam for serial number: 72

#### Exercise 1

Compute the curvature for  $C(t) = \{3 \cos[t], 8 \sin[t], 3 \cos[t] - 12 \sin[t]\}$  at the point  $t = 4$ .

- 1)  $k(4) = 1.85494$
- 2)  $k(4) = -3.9804$
- 3)  $k(4) = 0.0316153$
- 4)  $k(4) = 8.39658$
- 5)  $k(4) = 6.77368$

#### Exercise 2

Compute the mean curvature for  $X(u,v) = \{\cos[u] (2 + \cos[v]) + 4 (2 + \cos[v]) \sin[u] - 2 \sin[v], 3 (2 + \cos[v]) \sin[u] - \sin[v], -5 (2 + \cos[v]) \sin[u] + 2 \sin[v]\}$  at the point  $(u,v) = (1, 2)$ .

- 1)  $H(1, 2) = 5.44508$
- 2)  $H(1, 2) = 2.92841$
- 3)  $H(1, 2) = 0.0537985$
- 4)  $H(1, 2) = 8.76183$
- 5)  $H(1, 2) = 4.20306$

## Further Mathematics - Degree in Engineering - 2024/2025

### 03-Differential Geometry-Computers exam for serial number: 73

#### Exercise 1

Compute the curvature for  $C(t) =$

$\{\cos[t], -6t + 3\cos[t] - 2\sin[t], 2t + \sin[t]\}$  at the point  $t=0$ .

1)  $k(0) = -5.77545$

2)  $k(0) = 4.45802$

3)  $k(0) = -3.82142$

4)  $k(0) = 3.96875$

5)  $k(0) = 0.0198965$

#### Exercise 2

Compute the mean curvature for  $X(u,v) =$

$\{v\cos[u], -2v\cos[u] + v\sin[u], v\}$  at the point  $(u,v) = (0, 8)$ .

1)  $H(0, 8) = -5.77545$

2)  $H(0, 8) = 4.45802$

3)  $H(0, 8) = -3.82142$

4)  $H(0, 8) = 3.96875$

5)  $H(0, 8) = 0.132583$

## Further Mathematics - Degree in Engineering - 2024/2025

### 03-Differential Geometry-Computers exam for serial number: 74

#### Exercise 1

Compute the torsion for  $C(t) = \{-2t + 3(2 - 5t - 2t^2) - 4(-5 + 6t + 8t^2), -5 + 6t + 8t^2, 2 - 6t - 2t^2 - 2(-5 + 6t + 8t^2)\}$  at the point  $t = 3$ .

1)  $\tau(3) = -6.85951$

2)  $\tau(3) = 1.65208$

3)  $\tau(3) = 0$

4)  $\tau(3) = -5.33549$

5)  $\tau(3) = 8.06878$

#### Exercise 2

Compute the mean curvature for  $X(u,v) = \{-6 + 2u^2 + 5u(-1 + v) - v - 4v^2, v, 6 - 2u^2 + u(6 - 5v) + 3v + 4v^2\}$  at the point  $(u,v) = (-6, -3)$ .

1)  $H(-6, -3) = -8.83812$

2)  $H(-6, -3) = 4.34686$

3)  $H(-6, -3) = -0.01774$

4)  $H(-6, -3) = -7.56882$

5)  $H(-6, -3) = 1.56421$

## Further Mathematics - Degree in Engineering - 2024/2025 03-Differential Geometry-Computers exam for serial number: 75

### Exercise 1

Compute the torsion for  $C(t) =$

$\{3t + 2\cos[t] - 3\sin[t], \sin[t], 3t + \cos[t] - \sin[t]\}$  at the point  $t=6$ .

- 1)  $\tau(6) = 8.04637$
- 2)  $\tau(6) = -8.16362$
- 3)  $\tau(6) = 0.0708967$
- 4)  $\tau(6) = -4.58704$
- 5)  $\tau(6) = -4.90635$

### Exercise 2

Compute the mean curvature for  $X(u,v) =$

$\{u(4-3v) - v(2+9v), v, u(5-3v) - v(2+9v)\}$  at the point  $(u,v) = (9, -8)$ .

- 1)  $H(9, -8) = -4.02761$
- 2)  $H(9, -8) = 4.45537$
- 3)  $H(9, -8) = 0.0027851$
- 4)  $H(9, -8) = -4.90635$
- 5)  $H(9, -8) = 8.65709$

## Further Mathematics - Degree in Engineering - 2024/2025

### 03-Differential Geometry-Computers exam for serial number: 76

#### Exercise 1

Compute the torsion for  $C(t) =$

$\{2 \cos[t], \cos[t] + 2 \sin[t], 2 \cos[t] + 2 \sin[t]\}$  at the point  $t=4$ .

- 1)  $\tau(4) = 0$
- 2)  $\tau(4) = 6.59039$
- 3)  $\tau(4) = 5.24968$
- 4)  $\tau(4) = -4.72764$
- 5)  $\tau(4) = -2.88594$

#### Exercise 2

Compute the mean curvature for  $X(u,v) =$

$\{2 \cos[u] (4 + 2 \cos[v]) + \sin[v], -2 \cos[u] (4 + 2 \cos[v]) + (4 + 2 \cos[v]) \sin[u] + \sin[v],$   
 $5 \cos[u] (4 + 2 \cos[v]) - 2 (4 + 2 \cos[v]) \sin[u] - \sin[v]\}$  at the point  $(u,v) = (4, 2)$ .

- 1)  $H(4, 2) = 0.2492$
- 2)  $H(4, 2) = 7.47025$
- 3)  $H(4, 2) = 2.41325$
- 4)  $H(4, 2) = 5.70737$
- 5)  $H(4, 2) = -0.367754$

Further Mathematics - Degree in Engineering - 2024/2025  
03-Differential Geometry-Computers exam for serial number: 77

### Exercise 1

Compute the curvature for  $C(t) = \{4 \cos[t], 4 \cos[t] + \sin[t], 0\}$  at the point  $t=2$ .

- 1)  $k(2) = 0.0247646$
- 2)  $k(2) = 4.86596$
- 3)  $k(2) = 6.69299$
- 4)  $k(2) = -2.49392$
- 5)  $k(2) = -4.64131$

### Exercise 2

Compute the Gauss curvature for  $X(u,v) =$

$\{\cos[u], -3v + \cos[u] + \sin[u], -2v + \cos[u] + \sin[u]\}$  at the point  $(u,v) = (4, -5)$ .

- 1)  $K(4, -5) = 0$
- 2)  $K(4, -5) = 4.86596$
- 3)  $K(4, -5) = 6.69299$
- 4)  $K(4, -5) = -2.49392$
- 5)  $K(4, -5) = -4.64131$

## Further Mathematics - Degree in Engineering - 2024/2025

### 03-Differential Geometry-Computers exam for serial number: 78

#### Exercise 1

Compute the curvature for  $C(t) =$

$\{2 \cos[t] + 2 \sin[t], -2 \cos[t], -2 \cos[t] - 2 \sin[t]\}$  at the point  $t = 6$ .

- 1)  $k(6) = -8.41966$
- 2)  $k(6) = 7.5803$
- 3)  $k(6) = 0.126406$
- 4)  $k(6) = -2.90513$
- 5)  $k(6) = -6.68376$

#### Exercise 2

Compute the Gauss curvature for  $X(u,v) =$

$\{v \cos[u] - v \sin[u], 2v \cos[u] - v \sin[u], v + v \cos[u] - v \sin[u]\}$  at the point  $(u,v) = (3, 2)$ .

- 1)  $K(3, 2) = -6.68376$
- 2)  $K(3, 2) = -4.56082$
- 3)  $K(3, 2) = 0$
- 4)  $K(3, 2) = -2.52568$
- 5)  $K(3, 2) = 7.5803$

Further Mathematics - Degree in Engineering - 2024/2025  
03-Differential Geometry-Computers exam for serial number: 79

### Exercise 1

Compute the torsion for  $C(t) =$

$\{\cos[t], -t - \cos[t] - \sin[t], t + \cos[t] + 2\sin[t]\}$  at the point  $t=3$ .

1)  $\tau(3) = 0.568864$

2)  $\tau(3) = 8.29017$

3)  $\tau(3) = 3.98899$

4)  $\tau(3) = -4.55433$

5)  $\tau(3) = 2.81299$

### Exercise 2

Compute the Gauss curvature for  $X(u,v) =$

$\{(1+v^2)\cos[u] + 2(1+v^2)\sin[u], -v + 2(1+v^2)\sin[u], v - 2(1+v^2)\cos[u] - 5(1+v^2)\sin[u]\}$   
at the point  $(u,v) = (1, 8)$ .

1)  $K(1, 8) = -1.05866 \times 10^{-9}$

2)  $K(1, 8) = -4.9659$

3)  $K(1, 8) = 6.30026$

4)  $K(1, 8) = 2.81299$

5)  $K(1, 8) = -3.42129$

## Further Mathematics - Degree in Engineering - 2024/2025

### 03-Differential Geometry-Computers exam for serial number: 80

#### Exercise 1

Compute the curvature for  $C(t) = \{4 - t + t^2 - 2(6 - 8t^2), 2t - 4(6 - 8t^2) + 3(4 - 2t + t^2), -t + 3(6 - 8t^2) - 3(4 - 2t + t^2)\}$  at the point  $t=0$ .

- 1)  $k(0) = 4.21245$
- 2)  $k(0) = 6.92643$
- 3)  $k(0) = 3.41545$
- 4)  $k(0) = 0.694822$
- 5)  $k(0) = 7.27348$

#### Exercise 2

Compute the Gauss curvature for  $X(u,v) = \{\cos[u](3 + \cos[v]) + 6(3 + \cos[v])\sin[u] + 3\sin[v], \cos[u](3 + \cos[v]) + 5(3 + \cos[v])\sin[u] + 2\sin[v], 2(3 + \cos[v])\sin[u] + \sin[v]\}$  at the point  $(u,v) = (3, 2)$ .

- 1)  $K(3, 2) = -3.80537$
- 2)  $K(3, 2) = 2.07495$
- 3)  $K(3, 2) = 6.90372$
- 4)  $K(3, 2) = -0.000867861$
- 5)  $K(3, 2) = 5.44666$

Further Mathematics - Degree in Engineering - 2024/2025  
03-Differential Geometry-Computers exam for serial number: 81

### Exercise 1

Compute the torsion for  $C(t) =$

$\{3 \cos[t], -3 \cos[t] + 4 \sin[t], -6 \cos[t] + 4 \sin[t]\}$  at the point  $t=0$ .

- 1)  $\tau(0) = -2.39303$
- 2)  $\tau(0) = 0.987065$
- 3)  $\tau(0) = 0$
- 4)  $\tau(0) = 4.63573$
- 5)  $\tau(0) = -0.858705$

### Exercise 2

Compute the Gauss curvature for  $X(u,v) =$

$\{u, 3 + 4u^2 + u(3 - 6v) - 5v + 6v^2, u + v\}$  at the point  $(u,v) = (-4, -3)$ .

- 1)  $K(-4, -3) = 0.987065$
- 2)  $K(-4, -3) = -3.62977$
- 3)  $K(-4, -3) = 0.000564568$
- 4)  $K(-4, -3) = -7.33159$
- 5)  $K(-4, -3) = -6.68462$

## Further Mathematics - Degree in Engineering - 2024/2025

### 03-Differential Geometry-Computers exam for serial number: 82

#### Exercise 1

Compute the curvature for  $C(t) =$

$$\{t + 2(-9 + t - 9t^2), -9 + t - 9t^2, 8 + 9t + 4t^2 + 3(-9 + t - 9t^2)\} \text{ at the point } t=1.$$

1)  $k(1) = 0.00266613$

2)  $k(1) = 4.16743$

3)  $k(1) = 1.75382$

4)  $k(1) = -4.16926$

5)  $k(1) = -2.80022$

#### Exercise 2

Compute the Gauss curvature for  $X(u,v) =$

$$\{-v + v \cos[u] - v \sin[u], -v + v \sin[u], v\} \text{ at the point } (u,v) = (2, 6).$$

1)  $K(2, 6) = 0$

2)  $K(2, 6) = -4.16926$

3)  $K(2, 6) = 4.96589$

4)  $K(2, 6) = 1.07624$

5)  $K(2, 6) = 5.63609$

Further Mathematics - Degree in Engineering - 2024/2025  
 03-Differential Geometry-Computers exam for serial number: 83

### Exercise 1

Compute the curvature for  $C(t) =$

$\{-t + 2(1 + 8t - 2t^2) + 6(2 - t + 5t^2), 1 + 7t - 2t^2 + 2(2 - t + 5t^2), 2 - t + 5t^2\}$  at the point  $t = 0$ .

- 1)  $k(0) = -0.696479$
- 2)  $k(0) = 7.82922$
- 3)  $k(0) = -1.19443$
- 4)  $k(0) = 0.176067$
- 5)  $k(0) = -5.11245$

### Exercise 2

Compute the mean curvature for  $X(u,v) =$

$\{2\cos[u] + \sin[u], \cos[u] + \sin[u], v - 2\cos[u]\}$  at the point  $(u,v) = (3, 0)$ .

- 1)  $H(3, 0) = -5.11245$
- 2)  $H(3, 0) = -0.696479$
- 3)  $H(3, 0) = 8.35577$
- 4)  $H(3, 0) = 0.10135$
- 5)  $H(3, 0) = -1.19443$

## Further Mathematics - Degree in Engineering - 2024/2025

### 03-Differential Geometry-Computers exam for serial number: 84

#### Exercise 1

Compute the curvature for  $C(t) =$

$\{\cos[t], -2t + 2\cos[t] + \sin[t], -t + 4\cos[t] + \sin[t]\}$  at the point  $t = 5$ .

- 1)  $k(5) = 8.04821$
- 2)  $k(5) = 0.043201$
- 3)  $k(5) = -8.84339$
- 4)  $k(5) = 3.7831$
- 5)  $k(5) = 7.78362$

#### Exercise 2

Compute the mean curvature for  $X(u,v) =$

$\{v\cos[u], v\cos[u] + v\sin[u], v - 2v\cos[u] + v\sin[u]\}$  at the point  $(u,v) = (0, 1)$ .

- 1)  $H(0, 1) = 2.67677$
- 2)  $H(0, 1) = 0.102062$
- 3)  $H(0, 1) = 4.17951$
- 4)  $H(0, 1) = 8.01365$
- 5)  $H(0, 1) = -2.6052$

Further Mathematics - Degree in Engineering - 2024/2025  
 03-Differential Geometry-Computers exam for serial number: 85

### Exercise 1

Compute the curvature for  $C(t) =$

$\{2t + 5 \cos[t] + 5 \sin[t], 2t + 4 \cos[t] + 5 \sin[t], t + 2 \cos[t] + 2 \sin[t]\}$  at the point  $t=3$ .

1)  $k(3) = -5.08842$

2)  $k(3) = -8.51534$

3)  $k(3) = 0.025553$

4)  $k(3) = 6.82392$

5)  $k(3) = -1.09906$

### Exercise 2

Compute the Gauss curvature for  $X(u,v) =$

$\{4v + 17v \cos[u] + 2v \sin[u], 2v + 8v \cos[u] + v \sin[u], v + 4v \cos[u]\}$

at the point  $(u,v) = (4, 9)$ .

1)  $K(4, 9) = -1.82034$

2)  $K(4, 9) = 2.25881$

3)  $K(4, 9) = 0$

4)  $K(4, 9) = -8.5088$

5)  $K(4, 9) = -1.09906$

## Further Mathematics - Degree in Engineering - 2024/2025

### 03-Differential Geometry-Computers exam for serial number: 86

#### Exercise 1

Compute the curvature for  $C(t) =$

$\{4t + \cos[t], -8t - 2\cos[t] + \sin[t], -6t - 2\cos[t]\}$  at the point  $t=0$ .

- 1)  $k(0) = -2.80487$
- 2)  $k(0) = 6.89535$
- 3)  $k(0) = 0.00295556$
- 4)  $k(0) = -8.24916$
- 5)  $k(0) = -4.49357$

#### Exercise 2

Compute the mean curvature for  $X(u,v) =$

$\{\cos[u] (4 + 3\cos[v]) + 2(4 + 3\cos[v]) \sin[u], (4 + 3\cos[v]) \sin[u],$   
 $-2\cos[u] (4 + 3\cos[v]) - 6(4 + 3\cos[v]) \sin[u] + \sin[v]\}$  at the point  $(u,v) = (0, 5)$ .

- 1)  $H(0, 5) = 7.01742$
- 2)  $H(0, 5) = 8.88172$
- 3)  $H(0, 5) = 0.0906372$
- 4)  $H(0, 5) = 4.99715$
- 5)  $H(0, 5) = 5.1041$

Further Mathematics - Degree in Engineering - 2024/2025  
03-Differential Geometry-Computers exam for serial number: 87

### Exercise 1

Compute the curvature for  $C(t) =$

$\{-9 \cos[t] + 8 \sin[t], -6 \cos[t] + 4 \sin[t], 3 \cos[t] - 4 \sin[t]\}$  at the point  $t=0$ .

- 1)  $k(0) = 8.77035$
- 2)  $k(0) = 0.0220971$
- 3)  $k(0) = -0.995307$
- 4)  $k(0) = 4.235$
- 5)  $k(0) = -0.735276$

### Exercise 2

Compute the mean curvature for  $X(u,v) =$

$\{-2v - \cos[u] - \sin[u], 2 \cos[u] + \sin[u], v + 2 \cos[u] + \sin[u]\}$  at the point  $(u,v) = (4, 1)$ .

- 1)  $H(4, 1) = 8.77035$
- 2)  $H(4, 1) = 0.157664$
- 3)  $H(4, 1) = 8.68019$
- 4)  $H(4, 1) = -6.78374$
- 5)  $H(4, 1) = 1.33552$

## Further Mathematics - Degree in Engineering - 2024/2025

### 03-Differential Geometry-Computers exam for serial number: 88

#### Exercise 1

Compute the curvature for  $C(t) = \{t - 2(-9 - 5t + 6t^2), 5 - 6t - 4t^2, -9 - 5t + 6t^2\}$  at the point  $t = 5$ .

- 1)  $k(5) = -1.12464$
- 2)  $k(5) = 3.03018$
- 3)  $k(5) = -8.79778$
- 4)  $k(5) = -5.96075$
- 5)  $k(5) = 0.000116127$

#### Exercise 2

Compute the mean curvature for  $X(u,v) = \{v, -v \cos[u] + v \sin[u], v - v \cos[u]\}$  at the point  $(u,v) = (2, 2)$ .

- 1)  $H(2, 2) = -2.02021$
- 2)  $H(2, 2) = 7.70681$
- 3)  $H(2, 2) = -5.96075$
- 4)  $H(2, 2) = -3.30098$
- 5)  $H(2, 2) = 0.778914$

Further Mathematics - Degree in Engineering - 2024/2025  
03-Differential Geometry-Computers exam for serial number: 89

### Exercise 1

Compute the curvature for  $C(t) =$

$\{\cos[t] - 4\sin[t], \cos[t] + 2\sin[t], -4\sin[t]\}$  at the point  $t = 5$ .

- 1)  $k(5) = 7.31094$
- 2)  $k(5) = -2.33612$
- 3)  $k(5) = -7.83683$
- 4)  $k(5) = -7.99212$
- 5)  $k(5) = 1.18364$

### Exercise 2

Compute the mean curvature for  $X(u,v) =$

$\{v\cos[u], v - v\sin[u], v - 2v\sin[u]\}$  at the point  $(u,v) = (6, 7)$ .

- 1)  $H(6, 7) = -7.83683$
- 2)  $H(6, 7) = 5.70694$
- 3)  $H(6, 7) = 7.35099$
- 4)  $H(6, 7) = -4.59197$
- 5)  $H(6, 7) = 0.0165018$

## Further Mathematics - Degree in Engineering - 2024/2025

### 03-Differential Geometry-Computers exam for serial number: 90

#### Exercise 1

Compute the torsion for  $C(t) = \{\cos[t], 3t + 2\cos[t] + \sin[t], 3t\}$  at the point  $t=0$ .

- 1)  $\tau(0) = 1.80689$
- 2)  $\tau(0) = -7.21398$
- 3)  $\tau(0) = 0.0491803$
- 4)  $\tau(0) = 1.17088$
- 5)  $\tau(0) = 4.62885$

#### Exercise 2

Compute the Gauss curvature for  $X(u,v) =$

$\{u + v, -2u - v, -6 - 9u^2 - v - 2v^2 + 2u(-7 + 2v)\}$  at the point  $(u,v) = (-3, 4)$ .

- 1)  $K(-3, 4) = 4.62885$
- 2)  $K(-3, 4) = 7.82768$
- 3)  $K(-3, 4) = 1.36943 \times 10^{-7}$
- 4)  $K(-3, 4) = -8.5432$
- 5)  $K(-3, 4) = 1.80689$

Further Mathematics - Degree in Engineering - 2024/2025  
03-Differential Geometry-Computers exam for serial number: 91

### Exercise 1

Compute the curvature for  $C(t) = \{\cos[t], \sin[t], t - \cos[t]\}$  at the point  $t=5$ .

- 1)  $k(5) = 8.5$
- 2)  $k(5) = -4.52193$
- 3)  $k(5) = 1.03764$
- 4)  $k(5) = 6.19165$
- 5)  $k(5) = 5.90342$

### Exercise 2

Compute the Gauss curvature for  $X(u,v) =$

$\{\cos[u] (4 + \cos[v]) - (4 + \cos[v]) \sin[u] + 4 \sin[v], (4 + \cos[v]) \sin[u],$   
 $\cos[u] (4 + \cos[v]) - (4 + \cos[v]) \sin[u] + 5 \sin[v]\}$  at the point  $(u,v) = (1, 4)$ .

- 1)  $K(1, 4) = 0.896207$
- 2)  $K(1, 4) = -4.52193$
- 3)  $K(1, 4) = -0.0381071$
- 4)  $K(1, 4) = 4.71397$
- 5)  $K(1, 4) = 8.5$

## Further Mathematics - Degree in Engineering - 2024/2025

### 03-Differential Geometry-Computers exam for serial number: 92

#### Exercise 1

Compute the torsion for  $C(t) =$

$\{\cos[t], -2\cos[t] + \sin[t], 2t + 2\cos[t] - 2\sin[t]\}$  at the point  $t=1$ .

1)  $\tau(1) = 0.480658$

2)  $\tau(1) = -2.35501$

3)  $\tau(1) = 1.02939$

4)  $\tau(1) = -0.931452$

5)  $\tau(1) = 8.87494$

#### Exercise 2

Compute the mean curvature for  $X(u,v) =$

$\{14 + 10u^2 - 19v + 14v^2 + u(17 + 12v), -14 - 10u^2 + 19v - 14v^2 - 4u(4 + 3v), 7 + 5u^2 - 9v + 7v^2 + u(9 + 6v)\}$  at the point  $(u,v) = (1, -9)$ .

1)  $H(1, -9) = -0.0131318$

2)  $H(1, -9) = 5.00139$

3)  $H(1, -9) = 2.53429$

4)  $H(1, -9) = -0.749251$

5)  $H(1, -9) = 4.40529$

Further Mathematics - Degree in Engineering - 2024/2025  
03-Differential Geometry-Computers exam for serial number: 93

### Exercise 1

Compute the torsion for  $C(t) =$

$\{12 \cos[t] + 20 \sin[t], 4 \sin[t], 8 \cos[t] + 12 \sin[t]\}$  at the point  $t = 5$ .

- 1)  $\tau(5) = -5.67349$
- 2)  $\tau(5) = 6.5787$
- 3)  $\tau(5) = 4.62992$
- 4)  $\tau(5) = 1.70237$
- 5)  $\tau(5) = 0$

### Exercise 2

Compute the mean curvature for  $X(u,v) = \{\cos[u] (4 + 3 \cos[v]) + 2 (4 + 3 \cos[v]) \sin[u],$   
 $3 \cos[u] (4 + 3 \cos[v]) + 5 (4 + 3 \cos[v]) \sin[u] + \sin[v],$   
 $3 \cos[u] (4 + 3 \cos[v]) + 4 (4 + 3 \cos[v]) \sin[u] + \sin[v]\}$  at the point  $(u,v) = (3, 6)$ .

- 1)  $H(3, 6) = -4.84619$
- 2)  $H(3, 6) = -5.67349$
- 3)  $H(3, 6) = 6.58401$
- 4)  $H(3, 6) = -7.01431$
- 5)  $H(3, 6) = 9.83426$

## Further Mathematics - Degree in Engineering - 2024/2025

### 03-Differential Geometry-Computers exam for serial number: 94

#### Exercise 1

Compute the torsion for  $C(t) =$

$\{3t + 2\cos[t], \sin[t], 6t + 3\cos[t] - 2\sin[t]\}$  at the point  $t = 3$ .

- 1)  $\tau(3) = 6.02523$
- 2)  $\tau(3) = -2.56669$
- 3)  $\tau(3) = 0.0672394$
- 4)  $\tau(3) = 6.76297$
- 5)  $\tau(3) = -4.95991$

#### Exercise 2

Compute the mean curvature for  $X(u,v) =$

$\{-2v - \cos[u], -v + \cos[u] + \sin[u], v + \cos[u]\}$  at the point  $(u,v) = (4, 1)$ .

- 1)  $H(4, 1) = 0.044245$
- 2)  $H(4, 1) = -2.94599$
- 3)  $H(4, 1) = 0.894917$
- 4)  $H(4, 1) = -2.56669$
- 5)  $H(4, 1) = -4.95991$

Further Mathematics - Degree in Engineering - 2024/2025  
03-Differential Geometry-Computers exam for serial number: 95

### Exercise 1

Compute the torsion for  $C(t) = \{3t + 2(t + t^2), 3 + 6t - 4t^2, 3 + 8t - 3t^2\}$  at the point  $t = 2$ .

- 1)  $\tau(2) = -4.57821$
- 2)  $\tau(2) = 0$
- 3)  $\tau(2) = 6.31436$
- 4)  $\tau(2) = 4.92171$
- 5)  $\tau(2) = 7.92354$

### Exercise 2

Compute the mean curvature for  $X(u,v) =$

$\{v + 2v \cos[u], v + v \sin[u], v + v \cos[u]\}$  at the point  $(u,v) = (6, -2)$ .

- 1)  $H(6, -2) = 6.31436$
- 2)  $H(6, -2) = 0.126242$
- 3)  $H(6, -2) = -6.70727$
- 4)  $H(6, -2) = 3.46747$
- 5)  $H(6, -2) = 7.61788$

## Further Mathematics - Degree in Engineering - 2024/2025

### 03-Differential Geometry-Computers exam for serial number: 96

#### Exercise 1

Compute the torsion for  $C(t) = \{4 \cos[t] + 12 \sin[t], 4 \sin[t], 0\}$  at the point  $t=6$ .

- 1)  $\tau(6) = 0$
- 2)  $\tau(6) = 2.81549$
- 3)  $\tau(6) = -8.89472$
- 4)  $\tau(6) = 2.05805$
- 5)  $\tau(6) = 5.22446$

#### Exercise 2

Compute the mean curvature for  $X(u,v) = \{u - v, v, -9 - 7u^2 + u(10 - 3v) + 8v - 9v^2\}$  at the point  $(u,v) = (4, -9)$ .

- 1)  $H(4, -9) = 0.0677286$
- 2)  $H(4, -9) = -3.28355$
- 3)  $H(4, -9) = -5.90108$
- 4)  $H(4, -9) = 2.42649$
- 5)  $H(4, -9) = 5.22446$

## Further Mathematics - Degree in Engineering - 2024/2025

### 03-Differential Geometry-Computers exam for serial number: 97

#### Exercise 1

Compute the curvature for  $C(t) = \{t, -5 - 5t + 5t^2, 9 - 3t^2\}$  at the point  $t=10$ .

- 1)  $k(10) = -2.86761$
- 2)  $k(10) = 0.0000226872$
- 3)  $k(10) = -1.9805$
- 4)  $k(10) = -3.44923$
- 5)  $k(10) = 8.39704$

#### Exercise 2

Compute the mean curvature for  $X(u,v) =$

$\{-2 \cos[u] (4 + 3 \cos[v]) - (4 + 3 \cos[v]) \sin[u], \cos[u] (4 + 3 \cos[v]), \sin[v]\}$   
at the point  $(u,v) = (0, 4)$ .

- 1)  $H(0, 4) = 4.39811$
- 2)  $H(0, 4) = -0.20469$
- 3)  $H(0, 4) = 2.90208$
- 4)  $H(0, 4) = -2.86761$
- 5)  $H(0, 4) = -2.47197$

## Further Mathematics - Degree in Engineering - 2024/2025

### 03-Differential Geometry-Computers exam for serial number: 98

#### Exercise 1

Compute the curvature for  $C(t) =$

$$\{-\cos[t] - 2\sin[t], \cos[t] + \sin[t], t - \cos[t] - 4\sin[t]\} \text{ at the point } t=1.$$

1)  $k(1) = -1.06554$

2)  $k(1) = 0.86953$

3)  $k(1) = 2.80102$

4)  $k(1) = 15.3116$

5)  $k(1) = -4.56933$

#### Exercise 2

Compute the Gauss curvature for  $X(u,v) =$

$$\{8 - 33u - 24u^2 + 10v - 8v^2, -2 + 9u + 6u^2 - 2v + 2v^2, 2 - 8u - 6u^2 + 3v - 2v^2\}$$

at the point  $(u,v) = (-8, 0)$ .

1)  $K(-8, 0) = 8.34699$

2)  $K(-8, 0) = -1.55968$

3)  $K(-8, 0) = -5.74926$

4)  $K(-8, 0) = 1.123 \times 10^{-8}$

5)  $K(-8, 0) = 1.41864$

Further Mathematics - Degree in Engineering - 2024/2025  
03-Differential Geometry-Computers exam for serial number: 99

### Exercise 1

Compute the curvature for  $C(t) = \{5 + 4t + 5t^2, -5 - 3t - 5t^2, 2 + 2t - 5t^2\}$  at the point  $t=4$ .

- 1)  $k(4) = 4.3782$
- 2)  $k(4) = 0.000208242$
- 3)  $k(4) = -6.36843$
- 4)  $k(4) = -3.0347$
- 5)  $k(4) = -8.61069$

### Exercise 2

Compute the Gauss curvature for  $X(u,v) =$

$\{3v + v \cos[u] - 2v \sin[u], -3v + v \sin[u], v\}$  at the point  $(u,v) = (4, -2)$ .

- 1)  $K(4, -2) = 1.23598$
- 2)  $K(4, -2) = 0$
- 3)  $K(4, -2) = -8.1474$
- 4)  $K(4, -2) = 2.35821$
- 5)  $K(4, -2) = -3.37049$

## Further Mathematics - Degree in Engineering - 2024/2025

### 03-Differential Geometry-Computers exam for serial number: 100

#### Exercise 1

Compute the torsion for  $C(t) = \{t + 2(-8 - 6t - 4t^2) - 2(-6 + t + 9t^2), -6 + 9t^2, -8 - 4t - 4t^2 - 3(-6 + t + 9t^2)\}$  at the point  $t=8$ .

- 1)  $\tau(8) = 3.02548$
- 2)  $\tau(8) = 0$
- 3)  $\tau(8) = -0.900468$
- 4)  $\tau(8) = 8.87739$
- 5)  $\tau(8) = -3.77665$

#### Exercise 2

Compute the Gauss curvature for  $X(u,v) = \{2v + 5v \cos[u], -v - 2v \cos[u], v - v \cos[u] + v \sin[u]\}$  at the point  $(u,v) = (0, 10)$ .

- 1)  $K(0, 10) = -0.900468$
- 2)  $K(0, 10) = 0$
- 3)  $K(0, 10) = 4.16021$
- 4)  $K(0, 10) = 6.63148$
- 5)  $K(0, 10) = 7.11874$