# 1 Forms HW

**Exercise 1** *Consider the following* 1*-form in* $\mathbb{R}^2$*:*

$$\omega = x^2 e^y \, dy.$$

*Compute and simplify* $d\omega$*.*

**Exercise 2** *Consider the following* 1*-form in* $\mathbb{R}^2$*:*

$$\omega = 3xy \, dx + \cos x \, dy.$$

*Compute and simplify* $d\omega$*.*

**Exercise 3** *Consider the following* 1*-form in* $\mathbb{R}^3$*:*

$$\omega = xe^y \, dx + 5y^2 \sin z \, dy + 7xz \, dz.$$

*Compute and simplify* $d\omega$*.*

**Exercise 4** *Consider the following* 1*-form in* $\mathbb{R}^3$*:*

$$\omega = x^2 \, dy - 3y \, dz.$$

*Compute and simplify* $d\omega$*.*

**Exercise 5** *Consider the following* 2*-form in* $\mathbb{R}^3$*:*

$$\omega = xyz^2 \, dy \wedge dz + 2 \sin x \cos y \, dz \wedge dx + ye^z \, dx \wedge dy.$$

*Compute and simplify* $d\omega$*.*

**Exercise 6** *Consider the following* 1*-form in* $\mathbb{R}^2$*:*

$$\omega = 2x \, dx + \cos y \, dy.$$

*Let* $C \subset \mathbb{R}^2$ *be the straight line from* $(-1, 0)$ *to* $(3, \pi/2)$*. Compute*

$$\int_C \omega \, d\gamma.$$

**Exercise 7** *Consider the following* 1*-form in* $\mathbb{R}^3$*:*

$$\omega = e^x \, dx + \cos z \, dz.$$

*Let* $C \subset \mathbb{R}^3$ *be the portion of the circle* $z = \sqrt{1 - x^2}$ *in the plane* $y = 0$ *from* $(1, 0, 0)$ *to* $(0, 0, 1)$*. Compute*

$$\int_C \omega \, d\gamma.$$

**Exercise 8** *Consider the following 2-form in* $\mathbb{R}^3$*:*

$$\omega = e^x\, dy \wedge dz + (5 - y)\, dz \wedge dx + x^3 \cos y\, dx \wedge dy.$$

*Let* $\Sigma \subset \mathbb{R}^3$ *be the square with vertices* $(0, 0, 0)$, $(1, 0, 0)$, $(1, 0, 1)$, $(0, 0, 1)$, *oriented towards the* $y$*-axis. Compute*

$$\iint_\Sigma \omega\, dS.$$