TD4: Electromagnetism

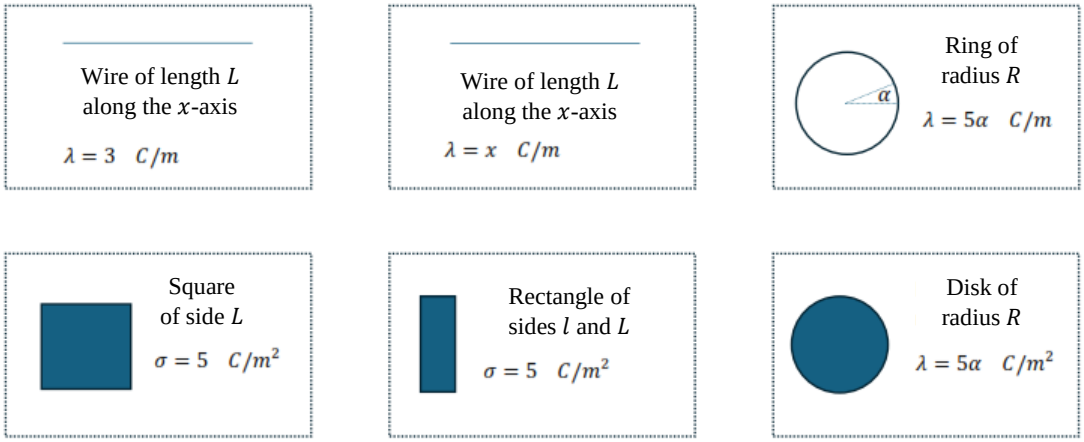
Continuous electric charge distributions

Exercise 1: Integration elements

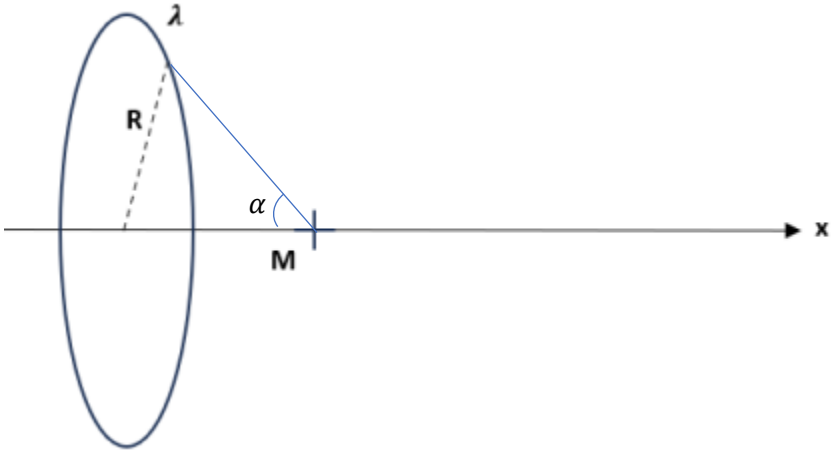
1. In 1D, write the infinitesimal length element dl in the case of (a) a straight line, and (b) a ring of radius R. Justify your answer with a diagram.
2. In 2D, write the infinitesimal surface element dS in the case of (a) a square, and (b) a disk. Justify your answer with a diagram.

Exercise 2: Calculation of total charge

1. Give the expression for the total electric charge of
   a. a wire with linear charge density λ, and
   b. a disk with surface charge density σ.
2. Calculate the total electric charge in the following cases



Exercise 3 (optional): Charge distribution on a ring



We are interested in the electrostatic field $\vec{E}$ created at a point M at distance x from the origin, on the perpendicular axis of symmetry of a circle of radius R that is uniformly charged with a linear charge distribution λ.

1. Use the symmetries of the charge distribution to determine the direction of the field $\vec{E}$.
2. Use Coulomb's law and a vector projection to express the infinitesimal field created at point M by a random point P on the circle.
3. Integrate this quantity to obtain the norm of the total field $\vec{E}$ and then give its vector form.
4. Calculate the potential at point M.
5. How can you check that your result is reasonable?