# FYS100 Fysikk
# Obligatorisk Indlevering I

To be handed in at the latest **Friday 4. September, at 18.00**. You must hand it in by scanning your handwritten solution into a single .pdf file, and uploading it to It's learning in "Indlevering 1". If you have written the solution as a electronic document (and not by hand), convert this to .pdf and upload

**Good luck!**

**Problem 1: Significant digits**

Perform the following calculations, rounding off in the appropriate way:
a) $10.1 + 623.45$.

b) $7 \times 0.243$.

c) $(0.1 - 10.3 + 5.132)/12.8$.

d) $\cos(1.0)$.

**Problem 2: Dimensional Analysis**

a) Given a height $h$, a mass $m$ and the gravitational acceleration $g$, construct by dimensional analysis an energy for the system.

b) Given a mass $m$ and the speed of light $c$, construct an energy for the system.

c) Given the Newton constant $G$, the speed of light $c$ and the Planck constant $h$, construct an energy of the system.

**Problem 3: Vectors, part I**

Consider the 4 position vectors is two dimensions (in some $x, y$ coordinate system)

$$\vec{\mathbf{P}}_1 = (3, 4), \quad \vec{\mathbf{P}}_2 = (1, -6), \quad \vec{\mathbf{P}}_3 = (-3, -5), \quad \vec{\mathbf{P}}_4 = (-7, 0). \tag{1}$$

a) Find the polar form $(r, \theta)$ of each of the 4 vectors $\vec{\mathbf{P}}_{1,2,3,4}$.

b) Find the Cartesian and Polar representations of $\vec{\mathbf{P}}_1 + \vec{\mathbf{P}}_2$, $\vec{\mathbf{P}}_3 + \vec{\mathbf{P}}_4$ and $\vec{\mathbf{P}}_1 + \vec{\mathbf{P}}_2 - \vec{\mathbf{P}}_3 - \vec{\mathbf{P}}_4$.

c) Using the scalar product, find the relative angle between $\vec{\mathbf{P}}_1$ and $\vec{\mathbf{P}}_3$; and between $\vec{\mathbf{P}}_2$ and $\vec{\mathbf{P}}_4$.

## Problem 4: Vectors, part II

Three vectors are given in coordinate form by:

$$\vec{\mathbf{A}} = (1, 2, 3), \qquad \vec{\mathbf{B}} = (-3, -1, 4), \qquad \vec{\mathbf{C}} = (2, 5, 0) \tag{2}$$

a) What is the average of these three vectors?

b) What is the angle of each of them with the x-axis?

c) What is the projection of $\vec{\mathbf{A}}$ on $\vec{\mathbf{B}}$? Of $\vec{\mathbf{A}}$ on $\vec{\mathbf{C}}$?

d) Show explicitly that $\vec{\mathbf{A}} \times (\vec{\mathbf{B}} + \vec{\mathbf{C}}) = \vec{\mathbf{A}} \times \vec{\mathbf{B}} + \vec{\mathbf{A}} \times \vec{\mathbf{C}}$. What is the length of the resulting vector?

## Problem 5: Trigonometry

Consider a triangle of sides 6, 8 and 9 m (exact).

a) What are the angles of the triangle?

b) What is its area?