Høsten 2019

FYS100 Fysikk: Hand-in I

To be handed in at the latest **Friday 23. August 2019, at 23.59**.
You **must** hand it in by scanning your handwritten solution or compiling your electronic documents into **a single .pdf** file, and uploading it to Canvas in "Hand-in 1". Bad mobile phone pictures are not acceptable (there are apps that work OK), nor are any other file formats than a single .pdf.

You **must**:

- Put your name and student number on each page.
- Make sketches for all problems, where it makes sense.
- Write in a readable, well-structured way.

Pass is 40% correct (including partial credit). There is no grade. There is **no option** to correct and resubmit.

Good luck!

Problem 1: Significant figures (1.36 from the book)

How many significant figures are there in the following numbers?

a) 78.9 ± 0.2 **Solution:** 3

b) 3.788×10^9 **Solution:** 4

c) 2.46×10^{-6} **Solution:** 3

c) 0.0053 **Solution:** 2

One mark for each part.

Problem 2: Conversion of Units

An aircraft on final approach to Stavanger Airport arrives over Hafrsfjord roughly 5.1 kilometres from the end of the runway (directly west from the UiS campus).

a) If the aircraft maintains a true groundspeed of 150 knots, how long in seconds does it take for the aircraft to reach the runway? (One knot equals one nautical mile per hour. One nautical mile equals 1852 metres.) **Solution:** True groundspeed = $150 * 1852/3600 = 77.167$ m/s, time taken = distance/speed = $5100/77.167 = 66.1$s which is 66s to 2 significant figures.

b) If the aircraft has an altitude of 600 feet when it arrives over Hafsfjord, what angle does its flight-path make with the ground as it flies down to the runway? (One foot equals 0.3048 metres.) **Solution:** Altitude = $600*0.3048 = 182.88$m. Angle = $\arctan(182.88/5100) = 2.05$ degrees, or 2.1 degrees to 2 significant figures (0.036 radians).

Two marks for each part.

Problem 3: Vectors

A particle in an 3-dimensional x-y-z coordinate system has a velocity vector with components $(5\sin\theta, 5\cos\theta, 12)$, where $\theta = 3t$.

a) What are the components of the velocity vector at the time $t = 0s$? **Solution:** (0, 5, 12)

b) What is the magnitude of the velocity at the time $t = 0s$? **Solution:** $\sqrt{0^2 + 5^2 + 12^2} = 13$m/s

c) What is the magnitude of the velocity at the time $t = 7s$? What is the change in the velocity magnitude? **Solution:** $\sqrt{5^2(\sin^2\theta + \cos^2\theta) + 12^2} = 13$m/s. No change in magnitude.

d) Find the components of the acceleration of the particle. **Solution:** Differentiate vector components with respect to t. $(15\cos\theta, -15\sin\theta, 0)$

e) What are the components of the acceleration vector at the time $t = 0s$? **Solution:** $(15, 0, 0)$ Although the magnitude of the velocity is constant, the acceleration is non-zero.

f) What is the magnitude of the acceleration? **Solution:** 15ms^{-2}.

g) Describe in words the motion of the particle. **Solution:** The motion is a helix, centered around the origin in the $x - y$ plane, turning clockwise and going upwards in the z direction.

One mark for each part

Total marks $4 + 4 + 7 = 15$**. 6 marks needed for pass.**