

Høsten 2016

# FYS100 Fysikk

## Problems week 34

First some problems from the book:

- 1.9, 1.12
- 3.23, 3.36

**Additional Problem 1:** Find all the solutions for  $\theta$  to the following equations, expressed in both radians and degrees. Draw the solutions on a unit circle:

- $\cos \theta = 1.$
- $\sin \theta = 0.4.$
- $\tan \theta = -2.$
- $\cos \theta + \sin \theta = 0.$
- $\cos \theta + 3 \sin \theta = 0.$

**Additional Problem 2:** Consider a right triangle with sides  $a$  and  $b$ , and hypotenuse  $c$ . Expressed in  $a, b, c$ , what is:

- The sine, cosine and tangent of the angle opposite  $a$ ?
- The sine, cosine and tangent of the angle opposite  $b$ ?
- The sine, cosine and tangent of the angle opposite  $c$ ?

**Additional Problem 3:** How many significant digits and decimals are there in the following numbers:

- 1
- 0.12
- 0.0034

d) 117.8

e)  $\pi$

**Additional Problem 4:** Assume that you have measured two quantities  $a = 0.4$  and  $b = 0.2$  with an error of  $\Delta a = 0.1$  and  $\Delta b = 0.03$ , respectively. Here are some functions  $f(a, b)$  of  $a$  and  $b$ :

a)  $f(a, b) =: a + b; a - b; a/b; b/a; ab.$

b)  $f(a, b) =: a^2; a^3; a^2b.$

c)  $f(a, b) =: \log(a)$

Compute their value, and compute an estimate for the error in three ways:

1. Computing "worst case scenarios" (the extreme cases, where the errors on the input are the largest possible). Then use as the estimated error half the difference between the largest and smallest possible values of the output.
2. Computing (you may want to compare this with B.8 of the book)

$$\Delta f(a, b) = \frac{df}{da} \Delta a + \frac{df}{db} \Delta b. \quad (1)$$

3. Computing

$$\Delta f(a, b) = \sqrt{\left(\frac{df}{da} \Delta a\right)^2 + \left(\frac{df}{db} \Delta b\right)^2}. \quad (2)$$