

# Homework 3

## Geometrical methods in theoretical physics HT-15

Here we assume that we are dealing with a principal bundle with a connection  $A$  and  $F$  is its field strength.

1. If the connection is defined by the following expression

$$A = g^{-1}dg$$

then show that  $F = 0$

2. If the connection transforms as

$$A \rightarrow g^{-1}Ag + g^{-1}dg$$

show that  $F$  transforms as follows

$$F \rightarrow g^{-1}Fg .$$

3. Consider the four form defined as follows

$$\text{Tr}(F \wedge F) .$$

Show that this form is closed and locally it can be written as

$$\text{Tr}(F \wedge F) = dK .$$

Derive the form of  $K$ .

**to be handed in before 5 p.m., January 15, 2016**