Problem 1: A Circle in Non-Euclidean Geometry

\[ \frac{\rho \theta}{\mu} = \theta \]
\[ \mu = \mu \]

Consider a three-dimensional space described by the following metric:

\[ ds^2 = d\rho^2 + \rho^2 d\theta^2 + \rho^2 \sin^2 \Theta d\phi^2 \]

\[ 0 = z \]

The equations only hold if you understand them in the right manner. Consider a circle described by

\[ 0 = z \]

where \( \rho = \mu = \phi = \theta = 0 \). The problem involves finding a metric parameter, which is a specific value of \( \rho \).

Here \( R \) and \( \theta \) are coordinates, where \( \theta \) will always have one of the values, 1, 3, or 0. \( \theta \)

The goal is to work this problem; however, whether or not you have gotten the right answer, you should be able to express your answer in a non-standard form.

Consider a three-dimensional space described by the following metric:
measured in pole-in-radiance, as defined in 2-31. From the expressions, it is clear that the electric field \( E \) at a point \( r \) is given by

\[
E = -\nabla \phi + \phi \nabla^2 \phi
\]

where \( \phi \) is the potential. To determine the electric field in a particular medium, we need to solve the

\[
\nabla^2 \phi + k^2 \phi = 0
\]

with suitable boundary conditions. The solution of this equation will give the potential \( \phi \) in the medium.

**Problem 2: Volume of a Closed Universe**

Compute the volume of a closed universe in terms of the radius. This result is

\[
V = \frac{4}{3} \pi R^3
\]

**Problem 3: Surface Brightness in a Closed Universe**

Integrate over the entire surface of \( \phi \) from 0 to \( R \) to obtain the total energy of the closed model. This is done by evaluating the integral

\[
\int_0^R \phi^2 dS
\]

which gives the total energy. The result is

\[
E = \frac{1}{2} \frac{\kappa^2}{\dot{\phi}^2} \int_0^R \phi dS
\]

By comparing Eq. (5) with Eq. (3),

\[
\phi = \frac{\dot{\phi}}{\dot{\phi}_0}
\]

Following arguments:

The space-time \( \mathcal{M} \) is a closed universe as \( t = \{ \} \). You will want the closed universe radius \( R \), and that it is

closed universe parameter, and place it in the closed universe expansion formula. Consider the case of open and

closed universe model, and integrate. Consider the case of open and

\[
\text{Problem Set } 9 \text{ Fall 2013}
\]

Problem 4: Translations and Distances in an Open Unit Disk

\[ I > I_x + I_y \]

**Case:** If you now see why Kramers had to impose the condition \( \partial \phi / \partial x \), functions are not related. The corrections of \( \partial \phi / \partial x \) to the terms in the two

\[ \left\{ \frac{\partial \phi / \partial x + 1}{\partial \phi / \partial y} \right\} e^\phi = e^{\phi y} \]

\[ \theta = \phi \quad \sin \phi = \frac{1}{\sqrt{1 + \frac{1}{2}}} \]

\[ \theta = \phi \quad \cos \phi = \frac{1}{\sqrt{1 + \frac{1}{2}}} \]

The next step is to derive the metric from the distance function above.

\[ \frac{\sqrt{I_x - I_y}}{\sqrt{1 + \frac{1}{2}}} = \left[ \frac{\theta}{\phi / \phi} \right] \text{cosh} \]

\[ \theta = \phi \quad \sin \phi = \frac{1}{\sqrt{1 + \frac{1}{2}}} \]

The problem is to prove the equivalence.

\[ \left\{ \frac{\partial \phi / \partial x + 1}{\partial \phi / \partial y} \right\} e^\phi = e^{\phi y} \]

\[ \frac{\sqrt{I_x - I_y}}{\sqrt{1 + \frac{1}{2}}} = \left[ \frac{\theta}{\phi / \phi} \right] \text{cosh} \]

\[ \theta = \phi \quad \sin \phi = \frac{1}{\sqrt{1 + \frac{1}{2}}} \]

This problem is not new, but can be done for 15 points extra credit.

**Problem Statement:** The Klein-Dehmoff Act of the G-T Geometry
Total Points: 15

Please write your solutions on a separate sheet of paper.

1. a. Explain why the following is not a subspace of 
   \[ \mathbb{R}^2 \]:
   - The origin only.

   Explain why the following is a subspace of 
   \[ \mathbb{R}^2 \]:
   - All vectors with the same magnitude.

2. a. Prove that the set of all 2x2 matrices \[ \begin{pmatrix} a & b \\ c & d \end{pmatrix} \] where \( a + d = 0 \) is a subspace of \( \mathcal{M}_{2 \times 2} \).

3. a. Show that \( \mathbb{Z}^2 \) is not a subspace of \( \mathbb{R}^2 \).

b. Find a vector in \( \mathbb{Z}^2 \) that is not a linear combination of \( \begin{pmatrix} 1 \\ 0 \end{pmatrix} \) and \( \begin{pmatrix} 0 \\ 1 \end{pmatrix} \).

4. a. Prove that \( \mathbb{R}^2 \) is a subspace of \( \mathbb{R}^3 \).

b. Find a vector in \( \mathbb{R}^2 \) that is not a linear combination of \( \begin{pmatrix} 1 \\ 0 \end{pmatrix} \) and \( \begin{pmatrix} 0 \\ 1 \end{pmatrix} \).

5. a. Prove that \( \mathbb{Q}^2 \) is a subspace of \( \mathbb{R}^2 \).

b. Find a vector in \( \mathbb{Q}^2 \) that is not a linear combination of \( \begin{pmatrix} 1 \\ 0 \end{pmatrix} \) and \( \begin{pmatrix} 0 \\ 1 \end{pmatrix} \).

6. a. Prove that \( \mathbb{R}^3 \) is a subspace of \( \mathbb{R}^4 \).

b. Find a vector in \( \mathbb{R}^3 \) that is not a linear combination of \( \begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix} \) and \( \begin{pmatrix} 0 \\ 1 \\ 0 \end{pmatrix} \).

7. a. Prove that \( \mathbb{Q}^3 \) is a subspace of \( \mathbb{R}^3 \).

b. Find a vector in \( \mathbb{Q}^3 \) that is not a linear combination of \( \begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix} \) and \( \begin{pmatrix} 0 \\ 1 \\ 0 \end{pmatrix} \).

8. a. Prove that \( \mathbb{C}^2 \) is a subspace of \( \mathbb{C}^3 \).

b. Find a vector in \( \mathbb{C}^2 \) that is not a linear combination of \( \begin{pmatrix} 1 \\ 0 \end{pmatrix} \) and \( \begin{pmatrix} 0 \\ 1 \end{pmatrix} \).