

PHYS 410 Homework # 8

6.1. On a spherical surface, the longitude and latitude lines are orthogonal.



For a small change in position, we have the change in longitude and latitude:

$$ds_{\phi} = R \cdot d\theta, \quad ds_{\lambda} = R \sin\theta \cdot d\phi$$

$$\Rightarrow ds = \sqrt{ds_{\phi}^2 + ds_{\lambda}^2} = R \cdot d\theta \sqrt{1 + \sin^2\theta \frac{d\phi^2}{d\theta^2}}$$

$$\Rightarrow L = \int_{\theta_1}^{\theta_2} ds = R \int_{\theta_1}^{\theta_2} \sqrt{1 + \sin^2\theta \frac{d\phi^2}{d\theta^2}} \cdot d\theta$$

6.3



$$L(P, Q) = \sqrt{x_1^2 + y_1^2 + z_1^2} + \sqrt{x_2^2 + y_2^2 + z_2^2}$$

$$\Rightarrow T = L/c$$

According to Fermat's principle, we get:

$$\frac{\delta T}{\delta x} = 0, \quad \frac{\delta T}{\delta y} = 0.$$

$$\frac{\delta T}{\delta z} = 0 \Rightarrow 2 \cdot \left(\frac{1}{\sqrt{x_1^2 + y_1^2 + z_1^2}} + \frac{1}{\sqrt{x_2^2 + y_2^2 + z_2^2}} \right) = 0 \Rightarrow z = 0 \quad (1)$$

$$\frac{\delta T}{\delta x} = 0 \Rightarrow \frac{x_1}{\sqrt{x_1^2 + y_1^2 + z_1^2}} + \frac{x_2}{\sqrt{x_2^2 + y_2^2 + z_2^2}} = 0 \quad (2)$$



According to (1), when $z=0$, we get from (2):

$$\sin\theta_1 = \sin\theta_2$$

$$\Rightarrow \theta_1 = \theta_2$$

6.5



According to General Geometric relation, we know $\angle APB = \frac{\theta}{2}$.

$$\text{And } \alpha = \frac{\theta - \theta}{2}$$

$$\Rightarrow AP = AB \cdot \sin(\frac{\theta}{2} - \alpha) = AB \cos \frac{\alpha}{2} = AB \sin \frac{\theta}{2} = 2R \sin \frac{\theta}{2}$$

$$BP = AB \cdot \sin \alpha = 2R \cdot \cos \frac{\theta}{2}$$

$$\Rightarrow APB = 2R \cdot (\sin \frac{\theta}{2} + \cos \frac{\theta}{2}) = 2\sqrt{2} \sin(\frac{\theta}{2} + \frac{\pi}{4}) R$$

$$\Rightarrow (APB)_{max} = 2\sqrt{2} R \text{ when } \theta = \frac{\pi}{2}, \text{ which is the real path.}$$

6.7

(2.4.2)



In cylinder coordinates, when R is const, the infinitesimal change in position corresponds to

$$ds = \sqrt{R^2 d\phi^2 + dz^2} = dz \sqrt{1 + R^2 \frac{d\phi^2}{dz^2}} = f(\phi, z) dz$$

$$\Rightarrow L = \int_{\phi_1}^{\phi_2} ds = \int_{z_1}^{z_2} f(\phi, z) dz$$

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For Classical Mechanics And Electrodynamics (Second Edition). Jon Magne Leinaas, 2025 **Cognitive Structures in Scientific Inquiry**, 2016-08-01 This book is the second of two volumes devoted to the work of Theo Kuipers a leading Dutch philosopher of science Philosophers and scientists from all over the world thirty seven in all comment on Kuipers philosophy and each of their commentaries is followed by a reply from Kuipers The present volume is devoted to Kuipers neo classical philosophy of science as laid down in his Structures in Science Kluwer 2001 Kuipers defends a dialectical interaction between science and philosophy in that he views philosophy of science as a meta science which formulates cognitive structures that provide heuristic patterns for actual scientific research including design research In addition Kuipers pays considerable attention to the computational approaches to philosophy of science as well as to the ethics of doing research Thomas Nickles David Atkinson Jean Paul van Bendegem Maarten Franssen Anne Ruth Mackor Arno Wouters Erik Weber Helena de Preester Eric Scerri Adam Grobler Andrzej Wisniewski Alexander van den Bosch Gerard Vreeswijk Jaap Kamps Paul Thagard Emma Ruttkamp Robert Causey Henk Zandvoort comment on these ideas of Kuipers and many present their own account The present book also contains a synopsis of Structures in Science It can be read independently of the first volume of Essays in Debate with Theo Kuipers which is devoted to Kuipers From Instrumentalism to Constructive Realism 2000 Introduction To Classical Mechanics: Solutions To Problems John Dirk Walecka, 2020-08-24 The textbook

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 Research and Education Association,1995

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Collected Papers on Wave Mechanics Erwin Schrödinger, 1928

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