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[General Relativity Without Calculus] offers a compact but mathematically correct introduction to the general theory of relativity, assuming only a basic knowledge of high school mathematics and physics. Targeted at first year undergraduates (and advanced high school students) who wish to learn Einstein[s theory beyond popular science ...

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General Relativity Without Calculus: A Concise Introduction to the Geometry of Relativity (Undergraduate Lecture Notes in Physics) 2011th Edition, Kindle Edition. by Jose Natario (Author) Format: Kindle Edition. 5.0 out of 5 stars 1 rating. Part of: Undergraduate Lecture Notes in Physics (100 Books)

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General Relativity Without Calculus - A Concise Introduction to the Geometry of Relativity | Jose Natario | Springer. Undergraduate Lecture Notes in Physics. Provides a quite original approach to Relativity, in that it tries to convey nontrivial, quantitative ideas about geometry and general relativity using elementary mathematics only.

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General Relativity Without Calculus 13 interpret them): (t$= $ t$ vx c2. x$= $(x $vt) where c represents the speed of light (about 300,000 kilometers per second) and $ = 1 q 1 $v2. c2. The special theory of relativity, developed by Einstein in 1905, boils down to analyzing the consequences of these transformations.

GeneralRelativityWithoutCalculus

A researcher in optical networking technologies, Gannett has shown that the Lorentz transformations and velocity addition law can be derived without assuming the constancy of the speed of light,...

Relativity Derived Without Calculus -- Possibly Centuries Ago

General Relativity, at its core, is a mathematical model that describes the relationship between events in space-time; the basic finding of the theory is that the relationship between events in the same as the relationship between points on a manifold with curvature, and the geometry of that manifold is determined by sources of energy-momentum and their distribution in space-time.

The Maths of General Relativity - Markus Hanke

First general relativity is typically taught at a 4th year undergraduate level or sometimes even a graduate level, obviously this presumes a good undergraduate training in mathematics and physics. Personally, I'm more of the opinion that one should go and learn other physics before tackling general relativity.

What are the prerequisites to studying general relativity?

ometry and general relativity require mathematical entities of still higher rank. The tools of vector analysis are simply incapable of allowing one to write down the governing laws in an invariant form, and one has to adopt a different mathematics from the vector analysis taught in the freshman and

sophomore years. Tensor calculus is that ...

Tensor Calculus - SMU

Definition and basic properties. General relativity is a metric theory of gravitation. At its core are Einstein's equations, which describe the relation between the geometry of a four-dimensional pseudo-Riemannian manifold representing spacetime, and the energy–momentum contained in that spacetime.

General relativity - Wikipedia

'General Relativity Without Calculus' offers a compact but mathematically correct introduction to the general theory of relativity, assuming only a basic knowledge of high school mathematics and physics.

General Relativity Without Calculus - springer

1.14 Preview of general relativity 20 1.15 Caveats on the equivalence principle 22 1.16 Gravitational frequency shift and light bending 24 Exercises 1 27 I Special Relativity 31 2 Foundations of special relativity; The Lorentz transformation 33 2.1 On the nature of physical theories 33 2.2 Basic features of special relativity 34

Relativity - 202.38.64.11

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General relativity without calculus : a concise ...

In general relativity, Regge calculus is a formalism for producing simplicial approximations of spacetimes that are solutions to the Einstein field equation. The calculus was introduced by the Italian theoretician Tullio Regge in 1961. Overview. The starting point for Regge's work ...

Regge calculus - Wikipedia

Manifolds Generally speaking, amanifoldis a space that with curvature and complicated topology that locallylooks like Rn. Examples: Rn itself. R is a line and R2 a plane. The n-sphere, Sn; that is, the locus of all points some fixed distance from the origin in Rn+ 1.S is a circle and S2 sphere. The n-torus Tn.T2 is the surface of a doughnut. A Riemann surface of genus g.

'General Relativity Without Calculus' offers a compact but mathematically correct introduction to the general theory of relativity, assuming only a basic knowledge of high school mathematics and physics. Targeted at first year undergraduates (and advanced high school students) who wish to learn Einstein's theory beyond popular science accounts, it covers the basics of special relativity, Minkowski space-time, non-Euclidean geometry, Newtonian gravity, the Schwarzschild solution, black holes and cosmology. The quick-paced style is balanced by over 75 exercises (including full solutions), allowing readers to test and consolidate their understanding.

This book is an introduction to the theories of Special and General Relativity. The target audience are physicists, engineers and applied scientists who are looking for an understandable introduction to the topic - without too much new mathematics. The fundamental equations of Einstein's theory of Special and General Relativity are derived using matrix calculus, without the help of tensors. This feature makes the book special and a valuable tool for scientists and engineers with no experience in the field of tensor calculus. In part I the foundations of Special Relativity are developed, part II describes the structure and principle of General Relativity. Part III explains the Schwarzschild solution of spherical body gravity and examines the "Black Hole" phenomenon. Any necessary mathematical tools are user friendly provided, either directly in the text or in the appendices.

Never HIGHLIGHT a Book Again! Virtually all of the testable terms, concepts, persons, places, and events from the textbook are included. Cram101 Just the FACTS101 studyguides give all of the outlines, highlights, notes, and quizzes for your textbook with optional online comprehensive practice tests. Only Cram101 is Textbook Specific. Accompanys: 9783642214516 .

Differential Forms and the Geometry of General Relativity provides readers with a coherent path to understanding relativity. Requiring little more than calculus and some linear algebra, it helps readers learn just enough differential geometry to grasp the basics of general relativity. The book contains two intertwined but distinct halves. Designed for advanced undergraduate or beginning graduate students in mathematics or physics, most of the text requires little more than familiarity with calculus and linear algebra. The first half presents an introduction to general relativity that describes some of the surprising implications of relativity without introducing more formalism than necessary. This nonstandard approach uses differential forms rather than tensor calculus and minimizes the use of "index gymnastics" as much as possible. The second half of the book takes a more detailed look at the mathematics of differential forms. It covers the theory behind the mathematics used in the first half by emphasizing a conceptual understanding instead of formal proofs. The book provides a language to describe curvature, the key geometric idea in general relativity.

This concise textbook introduces the reader to advanced mathematical aspects of general relativity, covering topics like Penrose diagrams, causality theory, singularity theorems, the Cauchy problem for the Einstein equations, the positive mass theorem, and the laws of black hole thermodynamics. It emerged from lecture notes originally conceived for a one-semester course in Mathematical Relativity which has been taught at the Instituto Superior Técnico (University of Lisbon, Portugal) since 2010 to Masters and Doctorate students in Mathematics and Physics. Mostly self-contained, and mathematically rigorous, this book can be appealing to graduate students in Mathematics or Physics seeking specialization in general relativity, geometry or partial differential equations. Prerequisites include proficiency in differential geometry and the basic principles of relativity. Readers who are familiar with special relativity and have taken a course either in Riemannian geometry (for students of Mathematics) or in general relativity (for those in Physics) can benefit from this book.

A straightforward, enjoyable guide to the mathematics of Einstein's relativity To really understand Einstein's theory of relativity □ one of the cornerstones of modern physics □ you have to get to grips with the underlying mathematics. This self-study guide is aimed at the general reader who is motivated to tackle that not insignificant challenge. With a user-friendly style, clear step-by-step mathematical derivations, many fully solved problems and numerous diagrams, this book provides a comprehensive introduction to a fascinating but complex subject. For those with minimal mathematical background, the first chapter gives a crash course in foundation mathematics. The reader is then taken gently by the hand and guided through a wide range of fundamental topics, including Newtonian mechanics; the Lorentz transformations; tensor calculus; the Einstein field equations; the Schwarzschild solution (which gives a good approximation of the spacetime of our Solar System); simple black holes, relativistic cosmology

and gravitational waves. Special relativity helps explain a huge range of non-gravitational physical phenomena and has some strangely counter-intuitive consequences. These include time dilation, length contraction, the relativity of simultaneity, mass-energy equivalence and an absolute speed limit. General relativity, the leading theory of gravity, is at the heart of our understanding of cosmology and black holes. "I must observe that the theory of relativity resembles a building consisting of two separate stories, the special theory and the general theory. The special theory, on which the general theory rests, applies to all physical phenomena with the exception of gravitation; the general theory provides the law of gravitation and its relations tothe other forces of nature." ⏤ Albert Einstein, 1919 Understand even the basics of Einstein's amazing theory and the world will never seem the same again. Contents: Preface Introduction 1 Foundation mathematics 2 Newtonian mechanics 3 Special relativity 4 Introducing the manifold 5 Scalars, vectors, one-forms and tensors 6 More on curvature 7 General relativity 8 The Newtonian limit 9 The Schwarzschild metric 10 Schwarzschild black holes 11 Cosmology 12 Gravitational waves Appendix: The Riemann curvature tensor Bibliography Acknowledgements January 2019. This third edition has been revised to make the material even more accessible to the enthusiastic general reader who seeks to understand the mathematics of relativity.

This book provides an introduction to the theory of relativity and the mathematics used in its processes. Three elements of the book make it stand apart from previously published books on the theory of relativity. First, the book starts at a lower mathematical level than standard books with tensor calculus of sufficient maturity to make it possible to give detailed calculations of relativistic predictions of practical experiments. Self-contained introductions are given, for example vector calculus, differential calculus and integrations. Second, in-between calculations have been included, making it possible for the non-technical reader to follow step-by-step calculations. Thirdly, the conceptual development is gradual and rigorous in order to provide the inexperienced reader with a philosophically satisfying understanding of the theory. The goal of this book is to provide the reader with a sound conceptual understanding of both the special and general theories of relativity, and gain an insight into how the mathematics of the theory can be utilized to calculate relativistic effects.

Carefully documenting the different formulations of general relativity, the author reveals valuable insight into the nature of the gravitational force and its interaction with matter. This book will interest graduate students and researchers in the fields of general relativity, gravitational physics and differential geometry.

Comprehensive coverage of special theory (frames of reference, Lorentz transformation, more), general theory (principle of equivalence, more) and unified theory (Weyl's gauge-invariant geometry, more.) Foreword by Albert Einstein.

Spacetime and Geometry is an introductory textbook on general relativity, specifically aimed at students. Using a lucid style, Carroll first covers the foundations of the theory and mathematical formalism, providing an approachable introduction to what can often be an intimidating subject. Three major applications of general relativity are then discussed: black holes, perturbation theory and gravitational waves, and cosmology. Students will learn the origin of how spacetime curves (the Einstein equation) and how matter moves through it (the geodesic equation). They will learn what black holes really are, how gravitational waves are generated and detected, and the modern view of the expansion of the universe. A brief introduction to quantum field theory in curved spacetime is also included. A student familiar with this book will be ready to tackle research-level problems in gravitational physics.

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