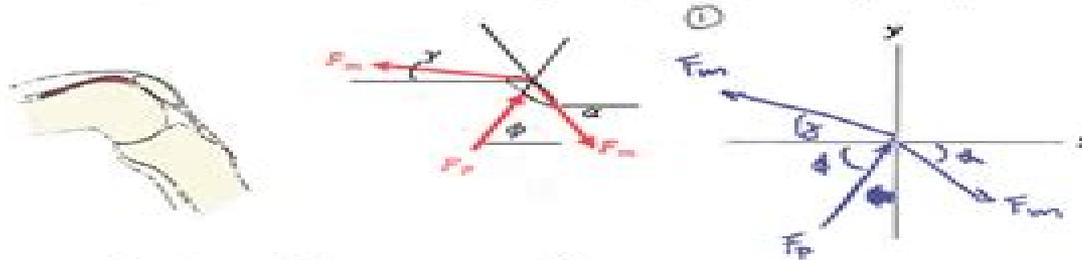


Problem 1:

As discussed in class, the patella helps to provide an additional moment arm to the quadriceps muscle to reduce the force necessary to extend the knee. Noting that the patella acts like a pulley, we can see that the muscle tension helps push the patella against the distal condyle of the femur. Using the knee diagrams below, complete the following:

1. Draw a FBD on the xy -axes assuming that the patellar compressive and muscle forces all intersect at the origin.
2. Write a set of force and moment balance equations describing the joint
3. Find expressions for the patellar contact angle, ϕ , and the patellar force F_p , as functions of muscle force magnitude and direction (F_m, γ, α).
4. How do you expect the patellar force to be different during a deep squat (high knee flexion angle) compared to standing? Justify your answer using the equations developed in (3).



$$\textcircled{2} \sum F_x = 0: -F_m \cos \gamma + F_p \cos \phi + F_m \cos \alpha = 0$$

$$F_p = \frac{F_m (\cos \gamma - \cos \alpha)}{\cos \phi}$$

$$\uparrow \sum F_y = 0: F_m \sin \gamma + F_p \sin \phi - F_m \sin \alpha = 0$$

$$\sum M = 0$$

$$\textcircled{3} \text{ FROM } \sum F_y \rightarrow \sin \phi = \frac{F_m (\sin \alpha - \sin \gamma)}{F_p} = \frac{\cos \phi (\sin \alpha - \sin \gamma)}{\cos \gamma - \cos \alpha}$$

$$\text{TAN } \phi = \frac{\sin \alpha - \sin \gamma}{\cos \gamma - \cos \alpha}$$

$$\phi = \text{TAN}^{-1} \left[\frac{\sin \alpha - \sin \gamma}{\cos \gamma - \cos \alpha} \right]$$

$\textcircled{4}$ AT HIGH FLEXION: α INCREASES } $F_p \approx \frac{1 - \cos \alpha}{\cos \phi} \rightarrow F_p \dots$
 $\gamma \approx \text{CONST, SMALL}$ } $F_m \cos \phi$ } INCREASES
 $\rightarrow \alpha \rightarrow 90^\circ \dots \rightarrow 45^\circ$ } F_m } DECREASES

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J Dewey



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Kinesiology of the Musculoskeletal System - E-Book Donald A. Neumann,2016-11-03 With its focus on the normal and abnormal mechanical interactions between the muscles and joints of the body Kinesiology of the Musculoskeletal System Foundations for Rehabilitation 3rd Edition provides a foundation for the practice of physical rehabilitation This comprehensive research based core text presents kinesiology as it relates to physical rehabilitation in a clinically relevant and accessible manner It provides students and clinicians with the language of human movement and acts as a bridge between basic science and clinical management Full color anatomic and kinesiological illustrations clearly demonstrate the anatomy functional movement and biomechanical principles underlying movement and dynamic new video clips help you interpret new concepts with visual demonstration More than 900 high quality illustrations provide you with the visual accompaniments you need to comprehend the material Clinical Connections boxes at the end of each chapter in Sections II through IV highlight or expand upon a particular clinical concept associated with the kinesiology covered in the chapter Special Focus boxes interspersed throughout the text provide numerous clinical examples that demonstrate why kinesiological information is needed Critical thinking questions challenge you to review or reinforce the main concepts contained within each chapter Evidence based approach emphasizes the importance of research in physical therapy decision making Evolve site for students comes with video clips answers to study questions and references linked to Medline Evolve site for instructors includes an image collection from the text teaching tips and lab activities NEW Kinesiology of Running chapter covers the biomechanics of running NEW Video clips help you interpret new concepts with visual demonstration NEW All new content on the pelvic floor NEW Thoroughly updated references emphasize the evidence based presentation of information in the text NEW QR codes linked to videos for easy viewing on mobile devices NEW Pageburst enhanced edition allows you to access multimedia content from the eBook without going to another website [Applied Mechanics Reviews](#),1974

EIT Industrial Review Donovan Young,2003-09-18 This guide is written for the afternoon FE EIT Industrial Exam and reviews each topic with numerous example problems and complete step by step solutions End of chapter problems with solutions and a complete sample exam with solutions are provided Topics covered Production Planning and Scheduling Engineering Economics Engineering Statistics Statistical Quality Control Manufacturing Processes Mathematical Optimization and Modeling Simulation Facility Design and Location Work Performance and Methods Manufacturing Systems Design Industrial Ergonomics Industrial Cost Analysis Material Handling System Design Total Quality Management Computer Computations and Modeling Queuing Theory and Modeling Design of Industrial Experiments Industrial Management Information System Design Productivity Measurement and Management 101 problems with complete solutions SI Units [Kinesiology](#) David Paul Greene,Susan L. Roberts,2005-01-01 Approaching the subject of kinesiology from the perspective of occupational therapy this unique text written by occupational therapists examines the everyday activities of

people using the principles of biomechanics to adapt to changes in their functional abilities This new edition stresses applicability to clinical practice with the inclusion of case examples In depth coverage of wrist and hand pathokinesiology as well as normal kinesiology function of the wrist and fingers Key terms chapter outlines and applications that enhance studying and learning 12 appendices and a glossary with metric conversions review of mathematics a diagram of body segment parameters and laboratory activities New material providing explanations of the pathokinesiology of shoulder subluxation rotator cuff tear adhesive capsulitis fractures tendon injuries and shoulder problems secondary to CVA More case studies and less emphasis on heavy calculations to ensure the concepts are more easily grasped Perforated lab manual filled with activities tied directly to the chapters Enhanced illustrations for easier visualization of the concepts demonstrated

An Introduction to Biomechanics Jay D. Humphrey, Sherry L. O'Rourke, 2016-10-18 This book covers the fundamentals of biomechanics Topics include bio solids biofluids stress balance and equilibrium Students are encouraged to contextualize principles and exercises within a big picture of biomechanics This is an ideal book for undergraduate students with interests in biomedical engineering **Engineering Mechanics** R. C. Hibbeler, 2010 Text and illustrations on lining papers

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Table of Contents Biomechanics Sample Problems And Solutions

1. Understanding the eBook Biomechanics Sample Problems And Solutions
 - The Rise of Digital Reading Biomechanics Sample Problems And Solutions
 - Advantages of eBooks Over Traditional Books
2. Identifying Biomechanics Sample Problems And Solutions
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Biomechanics Sample Problems And Solutions
 - User-Friendly Interface
4. Exploring eBook Recommendations from Biomechanics Sample Problems And Solutions
 - Personalized Recommendations
 - Biomechanics Sample Problems And Solutions User Reviews and Ratings
 - Biomechanics Sample Problems And Solutions and Bestseller Lists

5. Accessing Biomechanics Sample Problems And Solutions Free and Paid eBooks
 - Biomechanics Sample Problems And Solutions Public Domain eBooks
 - Biomechanics Sample Problems And Solutions eBook Subscription Services
 - Biomechanics Sample Problems And Solutions Budget-Friendly Options
6. Navigating Biomechanics Sample Problems And Solutions eBook Formats
 - ePub, PDF, MOBI, and More
 - Biomechanics Sample Problems And Solutions Compatibility with Devices
 - Biomechanics Sample Problems And Solutions Enhanced eBook Features
7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Biomechanics Sample Problems And Solutions
 - Highlighting and Note-Taking Biomechanics Sample Problems And Solutions
 - Interactive Elements Biomechanics Sample Problems And Solutions
8. Staying Engaged with Biomechanics Sample Problems And Solutions
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Biomechanics Sample Problems And Solutions
9. Balancing eBooks and Physical Books Biomechanics Sample Problems And Solutions
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Biomechanics Sample Problems And Solutions
10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
11. Cultivating a Reading Routine Biomechanics Sample Problems And Solutions
 - Setting Reading Goals Biomechanics Sample Problems And Solutions
 - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of Biomechanics Sample Problems And Solutions
 - Fact-Checking eBook Content of Biomechanics Sample Problems And Solutions
 - Distinguishing Credible Sources
13. Promoting Lifelong Learning

- Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
14. Embracing eBook Trends
- Integration of Multimedia Elements
 - Interactive and Gamified eBooks

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