

# GRIFFITHS ELECTRODYNAMICS SOLUTIONS

## KALMAN KNIZHNIK

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### Problem 2.1

a) Twelve equal charges,  $q$  are situated at the corners of a regular 12-sided polygon (for instance, one on each numeral of a clock face.) What is the net force on a test charge  $Q$  at the center?

The force on  $Q$  must be 0 by symmetry. The  $x$ ,  $y$ , and  $z$  components of the fields due to each charge cancel, so the force vanishes.

b) Suppose one of the 12  $q$ 's is removed (the one at "6 o'clock"). What is the force on  $Q$ ? Explain your reasoning carefully.

Now it is like 10 of the charges cancel, the only one that doesn't cancel being the one directly opposite the missing charge. Thus, the force is

$$F = \frac{1}{4\pi\epsilon_0} \frac{qQ}{r^2} \quad \square \quad (1)$$

pointing in the direction of the missing charge. Here,  $r$  is the distance from the center to each charge.

c) Now 13 equal charges,  $q$ , are placed at the corners of a regular 13-sided polygon. What is the force on a test charge  $Q$  at the center.

Again, by symmetry, the answer is still 0.

d) If one of the 13  $q$ 's is removed, what is the force on  $Q$ ? Explain your reasoning.

The same answer as in part b, equation 1, and for the same reason.

### Problem 2.2

a) Find the electric field (magnitude and direction) a distance  $z$  above the midpoint between two equal charges,  $q$ , a distance  $d$  apart. Check that your result is consistent with what you'd expect when  $z \gg d$ .

The force would not have components in the  $y$  or  $x$  direction, if we put the charges in the  $x - z$  plane, there is no  $y$ -component of the field at the point in question, and the  $x$ -components cancel. The  $z$ -component of the field is

$$\mathbf{E} = \frac{1}{4\pi\epsilon_0} \frac{2q}{z^2 + (d/2)^2} \sin(\theta) \hat{\mathbf{z}} = \frac{1}{4\pi\epsilon_0} \frac{2qz}{(z^2 + (d/2)^2)^{3/2}} \hat{\mathbf{z}} \quad \square \quad (2)$$

where the factor of 2 comes from adding up the two charges. When  $z \gg d$ , the electric field becomes

$$\mathbf{E} = \frac{1}{4\pi\epsilon_0} \frac{2q}{z^2} \hat{\mathbf{z}} \quad (3)$$

which is what you would expect, since the system acts like a point charge of charge  $2q$ .

b) Repeat part (a), only this time make the right hand charge  $-q$  instead of  $+q$ .

Now the  $z$ -components cancel and the  $x$ -components don't. Mathematically, this means replacing  $\sin(\theta)$  with  $\cos(\theta)$ .

$$\mathbf{E} = \frac{1}{4\pi\epsilon_0} \frac{2q}{z^2 + (d/2)^2} \cos(\theta) \hat{\mathbf{x}} = \frac{1}{4\pi\epsilon_0} \frac{qd}{(z^2 + (d/2)^2)^{3/2}} \hat{\mathbf{x}} \quad \square \quad (4)$$

where the 2 has canceled out with the  $d/2$  that comes from the cosine. If  $z \gg d$ , then from far away it looks like a dipole, and the field reduces to that of a dipole:

$$\mathbf{E} = \frac{1}{4\pi\epsilon_0} \frac{qd}{z^3} \hat{\mathbf{x}} \quad (5)$$

# Griffiths Electrodynamics Solutions Manual

**Susann Wagenknecht, Nancy J.  
Nersessian, Hanne Andersen**



## **Griffiths Electrodynamics Solutions Manual:**

Electrodynamics Carolina C. Ilie,Zachariah S. Schrecengost,2018-05-29 This book of problems and solutions is a natural continuation of Ilie and Schrecengost's first book Electromagnetism Problems and Solutions As with the first book this book is written for junior or senior undergraduate students and for graduate students who may have not studied electrodynamics yet and who may want to work on more problems and have an immediate feedback while studying This book of problems and solutions is a companion for the student who would like to work independently on more electrodynamics problems in order to deepen their understanding and problem solving skills and perhaps prepare for graduate school This book discusses main concepts and techniques related to Maxwell's equations conservation laws electromagnetic waves potentials and fields and radiation

**Empirical Philosophy of Science** Susann Wagenknecht,Nancy J. Nersessian,Hanne Andersen,2015-06-12 The book examines the emerging approach of using qualitative methods such as interviews and field observations in the philosophy of science Qualitative methods are gaining popularity among philosophers of science as more and more scholars are resorting to empirical work in their study of scientific practices At the same time the results produced through empirical work are quite different from those gained through the kind of introspective conceptual analysis more typical of philosophy This volume explores the benefits and challenges of an empirical philosophy of science and addresses questions such as What do philosophers gain from empirical work How can empirical research help to develop philosophical concepts How do we integrate philosophical frameworks and empirical research What constraints do we accept when choosing an empirical approach What constraints does a pronounced theoretical focus impose on empirical work Nine experts discuss their thoughts and empirical results in the chapters of this book with the aim of providing readers with an answer to these questions

*Penyelesaian Soal ON MIPA-PT* Abdurrouf,2014-12-01 Penulisan buku ini dilatarbelakangi oleh adanya kegiatan kompetisi tahunan untuk mahasiswa yang diselenggarakan oleh Kemendikbud berupa Olimpiade Nasional Bidang Matematika dan IPA tingkat Perguruan Tinggi atau ON MIPA PT Buku ini merupakan seri kedua dari 4 buku yang direncanakan untuk ditulis Buku ini merupakan kumpulan catatan dan analisis penulis terhadap kegiatan ON MIPA PT bidang Fisika untuk bidang uji Elektrodinamika dan dimaksudkan sebagai panduan dalam memberikan pedampingan bagi mahasiswa yang mau berkompetisi dalam ajang tersebut Bagian terbesar dari buku ini berisi contoh soal ON MIPA PT bidang uji elektrodinamika baik tingkat provinsi maupun nasional berikut referensi terkait Beberapa contoh soal diberikan padanannya dalam buku referensi Buku ini juga menyajikan pembahasan soal elektrodinamika Tidak ada klaim akan kebenaran penyelesaian yang diberikan Sekalipun demikian diharapkan jawaban yang ada mampu menginspirasi mahasiswa dan diharapkan bermanfaat bagi mereka yang ingin mempersiapkan diri untuk ajang tersebut

American Journal of Physics ,2000 *Electromagnetism* Carolina C Ilie,Zachariah S Schrecengost,2016-11-01 Electromagnetism Problems and solutions is an ideal companion book for the undergraduate student sophomore junior or senior who may want to work on

more problems and receive immediate feedback while studying Each chapter contains brief theoretical notes followed by the problem text with the solution and ends with a brief bibliography Also presented are problems more general in nature which may be a bit more challenging      AAPT Announcer American Association of Physics Teachers,1981      **Classical Electromagnetic Radiation, Third Edition** Mark A. Heald,Jerry B. Marion,2013-04-22 This newly corrected highly acclaimed text offers intermediate level juniors and first year graduate students of physics a rigorous treatment of classical electromagnetics The authors present a very accessible macroscopic view of classical electromagnetics that emphasizes integrating electromagnetic theory with physical optics The survey follows the historical development of physics culminating in the use of four vector relativity to fully integrate electricity with magnetism Starting with a brief review of static electricity and magnetism the treatment advances to examinations of multipole fields the equations of Laplace and Poisson dynamic electromagnetism electromagnetic waves reflection and refraction and waveguides Subsequent chapters explore retarded potentials and fields and radiation by charged particles antennas classical electron theory interference and coherence scalar diffraction theory and the Fraunhofer limit Fresnel diffraction and the transition to geometrical optics and relativistic electrodynamics A basic knowledge of vector calculus and Fourier analysis is assumed and several helpful appendices supplement the text An extensive Solutions Manual is also available      Classical Electromagnetic Radiation Mark A. Heald,Jerry B. Marion,2012-12-19 Newly corrected this highly acclaimed text is suitable for advanced physics courses The authors present a very accessible macroscopic view of classical electromagnetics that emphasizes integrating electromagnetic theory with physical optics The survey follows the historical development of physics culminating in the use of four vector relativity to fully integrate electricity with magnetism Corrected and emended reprint of the Brooks Cole Thomson Learning 1994 third edition      *The Bookseller* ,1981      **Books in Print Supplement** ,2002      **Scientific and Technical Books and Serials in Print** ,1984      **British Books in Print** ,1985      **Whitaker's Cumulative Book List** ,1986      **The Publishers' Trade List Annual** ,1985      **Books in Print** ,1991      Introduction to Electrodynamics David J. Griffiths,2017-06-29 This well known undergraduate electrodynamics textbook is now available in a more affordable printing from Cambridge University Press The Fourth Edition provides a rigorous yet clear and accessible treatment of the fundamentals of electromagnetic theory and offers a sound platform for explorations of related applications AC circuits antennas transmission lines plasmas optics and more Written keeping in mind the conceptual hurdles typically faced by undergraduate students this textbook illustrates the theoretical steps with well chosen examples and careful illustrations It balances text and equations allowing the physics to shine through without compromising the rigour of the math and includes numerous problems varying from straightforward to elaborate so that students can be assigned some problems to build their confidence and others to stretch their minds A Solutions Manual is available to instructors teaching from the book access can be requested from the resources section at [www.cambridge.org/electrodynamics](http://www.cambridge.org/electrodynamics)      **Forthcoming Books** Rose

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