

# Elementary Analysis: The Theory of Calculus by Ross Exercise Solutions

Khang Tong

## Chapter 1: The Set $\mathbb{N}$ of Natural Numbers

1. Prove  $1^2 + 2^2 + \cdots + n^2 = \frac{1}{6}n(n+1)(2n+1)$  for all positive integers  $n$ .

*Solution:*

Base Case:  $1 = \frac{1}{6}(1)(2)(3) = 1$  ✓

Inductive Step: Assume that  $1^2 + 2^2 + \cdots + n^2 = \frac{1}{6}n(n+1)(2n+1)$  is true for some  $n \in \mathbb{N}$ . Then,

$$\begin{aligned}1^2 + 2^2 + \cdots + n^2 + (n+1)^2 &= \frac{1}{6}n(n+1)(2n+1) + (n+1)^2 \\&= \frac{1}{6}n(n+1)(2n+1) + \frac{6(n+1)^2}{6} \\&= \frac{1}{6}(n+1)[n(2n+1) + 6(n+1)] \\&= \frac{1}{6}(n+1)[2n^2 + n + 6n + 6] \\&= \frac{1}{6}(n+1)(n+1+1)(2(n+1)+1)\end{aligned}$$

Hence,  $1^2 + 2^2 + \cdots + n^2 = \frac{1}{6}n(n+1)(2n+1)$  for all  $n \in \mathbb{N}$  ■

2. Prove  $3 + 11 + \cdots + (8n - 5) = 4n^2 - n$  for all positive integers  $n$ .

*Solution:*

Base Case:  $3 = 4(1)^2 - 1 = 3$  ✓

Inductive Step: Assume that  $3 + 11 + \cdots + (8n - 5) = 4n^2 - n$  for some  $n \in \mathbb{N}$ . Then,

$$\begin{aligned}3 + 11 + \cdots + (8n - 5) + (8(n+1) - 5) &= 4n^2 - n + (8(n+1) - 5) \\&= 4n^2 + 7n + 3 \\&= 4(n^2 + 2n + 1) - n - 1 \\&= 4(n+1)^2 - (n+1)\end{aligned}$$

Hence,  $3 + 11 + \cdots + (8n - 5) = 4n^2 - n$  for all  $n \in \mathbb{N}$  ■

3. Prove  $1^2 + 2^2 + \cdots + n^2 = (1 + 2 + \cdots + n)^2$  for all positive integers  $n$ .

# Elementary Analysis Ross Solutions

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## **Elementary Analysis Ross Solutions:**

*Elementary Analysis* Kenneth A. Ross, 2013-04-16 For over three decades this best selling classic has been used by thousands of students in the United States and abroad as a must have textbook for a transitional course from calculus to analysis It has proven to be very useful for mathematics majors who have no previous experience with rigorous proofs Its friendly style unlocks the mystery of writing proofs while carefully examining the theoretical basis for calculus Proofs are given in full and the large number of well chosen examples and exercises range from routine to challenging The second edition preserves the book s clear and concise style illuminating discussions and simple well motivated proofs New topics include material on the irrationality of pi the Baire category theorem Newton s method and the secant method and continuous nowhere differentiable functions Theorems, Corollaries, Lemmas, and Methods of Proof Richard J. Rossi, 2011-10-05 A hands on introduction to the tools needed for rigorous and theoretical mathematical reasoning Successfully addressing the frustration many students experience as they make the transition from computational mathematics to advanced calculus and algebraic structures Theorems Corollaries Lemmas and Methods of Proof equips students with the tools needed to succeed while providing a firm foundation in the axiomatic structure of modern mathematics This essential book Clearly explains the relationship between definitions conjectures theorems corollaries lemmas and proofs Reinforces the foundations of calculus and algebra Explores how to use both a direct and indirect proof to prove a theorem Presents the basic properties of real numbers  $\mathbb{R}$  Discusses how to use mathematical induction to prove a theorem Identifies the different types of theorems Explains how to write a clear and understandable proof Covers the basic structure of modern mathematics and the key components of modern mathematics A complete chapter is dedicated to the different methods of proof such as forward direct proofs proof by contrapositive proof by contradiction mathematical induction and existence proofs In addition the author has supplied many clear and detailed algorithms that outline these proofs Theorems Corollaries Lemmas and Methods of Proof uniquely introduces scratch work as an indispensable part of the proof process encouraging students to use scratch work and creative thinking as the first steps in their attempt to prove a theorem Once their scratch work successfully demonstrates the truth of the theorem the proof can be written in a clear and concise fashion The basic structure of modern mathematics is discussed and each of the key components of modern mathematics is defined Numerous exercises are included in each chapter covering a wide range of topics with varied levels of difficulty Intended as a main text for mathematics courses such as Methods of Proof Transitions to Advanced Mathematics and Foundations of Mathematics the book may also be used as a supplementary textbook in junior and senior level courses on advanced calculus real analysis and modern algebra Introduction to Numerical Ordinary and Partial Differential Equations Using MATLAB Alexander Stanoyevitch, 2011-10-14 **Applied Mechanics Reviews**, 1969 Notices of the American Mathematical Society American Mathematical Society, 1980 *Neoclassical Analysis* Mark Semenovich

Burgin,2007 Neoclassical analysis extends methods of classical calculus to reflect uncertainties that arise in computations and measurements In it ordinary structures of analysis that is functions sequences series and operators are studied by means of fuzzy concepts fuzzy limits fuzzy continuity and fuzzy derivatives For example continuous functions which are studied in the classical analysis become a part of the set of the fuzzy continuous functions studied in neoclassical analysis Aiming at representation of uncertainties and imprecision and extending the scope of the classical calculus and analysis neoclassical analysis makes at the same time methods of the classical calculus more precise with respect to real life applications Consequently new results are obtained extending and even completing classical theorems In addition facilities of analytical methods for various applications also become more broad and efficient

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also directed three sequels the theatrically released honey 2 2011 and two straight to video sequels

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