McGraw-Hill Ryerson

Advanced Functions 12

Study Guide and University Handbook

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Overview

Advanced Functions play an important role in many activities, from business and economics to the social, medical, and physical sciences. *McGraw-Hill Ryerson Advanced Functions 12 Study Guide and University Handbook* is designed for students planning to qualify for college or university. The study guide is designed to either complement the *McGraw-Hill Ryerson Advanced Functions 12* student book, or to stand alone as a thorough review of the course.

Study Guide Organization

- Chapter 1 introduces polynomial functions and the process of using secants and tangents to analyse average and instantaneous rates of change. Characteristics of polynomial functions are explored, including key features of their graphs and the relationship between finite differences and equations of polynomial functions. The chapter also examines the connection between equations and graphs of polynomial functions, along with transformations.
- In Chapter 2 equation-solving skills and graphing skills are combined to solve polynomial equations and inequalities. The relationship between the Remainder Theorem and the Factor Theorem is identified. Techniques for factoring polynomial functions of degree greater than two are examined and also applied to determine the roots of polynomial equations. Families of polynomial functions are analysed, including representing families of functions algebraically and exploring quartic functions. Finally, inequalities are solved graphically using technology, and algebraic methods for solving factorable polynomial inequalities are demonstrated.
- Chapter 3 focuses on anlysing properties of those rational functions created by taking the reciprocal of linear functions and quadratic functions. The equations and key features of the graphs of these rational functions are analysed, including finding their vertical and horizontal asymptotes. Different forms of rational functions are explored and, rational equations and inequalities are solved using a variety of methods (e.g., algebraically, using technology). Connections between real-world situations and rational functions are explored in the last section of the chapter through problem solving.
- Chapter 4 extends concepts of trigonometry by defining trigonometric ratios (both primary and reciprocal ratios) of any angle using radians for angle measures. Methods to convert between radian measure and degree measure are defined. The connection between trigonometric ratios and special angles is identified, along with equivalent trigonometric expressions. Compound angle formulas, including addition and subtraction formulas for cosine and sine, are examined and finally, the chapter ends with proofs of trigonometric identities.
- Chapter 5 applies the concepts from chapter 4 to analyse trigonometric functions. The graphs of the sine, cosine, and tangent functions, along with graphs of the reciprocal trigonometric functions are analysed and their key features are identified. Transformations of the graphs of the cosine and sine functions are examined. Trigonometric equations are solved by combining factoring techniques with knowledge of trigonometric ratios of special angles. The chapter ends with applications of instantaneous rates of change to problems involving trigonometry.
- Chapter 6 introduces two new functions, the exponential and logarithmic functions. The chapter begins by studying the exponential function and its inverse, including writing equations to fit data and graphing inverse functions. Then, logarithms and transformations of logarithmic functions are explored. The power law of logarithms is examined, including solving problems, evaluating logarithms, and graphing logarithmic functions. Finally, problems and applications connecting logarithms and the physical sciences, are solved.
- Chapter 7 builds on the concepts related to exponents and logarithms from chapter 6. Equivalent forms of exponential equations are identified, and techniques to solve exponential equations are investigated and applied. The Product and Quotient Laws of logarithms are developed and techniques to solve logarithmic equations are demonstrated. The final section of this chapter examines mathematical modelling with exponential and logarithmic equations, including solving problems using these equations.

- Chapter 8 integrates concepts from the seven preceding chapters to examine combined functions. The key features of the graphs and equations of the sum, difference, product, and quotient of different functions are examined. Composite functions are evaluated, and solutions to inequalities of combined functions are found. The chapter ends with an exploration of modelling with combined functions, including solving problems and developing models.
- In the University Preparation section, a collection of important Advanced Functions topics are explored. The section examines conics, including the ellipse and hyperbola. The connection between the graphs and equations of the ellipse and hyperbola are identified, as well as the development of the equations based on given information. Another topic is solving absolute value equations and inequalities. Matrices are also introduced and the operations of addition, subtraction, scalar multiplication and matrix multiplication are studied. The final topic of this section deals with extending important algebraic skills, including factoring and solving complex equations.

Study Guide Features

- Each section begins with a page of Key Concepts that summarize the concepts needed to complete the exercises.
- Exercises are organized into three sections: A (practice), B (connect and apply), and C (extend and challenge).
- Each chapter includes additional challenge questions that cover the concepts in the chapter, as well as extend your thinking and combine concepts from previous chapters.
- Selected questions in each section are marked by a star that indicates that full worked solutions are provided at the back of the book. Answers to all other questions are also provided.
- Each chapter ends with a checklist of concepts that specify what you should be able to do by the end of the chapter.
- A practice exam at the end of the study guide gives you the opportunity to determine if you are ready for the final examination.

Formulas

SYMBOLS

$\mathbb{R}$	real numbers	**Greek Lower Case Letters**	
$\mathbb{N}$	natural numbers	α	alpha (a)
$\mathbb{Z}$	integers	β	beta (b)
∞	infinity	γ	gamma (g)
$\in$	belongs to	δ	delta (d) lower case
$[a,b]$	$a \leq x \leq b$ (closed interval)	Δ	delta (d) upper case
(a,b)	$a < x < b$ (open interval)	λ	lamda (l)
$\overrightarrow{\text{AB}}, \vec{u}$	vector	ρ	rho (r)
$\lvert\vec{v}\rvert$	magnitude of a vector	θ	theta (th)
$\vec{u} \cdot \vec{v}$	dot product of vectors	τ	tau (t)
$\vec{u} \times \vec{v}$	cross product of vectors	π	pi (p)
$\frac{d}{dx}$	derivative operator	ω	omega (o)