

Exam 1 Study Guide

Functions and Sequences/Series

1 Week 1: Functions and Transformations

Section 1.2: Functions

Key Topics to Master:

- Definition of a function and function notation $f(x)$
- Domain and range of functions
- Evaluating functions at specific values
- One-to-one and onto functions
- Vertical line test for identifying functions
- Function operations (addition, subtraction, multiplication, division)

Essential Formulas:

- Function notation: $y = f(x)$
- Domain: set of all possible input values (x -values)
- Range: set of all possible output values (y -values)

Section 1.3: Graphs of Functions

Key Topics to Master:

- Reading and interpreting function graphs
- Identifying key features: intercepts, maximum/minimum points, intervals of increase/decrease
- Symmetry: even functions $f(-x) = f(x)$, odd functions $f(-x) = -f(x)$
- Piecewise functions and their graphs
- Graphing basic parent functions

Essential Formulas:

- x -intercepts: solve $f(x) = 0$
- y -intercept: evaluate $f(0)$
- Even function test: $f(-x) = f(x)$
- Odd function test: $f(-x) = -f(x)$

Section 1.4: Transformations of Functions

Key Topics to Master:

- Vertical shifts: $f(x) + k$ and $f(x) - k$
- Horizontal shifts: $f(x + h)$ and $f(x - h)$
- Vertical stretches and compressions: $a \cdot f(x)$
- Horizontal stretches and compressions: $f(bx)$
- Reflections across x -axis: $-f(x)$
- Reflections across y -axis: $f(-x)$
- Combined transformations

Essential Formulas: See Day 3 Notes Page 7 for the summary of all the transformations.

Sections 1.5 and 1.6: Composition and Inverse Functions

Key Topics to Master:

- Function composition: $(f \circ g)(x) = f(g(x))$
- Domain of composite functions
- Definition of inverse functions
- Horizontal line test for one-to-one functions
- Finding inverse functions algebraically
- Graphing inverse functions (reflection across $y = x$)
- Verifying inverse functions

Essential Formulas:

- Composition: $(f \circ g)(x) = f(g(x))$
- Inverse function notation: $f^{-1}(x)$
- Inverse verification: $f(f^{-1}(x)) = x$ and $f^{-1}(f(x)) = x$
- Steps to find inverse: swap x and y , then solve for y

2 Week 2: Sequences and Series

Section 8.1: Sequences and Series

Key Topics to Master:

- Definition of sequences and series
- Sequence notation: $a_n, a_1, a_2, a_3, \dots$
- Finding terms of a sequence given the general term
- Recursive vs. explicit formulas
- Partial sums and series notation

Essential Formulas:

- General term notation: a_n
- Series notation: $\sum_{k=1}^{\infty} a_k$
- Partial sum: $S_n = a_1 + a_2 + a_3 + \cdots + a_n$

Section 8.2: Arithmetic Sequences**Key Topics to Master:**

- Definition of arithmetic sequences
- Common difference (d)
- Finding the n th term of an arithmetic sequence
- Sum of arithmetic sequences
- Identifying arithmetic sequences from patterns

Essential Formulas:

- n th term: $a_n = a_1 + (n - 1)d$
- Common difference: $d = a_{n+1} - a_n$
- Sum of first n terms: $S_n = \frac{n}{2}(a_1 + a_n)$

Section 8.3: Geometric Sequences**Key Topics to Master:**

- Definition of geometric sequences
- Common ratio (r)
- Finding the n th term of a geometric sequence
- Sum of geometric sequences (finite and infinite)
- Identifying geometric sequences from patterns
- Convergence of infinite geometric series

Essential Formulas:

- n th term: $a_n = a_1 \cdot r^{n-1}$
- Common ratio: $r = \frac{a_{n+1}}{a_n}$
- Sum of first n terms: $S_n = \frac{a_1(1-r^n)}{1-r}$ for $r \neq 1$
- Sum of infinite geometric series: $S_{\infty} = \frac{a_1}{1-r}$ for $|r| < 1$