

# 07 Advanced Functions

Content Area: **Math**  
Course(s):  
Time Period: **Full Year**  
Length: **5-6 weeks**  
Status: **Published**

## **General Overview, Course Description or Course Philosophy**

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Senior Math Analysis CP is designed for seniors who will pursue liberal arts or humanities in college. The main course objective is to strengthen and extend the concepts of algebra, geometry, and problem solving, including modeling and reasoning. The course integrates ideas of functions and trigonometry with explorations in world-life applications. Additionally, students are provided SAT review and exposure to college placement exam experiences.

## **OBJECTIVES, ESSENTIAL QUESTIONS, ENDURING UNDERSTANDINGS**

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Objectives:

- Determine if a given relation is a function or not
- Identify the domain and range of a function
- Analyze characteristics of various categories of functions
- Operate on, and compose functions
- Generate the graph of a function
- Use functions as models

Essential Questions:

- What is a function and how are they used?
- What information can be evaluated from/by a function?
- What categories of function best model which types of behavior/scenario?

Enduring Understandings:

- A function is a mathematical relation in which each element of the domain is mapped to a single element in the range.
- Functions can be operated on with arithmetic operations and function composition
- The domain of a function is the set of real number inputs which produce real number outputs
- General properties follow various categories of functions such as polynomial, rational, exponential, linear, trigonometric, etc

## CONTENT AREA STANDARDS

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MA.F-BF.A.1	Write a function that describes a relationship between two quantities.
MA.F-BF.A.1b	Combine standard function types using arithmetic operations.
MA.F-BF.A.1c	Compose functions.
MA.F-BF.B.3	Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$ , $kf(x)$ , $f(kx)$ , and $f(x + k)$ for specific values of $k$ (both positive and negative); find the value of $k$ given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology.
MA.F-BF.B.4a	Solve an equation of the form $f(x) = c$ for a simple function $f$ that has an inverse and write an expression for the inverse.
MA.F-BF.B.4c	Read values of an inverse function from a graph or a table, given that the function has an inverse.
MA.F-IF.A.1	Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If $f$ is a function and $x$ is an element of its domain, then $f(x)$ denotes the output of $f$ corresponding to the input $x$ . The graph of $f$ is the graph of the equation $y = f(x)$ .
MA.F-IF.A.2	Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.
MA.F-IF.B.4	For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.
MA.F-IF.B.5	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.
MA.F-IF.C.7a	Graph linear and quadratic functions and show intercepts, maxima, and minima.
MA.F-IF.C.7b	Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
MA.F-IF.C.7c	Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.
MA.F-IF.C.7d	Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.
MA.F-IF.C.7e	Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.
MA.F-LE.A.1b	Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.
MA.F-LE.A.1c	Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.

**RELATED STANDARDS (Technology, 21st Century Life & Careers, ELA Companion Standards are Required)**

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CS.K-12.3.a	Identify complex, interdisciplinary, real-world problems that can be solved computationally.
CS.K-12.3.b	Decompose complex real-world problems into manageable sub-problems that could integrate existing solutions or procedures.
CS.K-12.3.c	Evaluate whether it is appropriate and feasible to solve a problem computationally.
LA.RH.9-10.5	Analyze how a text uses structure to emphasize key points or advance an explanation or analysis.
LA.RST.9-10.2	Determine the central ideas, themes, or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.
LA.RST.9-10.3	Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
LA.RST.9-10.4	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.
LA.RST.9-10.5	Analyze the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).
WRK.K-12.P.5	Utilize critical thinking to make sense of problems and persevere in solving them.
WRK.K-12.P.8	Use technology to enhance productivity increase collaboration and communicate effectively.

## **STUDENT LEARNING TARGETS**

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### **Declarative Knowledge**

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Students will understand that:

- A function is a mathematical relation in which each element of the domain is mapped to a single element in the range.
- Functions can be operated on with arithmetic operations and function composition
- The domain of a function is the set of real number inputs which produce real number outputs
- General properties follow various categories of functions such as polynomial, rational, exponential, linear, trigonometric, etc.

### **Procedural Knowledge**

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Students will be able to:

- (+) Compose functions. (★) *Analysis*
- (+) Graph rational functions expressed symbolically. (★) *Analysis*

- (+) Read values of an inverse function from a graph or a table, given that the function has an inverse. *Analysis*
- (+) Verify by composition that one function is the inverse of another. *Analysis*
- Combine standard function types using arithmetic operations. (★) *Analysis*
- Graph exponential and logarithmic functions expressed symbolically. (★) *Analysis*
- Graph linear and quadratic functions expressed symbolically. (★) *Analysis*
- Graph polynomial functions expressed symbolically. (★) *Analysis*
- Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions expressed symbolically. (★) *Analysis*
- Graph trigonometric functions expressed symbolically. (★) *Analysis*
- Identify the effect on the graph of replacing  $f(x)$  by  $f(x) + k$ ,  $k f(x)$ ,  $f(kx)$ , and  $f(x + k)$  for specific values of  $k$  (both positive and negative). (★) *Analysis*
- Recognize even and odd functions from their graphs and algebraic expressions for them. (★) *Analysis*
- Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another. (★) *Analysis*
- Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. (★) *Analysis*
- Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. (★) *Analysis*
- Relate the domain of a function to its graph and to the quantitative relationship it describes. (★) *Analysis*
- Calculate and interpret the average rate of change of a function. (★) *Comprehension*
- Find inverse functions. *Comprehension*
- Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. *Comprehension*
- Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context. *Comprehension*

## EVIDENCE OF LEARNING

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### Formative Assessments

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- Student feedback/questioning/observation
- Exit Ticket
- Error analysis
- Specific skill assessment/questions
- Survey/polling
- Reflection questions
- Scored/evaluated class work or homework

- Task completion

## **Summative Assessments**

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Lesson Quizzes  
Unit Test  
Performance Tasks

## **RESOURCES (Instructional, Supplemental, Intervention Materials)**

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## **INTERDISCIPLINARY CONNECTIONS**

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Interdisciplinary connections are frequently addressed through modeling and application problems whereby students solve and analyze situations taken from business, physics, engineering, biology, statistics, geography, and numerous other fields. Examples can be found in topic specific textbook problems and digital resources.

## **ACCOMMODATIONS & MODIFICATIONS FOR SUBGROUPS**

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See link to Accommodations & Modifications document in course folder.