
Performance Tasks for Part 2: Functions

“Big Ideas” Addressed by the Tasks

The *Performance Tasks* in this section provide opportunities for students to

- demonstrate facility in manipulating polynomials, rational expressions, and exponential expressions
- explore the concept of a function and use appropriate notation
- describe the properties of functions under transformations
- determine properties of several basic functions
- describe the relationship between the graph of a function and its image under transformations
- investigate and explain the relationship between a function and its inverse
- solve problems involving functions
- extend the understanding of a quadratic function
- use technology as an aid in problem solving
- read and interpret the results produced by graphing technology
- explore complex numbers
- solve multi-step problems
- report the solution to a problem clearly and concisely, using appropriate mathematical forms
- communicate and justify their reasoning
- examine complex numbers

Curriculum Expectations

The *Performance Tasks* address the following Curriculum Expectations from the Tools for Operating and Communicating with Functions strand of the Functions and Relations (university) course and the Functions (university/college) course.

Overall Expectations Addressed by the Performance Tasks
• OCV.01 demonstrate facility in manipulating polynomials, rational expressions, and exponential expressions • OCV.02 demonstrate an understanding of inverses and transformations of functions and facility in the use of function notation • OCV.03 communicate mathematical reasoning with precision and clarity throughout the course

Specific Expectations

Manipulating Polynomials, Rational Expressions, and Exponential Expressions

- OC1.02 add, subtract, and multiply polynomials
- OC1.03 determine the maximum or minimum value of a quadratic function whose equation is given in the form $y = ax^2 + bx + c$, using the algebraic method of completing the square
- OC1.04 identify the structure of the complex number system and express complex numbers in the form $a + bi$, where $i^2 = -1$ (e.g., $4i$, $3 - 2i$)
- OC1.05 determine the real or complex roots of quadratic equations, using an appropriate method (e.g., factoring, the quadratic formula, completing the square), and relate the roots to the x -intercepts of the graph of the corresponding function
- OC1.06(U) add, subtract, multiply, and divide complex numbers in rectangular form
- OC1.07(U)/OC1.06(U/C) add, subtract, multiply, and divide rational expressions, and state the restrictions on the variable values
- OC1.08(U)/OC1.07(U/C) simplify and evaluate expressions containing integer and rational exponents, using the laws of exponents
- OC1.09(U)/OC1.08(U/C) solve exponential equations (e.g., $4^x = 8^{x+3}$, $2^{2x} - 2^x = 12$)

Understanding Inverses and Transformations and Using Function Notation

- OC2.02 demonstrate facility in the use of function notation for substituting into and evaluating functions
- OC2.03 determine, through investigation, the properties of the functions defined by $f(x) = \sqrt{x}$ [e.g., domain, range, relationship to $f(x) = x^2$] and $f(x) = \frac{1}{x}$ [e.g., domain, range, relationship to $f(x) = x$.];
- OC2.04 explain the relationship between a function and its inverse (i.e., symmetry of their graphs in the line $y = x$; the interchange of x and y in the equation of the function; the interchanges of the domain and range), using examples drawn from linear and quadratic functions, and from the functions $f(x) = \sqrt{x}$ and $f(x) = \frac{1}{x}$
- OC2.05 represent inverse functions, using function notation, where appropriate
- OC2.06 represent transformations (e.g., translations, reflections, stretches) of the functions defined by $f(x) = x$, $f(x) = x^2$, $f(x) = \sqrt{x}$, $f(x) = \sin x$, and $f(x) = \cos x$, using function notation
- OC2.07 describe, by interpreting function notation, the relationship between the graph of a function and its image under one or more transformations
- OC2.08 state the domain and range of transformations of the functions defined by $f(x) = x$, $f(x) = x^2$, $f(x) = \sqrt{x}$, $f(x) = \sin x$, and $f(x) = \cos x$

Communicating Mathematical Reasoning

- OC3.01 explain mathematical processes, methods of solution, and concepts clearly to others
- OC3.02 present problems and their solutions to a group, and answer questions about the problems and the solutions
- OC3.03 communicate solutions to problems and to findings of investigations clearly and concisely, orally and in writing, using an effective integration of essay and mathematical forms
- OC3.04 demonstrate the correct use of mathematical language, symbols, visuals (e.g., diagrams, graphs), and conventions
- OC3.05 use graphing technology effectively (e.g., use appropriate menus and algorithms; set the graph window to display the appropriate section of a curve)

Unless noted otherwise, all expectations are common to both the Functions course and the Functions and Relations course.

	Task								
Expectations	Task #1, text p. 392 Studying Functions (60 min)	Task #2, text p. 392 The Cost of Money (45–60 min)	Task #3, text p. 392 Exponential Functions (45–60 min)	Task #4, text p. 393 Graphing Complex Numbers (45–60 min)	Task #5, text p. 393 Graphing Equations (45–60 min)	Task #6, text p. 394 Chartering a Flight (45–60 min)	Task #7, text p. 395 Fractals (45–60 min)	Task #8, text p. 395 Presenting Math (70–100 min)	Task #9, text p. 396 Demonstrating Math (60–120 min)
OC1.01									
OC1.02									X
OC1.03									X
OC1.04				X			X		
OC1.05									X
OC1.06 U only				X			X		
OC1.07 U 1.06 U/C									X
OC1.08 U 1.07 U/C			X						
OC1.09 U 1.08 U/C			X						
OC2.01									
OC2.02							X		
OC2.03	X				X	X		X	
OC2.04	X	X							
OC2.05	X	X							
OC2.06	X				X	X		X	
OC2.07	X				X	X		X	
OC2.08	X								
OC3.01		X			X	X		X	X
OC3.02								X	X
OC3.03			X				X		
OC3.04	X	X	X	X	X	X	X	X	X
OC3.05			X					X	X

Use of Technology

Students should have access to technology as they work with these tasks. Several *Performance Tasks* require graphing technology. The appropriate technology is discussed in each *Performance Task*.