



# Pre-Calculus

## Functions

A **function** is a relation in which each element of the domain (independent variable) is paired with only one element of the range (dependent variable). In many cases  $x$  is the independent variable and  $y$  or  $f(x)$  is the dependent variable. In this guide  $y$  and  $f(x)$  are interchangeable.



A function



Not a function



A function



A function

A relation can be tested to see whether it is a function by the vertical line test. Draw a vertical line through any graph, and if it hits an  $x$ -value more than once, it is not a function.

### Linear Functions

A function is a linear function if it can be written in the form  $f(x) = ax + b$  or  $y = ax + b$  where  $a$  is the slope and  $b$  is the  $y$ -intercept.

EX:  $f(x) = 4x - 1$  is a linear function. The slope is  $\frac{4}{1}$  (rise over run), and the  $y$ -intercept is  $-1$ .

The standard form of a linear function is  $0 = Ax + By + C$ . The slope is  $m = -\frac{A}{B}$ , and the  $y$ -intercept is  $-\frac{C}{B}$ .

The zeros of a function are found by setting  $y$  to 0 and solving for  $x$ .

EX: Find the zeros of  $f(x) = 4x - 1$ .

$$0 = 4x - 1 \quad -1 = 4x \quad -\frac{1}{4} = x$$

### Polynomial Functions

A function is a polynomial function if it can be written in the form  $f(x) = ax^n + bx^{n-1} + cx^{n-2} + \dots + dx + e$ .

The greatest power of a polynomial with one variable is called its **degree**.  
When the degree of the function is an odd integer, there is at least one real zero.

When the degree is an even integer, there may be no real zeros.

Both types can have imaginary roots of the form  $a + bi$ .

EX:  $f(x) = 2x^4 + x^3 + x + 10$  has a degree of 4. There are four roots to this polynomial.

EX:  $f(x) = 2x^3 + x^2 - 2x + 3$  has a degree of 3. This function has one real zero at  $x = -1.17$  and two non-real roots. (see graph)

EX:  $f(x) = x^2 + 1$  has a degree of 2. This function has two non-real roots. Its graph does not cross the  $x$ -axis.


 $x = -1.17213$   
 $y = 0.00086$ 

### Quadratic Functions

One commonly studied polynomial function is a quadratic function.

A quadratic function takes the form  $f(x) = ax^2 + bx + c$ .

The graph of a quadratic equation is a **parabola**.

Some parabolas represent quadratic equations but not quadratic functions. (see graph)

Quadratic equations can have zero, one, or two solutions.

The vertex of a parabola is its **critical point**. This is where the graph changes from increasing to decreasing or from decreasing to increasing.

The quadratic formula  $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$  can be used to find the roots of all quadratic equations.

The value under the square root symbol is the **discriminant**. It tells the type of roots of a quadratic equation.

$b^2 - 4ac > 0$ , two distinct real roots

$b^2 - 4ac = 0$ , exactly one real root

$b^2 - 4ac < 0$ , no real roots (two distinct imaginary roots)

EX: Find the roots of  $f(x) = x^2 - 4x + 1$

The discriminant  $b^2 - 4ac$  is  $(-4)^2 - 4(1)(1) > 0$ , so there are two real roots.

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-(-4) \pm \sqrt{4^2 - 4(1)(1)}}{2(1)}$$

$$x = 3.732 \text{ and } x = 0.267$$

EX: Find the number and type of the roots of  $f(x) = 2x^2 + 2x + 1$

The discriminant is less than 0, so there are two imaginary roots. A graph of this function does not cross the  $x$ -axis.



EX: Find the number and type of the roots of  $f(x) = x^2 + 2x + 1$ . The discriminant is 0, so there is one real root. A graph of this function intersects the  $x$ -axis in one place, at  $-1$ .

### Rational Functions

A function is a rational function if it can be written in the form  $f(x) = \frac{g(x)}{h(x)}$ .

EX:  $f(x) = \frac{x}{x+3}$ ,  $f(x) = \frac{2}{x}$ , and  $f(x) = \frac{1}{x-2} + 3$  are rational functions.

The parent function for all rational functions is  $f(x) = \frac{1}{x}$ .

The graph of the parent rational function consists of two parts, one in quadrant I and one in quadrant III.

The branches of rational functions approach asymptotes.


A rational function with asymptotes at  $x = 0$  &  $y = 0$ .

### Operations of Functions

Sum:  $(f + g)(x) = f(x) + g(x)$

Difference:  $(f - g)(x) = f(x) - g(x)$

Product:  $(f \cdot g)(x) = f(x) \cdot g(x)$

Quotient:  $\left(\frac{f}{g}\right)(x) = \frac{f(x)}{g(x)}$ ,  $g(x) \neq 0$

EX: Given  $f(x) = x + 2$  and  $g(x) = \frac{x}{x-4}$

Find the difference:  $(f - g)(x) = x + 2 - \frac{x}{x-4} = \frac{(x+2)(x-4) - x}{x-4} = \frac{x^2 - 3x - 8}{x-4}$ ,  $x \neq 4$

Find the product:  $(f \cdot g)(x) = (x + 2) \cdot \left(\frac{x}{x-4}\right) = \frac{x^2 + 2x}{x-4}$ ,  $x \neq 4$

Find the quotient:  $\left(\frac{f}{g}\right)(x) = \frac{x+2}{\frac{x}{x-4}} = (x+2) \cdot \left(\frac{x-4}{x}\right) = \frac{x^2 - 2x - 8}{x}$ ,  $x \neq 0$

### Composition of Functions

$(f \circ g)(x) = f(g(x))$

EX: Given  $f(x) = x + 2$  and  $g(x) = \frac{x}{x-4}$ , find  $(f \circ g)(x)$

$x + 2$  becomes  $\left(\frac{x}{x-4}\right) + 2 = \frac{x}{x-4} + \frac{2(x-4)}{x-4} = \frac{x + 2x - 8}{x-4} = \frac{3x - 8}{x-4}$ ,  $x \neq 4$

EX: Using the same functions, find  $(g \circ f)(x)$ .  $\left(\frac{x}{x-4}\right)$  becomes  $\frac{\frac{x}{x-4} + 2}{\frac{x}{x-4} - 4} = \frac{x + 2}{x - 2}$ ,  $x \neq 2$

### Inverse Functions

To find the inverse of a function, interchange  $x$  and  $y$  and solve the equation for  $y$ .

EX: Find the inverse of  $y = 5x - 2$

Interchange  $x$  and  $y$ :  $x = 5y - 2$

$$x + 2 = 5y \quad \frac{x+2}{5} = y$$

To show two functions are inverses, show that  $(f \circ g)(x) = x$  and  $(g \circ f)(x) = x$

EX: Given  $f(x) = 2x - 4$ ,  $g(x) = \frac{x+4}{2}$ ,  $(f \circ g)(x) = 2\left(\frac{x+4}{2}\right) - 4 = x$ , and

$$(g \circ f)(x) = \frac{(2x - 4) + 4}{2} = x$$

### Families of Functions

A **parent graph** is the basic graph in a family. All the other family members translate, rotate, reflect, shrink, or stretch based on changes in values.

For a general quadratic function,  $f(x) = a(x + h)^2 + c$ , the following rules show how the function is transformed.

When  $a$  is negative, the graph reflects across the  $x$ -axis.

When  $a$  is between 0 and 1, the graph shrinks or compresses.

When  $a$  is greater than 1, the graph expands.

When  $h$  is positive, the graph translates to the left.

When  $h$  is negative, the graph translates to the right.

When  $c$  is positive, the graph translates up.

When  $c$  is negative, the graph translates down.

Note: The parent function (in this case quadratic) could also be an absolute value function, a rational function, an exponential function, etc.

# Pre Calculus 1answer

**Minjie Lin**

A red circular graphic with a gradient, appearing as a semi-circle or a partial circle, located to the right of the author's name.

## **Pre Calculus 1 answer:**

*Pre-Calculus Problems with Worked Solutions* Quantum Scientific Publishing, 2023-06-11 Each book in our series of worked problems contains hundreds of problems with answers and detailed solutions The answers are separate from the solutions since many students just want to know that their answer is wrong before trying the problem again Titles in the series 1 Pre Algebra Problems with Worked Solutions 2 Algebra Problems with Worked Solutions 3 Pre Calculus Problems with Worked Solutions 4 Calculus Problems with Worked Solutions 5 Statistics Problems with Worked Solutions

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Homework Helpers: Pre-Calculus Denise Szecsei, 2025-09-12 This title in the Homework Helpers series will reinforce mathematical foundations and bolster students confidence in pre calculus The concepts are explained in everyday language before the examples are worked Good habits such as checking your answers after every problem are reinforced There are practice problems throughout the book and the answers to all of the practice problems are included The problems are solved clearly and systematically with step by step instructions provided Particular attention is placed on topics that students traditionally struggle with the most While this book could be used to supplement a standard pre calculus textbook it could also be used by college students or adult learners to refresh long forgotten concepts and skills Homework Helpers Pre Calculus is a straightforward and understandable introduction to differential calculus and its applications It covers all of the topics in a typical Calculus class including Linear functions Polynomials Rational functions Exponential functions Logarithmic functions Systems of equations This book also contains a review of the pre calculus concepts that form the foundation on which calculus is built

*Pre-Calculus Workbook* Sadler, 2019-01-02 The Pre Calculus workbook provides students with an overview of the skills in algebra functions trigonometry analytic geometry and graphical analysis that are crucial to success in higher level mathematics such as calculus It also constructs a bridge to calculus by providing some introductory insight into sequences and series Explanations of the concepts definitions of key vocabulary and detailed examples of problems and solutions are followed by practice exercises The Middle Upper Grades Math Series books provide students in middle school junior high and high school with instruction and practice in the fundamentals of math so they can transition to higher order math concepts with confidence Clear explanations numerous practice exercises and frequent reviews provide students with the tools for success in pre algebra algebra statistics and probability and pre calculus Correlated to current national state and provincial standards Mark Twain Media Publishing Company specializes in providing engaging supplemental books and decorative resources to complement middle and upper grade classrooms Designed by leading educators the product line covers a range of subjects including mathematics sciences language arts social studies history government fine arts and character

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**The Pre-calculus Problem Solver** Max Fogiel, Research and Education Association, 1984

**Barron's Math 360: A Complete Study Guide**

**to Pre-Calculus with Online Practice** Barron's Educational Series, Lawrence S. Leff, Christina

Pawlowski-Polanish, 2021-09-07 Previously published under the titles Precalculus the easy way and E Z precalculus

**Pre-Calculus** Kamrouz Berenji, Pre Calculus Your Guide to Mastering High School Mathematics This book is designed to guide you through the exciting and rewarding process of mastering Pre Calculus Whether you re returning to education after some time away or continuing your studies this resource is tailored to help you succeed in your learning journey What You Can Expect Well structured lessons covering the key topics in Pre Calculus Clear and accessible explanations to simplify complex concepts Practice problems to reinforce your skills step by step Effective strategies to tackle various types of problems Review sections and answer keys to evaluate your progress How to Make the Most of This Book Start with the Basics If you need a refresher begin with foundational topics before moving on to more advanced concepts Practice Consistently Math is a subject that requires practice Try solving the problems before looking at the answers Check Your Work Use the answer keys and explanations to identify and learn from your mistakes Utilize the Resources Don t skip the tips and strategies sections as they will help streamline your study process Stay Motivated Everyone learns at their own pace so take your time and revisit challenging sections when needed With dedication and consistency you ll see progress every day This book is more than just a study guide it s your companion on the path to achieving your academic goals Start today and get ready to conquer Pre Calculus     [Pre-Calculus: 1001 Practice Problems For Dummies \(+ Free Online Practice\)](#) Mary Jane Sterling, 2022-06-01 Practice your way to a better grade in pre calc Pre Calculus 1001 Practice Problems For Dummies gives you 1 001 opportunities to practice solving problems from all the major topics in Pre Calculus in the book and online Get extra help with tricky subjects solidify what you ve already learned and get in depth walk throughs for every problem with this useful book These practice problems and detailed answer explanations will turn you into a pre calc problem solving machine no matter what your skill level Thanks to Dummies you have a resource to help you put key concepts into practice Work through practice problems on all Pre Calculus topics covered in school classes Read through detailed explanations of the answers to build your understanding Access practice questions online to study anywhere any time Improve your grade and up your study game with practice practice practice The material presented in Pre Calculus 1001 Practice Problems For Dummies is an excellent resource for students as well as for parents and tutors looking to help supplement Pre Calculus instruction Pre Calculus 1001 Practice Problems For Dummies 9781119883623 was previously published as 1 001 Pre Calculus Practice Problems For Dummies 9781118853320 While this version features a new Dummies cover and design the content is the same as the prior release and should not be considered a new or updated product     [Answers in the Tool Box](#) Clifford Adelman, 1999     [Precalculus](#) Cynthia Y. Young, 2010-01-19 Engineers looking for an accessible approach to calculus will appreciate Young s introduction The book offers a clear writing style that helps reduce any math anxiety they may have while developing their problem solving skills It incorporates Parallel Words and Math boxes that provide detailed annotations

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**Breaking Barriers** Brian Cafarella, 2021-06-29 The fact college students often struggle in mathematics is not new They exhibit a great deal of anxiety dislike and overall disinterest Quantitative data displaying abysmal student success rates are widely available and shared This book explores the complexity surrounding the issue of student difficulties in community college math Though much quantitative research focuses on the faculty experiences and perspectives regarding methods and practices the author puts the focus on students experiences The book presents the results of a study focused on students who struggled in mathematics Though their experiences varied they all entered community college with a great deal of disgust and anxiety toward mathematics courses and requirements These impressions and attitudes create barriers to success However all the students eventually succeeded in fulfilling their college level mathematics requirement The author presents these students experiences prior to entering community college what led to both success and failure in their math courses and the common themes leading to success and failure Through these student responses the author assists readers in gaining a better understanding of the community college student who struggles in math and how to break students community college math barriers to success

TABLE OF CONTENTS Preface 1 Math is a Four Letter Word 2 The Framework for Developmental and Introductory College Level Math 3 The Study Settings and the Participants 4 Prior Experiences in Math 5 Attempting Math and Community College 6 Navigating the First Developmental Math Course 7 Math Pathways and Completing Developmental Math 8 The End of the Rainbow 9 I Need More Math Now What 10 Lessons Learned in the Aftermath Appendix A Analyzing the Results and Ensuring Accuracy Appendix B Pre Algebra and Introduction to Algebra Course Content Appendix C Stand Alone Quantway 1 and Statway 1 Course Content Appendix D Elementary Algebra all half semester Content Appendix E Intermediate Algebra Content Appendix F Lead Questions for Student Participants Appendix G Lead Questions for the Lester Community College Faculty Index BIOGRAPHY With 21 years of experience in mathematics education and 17 years as a community college math professor the author has instructed courses from developmental math through calculus He has served as Chair of the Developmental Math Department and Assistant Chair of the Mathematics Department at Sinclair College Dayton Ohio He received the Jon and Suanne Roueche Award for Teaching Excellence and the Ohio Magazine Excellence in Education Award His published research focuses on faculty viewpoints regarding pedagogical practices as well as conceptual research concentrating on developmental math His article Acceleration and Compression in Developmental Math Faculty Viewpoints was awarded Article of the Year by the Journal of Developmental Education

**Pre-calculus Mathematics** Hal G. Moore, 1977

This book delves into Pre Calculus 1answer. Pre Calculus 1answer is an essential topic that needs to be grasped by everyone, ranging from students and scholars to the general public. This book will furnish comprehensive and in-depth insights into Pre Calculus 1answer, encompassing both the fundamentals and more intricate discussions.

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