

# Precalculus

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## Introduction:

This course mainly follows the topics of *College Algebra* by Carl Stitz and Jeff Zeager, which is available on the precalculus lesson plan page. Don't be intimidated by the lengthy words in this textbook. Here are some suggestions for working through the book:

1. Read through the concept and proceed to the examples even you don't grasp it 100%. The authors always provide a detailed example for each new concept. As you follow through the explanation in the example, you might want to get a pencil and do the math yourself. You should get a better picture or understanding than you did from the first reading.
2. After you work through the examples, go back and read the previous concept paragraphs again. This is to enhance your understanding. You might still need to refer back to the examples as you read it.
3. Complete the examples without looking at the steps in the book to see if you are truly understanding the concepts. (You can skip this step if you are being asked to prove equations or theorems).

I'm hoping this guideline will help you to discover the "gold nuggets" in the book. In fact, you might find it interesting as the authors can be quite witty.

Occasionally, I have used some notes from *Precalculus* published by OpenStax College or added some of my own notes which, I hope, will help you to have a better understanding of the concept.

Each day's lesson will take approximately one hour. The chapter review exercises will take more time than the daily lesson, and the final test will probably take around three hours—the questions within these have been pulled from *Precalculus*. The solutions are provided in a separate download. The optional exercises in some of the daily lessons are mostly self-exploration or brainstorming kind of questions. So, answers are not provided for all of them. I'd encourage you to correct all your mistakes in the exercises before you proceed to the next lesson.

You need a graphing calculator for this course. However, the textbook does not provide instruction on how to use it for the exercises. Instructions are easily accessible on the Internet. (*Exercise caution when searching the Internet.*)

Whenever you see “Copy this,” copy the words in the box on an index card and label each accordingly as you might need to refer to them from time to time. It will also help you to have a quick reference as you do the exercises. I have color-coded the boxes as shown.



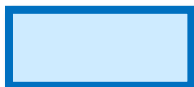
This contains numbered definition of the term.



This contains numbered theorem.



This contains numbered equation.



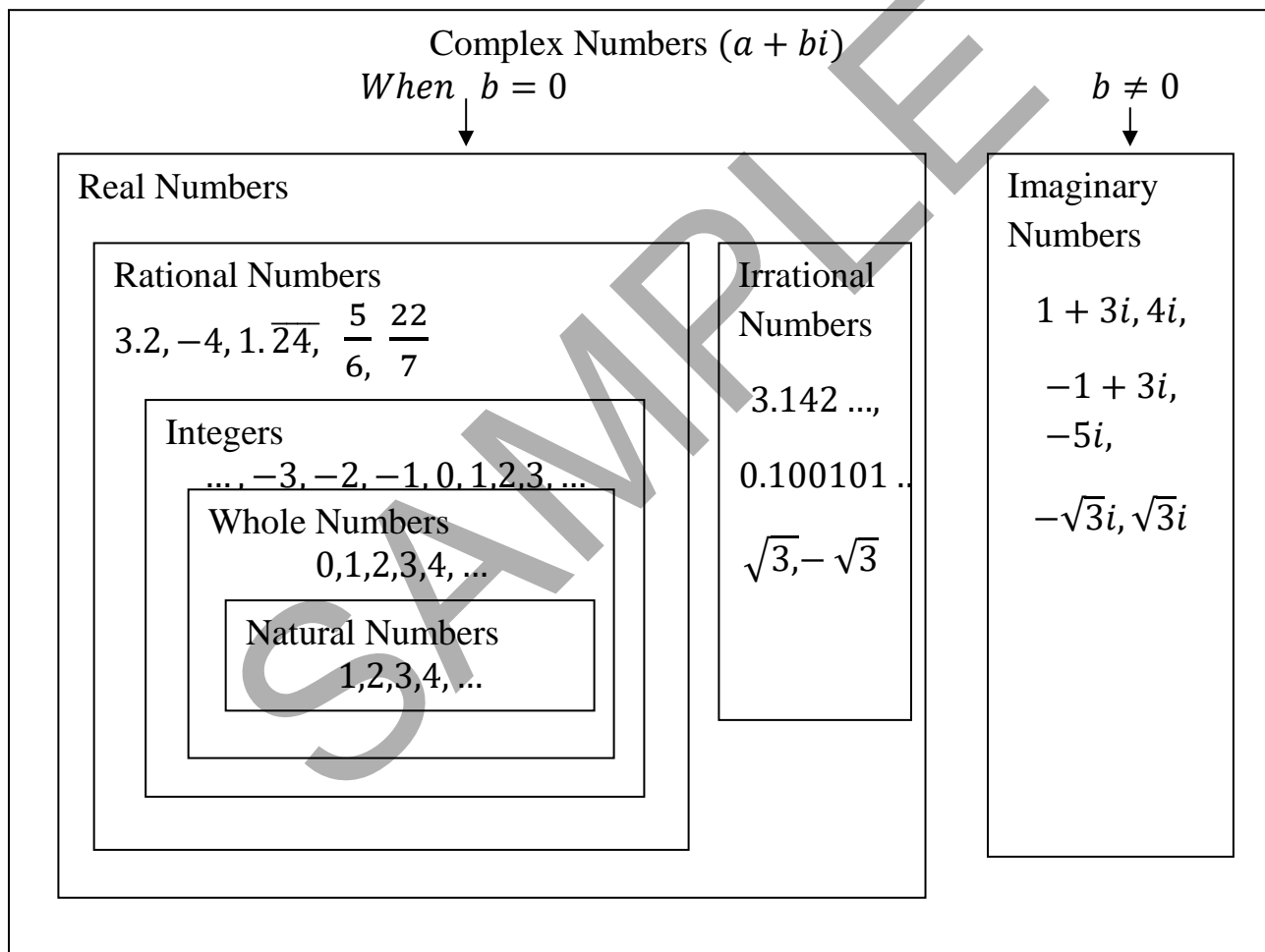
This contains notes or equation that is not numbered but might be useful for solving the exercises.

*The portions inside the boxes are courtesy of College Algebra by Carl Stitz and Jeff Zeager and used with permission.*

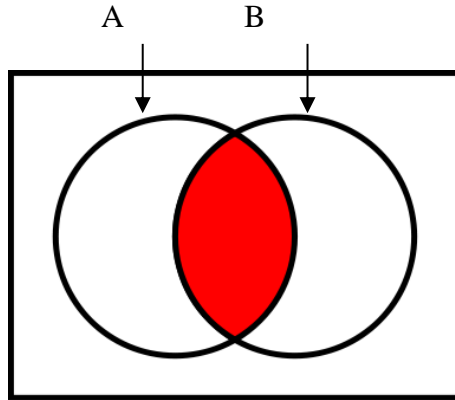
## Week 1: Relations and Functions

### Monday

1. Read textbook pp. 1-5: Chapter One - Section 1.1.1 (Relations and Functions: Sets of Real Numbers and the Cartesian Coordinate Planes - Sets of Numbers).
2. Notes:
  - I. To help you to visualize the definition of the sets of numbers, I have provided the following chart



II.



The red shaded part is  $A \cap B$ .

*(The picture is taken from [en.wikipedia.org/wiki/Intersection\\_\(set\\_theory\)](http://en.wikipedia.org/wiki/Intersection_(set_theory)) and is in the public domain.)*

III. When we list the elements for the union of the set numbers, we only need to write them out once the same element is in all the sets. For example, if  $A = \{1, 3, 4, 5\}$  and  $B = \{1, 3, 6, 7\}$  and  $C = \{1, 3, 4, 8\}$ , then  $A \cup B \cup C = \{1, 3, 4, 5, 6, 7, 8\}$ .

IV. If  $A = \{1, 3, 4, 5\}$  and  $B = \{2, 6, 7\}$ , then  $A \cap B = \{\}$  (empty set) and  $A \cup B = \{1, 2, 3, 4, 5, 6, 7\}$ .

3. Copy this:

section 1.1.1

p. 1

**Definition 1.1.** A set is a well-defined collection of objects which are called the 'elements' of the set. Here, 'well-defined' means that it is possible to determine if something belongs to the collection or not, without prejudice.

section 1.1.1

p. 4

**Definition 1.2.** Suppose  $A$  and  $B$  are two sets.

- The intersection of  $A$  and  $B$ :  $A \cap B = \{x \mid x \in A \text{ and } x \in B\}$
- The union of  $A$  and  $B$ :  $A \cup B = \{x \mid x \in A \text{ or } x \in B \text{ (or both)}\}$

4. Do Section 1.1.4 Exercises: Exercises 1 to 19 on pp. 14-15 in the textbook. The answers can be found on pp. 17-18, section 1.1.5 in the textbook.

## Tuesday

1. Read textbook pp. 6-10: Chapter One - Section 1.1.2 (Relations and Functions: Sets of Real Numbers and the Cartesian Coordinate Planes - The Cartesian Coordinate Plane). Stop before Section 1.1.3.
2. Copy this:

section 1.1.2

p. 9

**Definition 1.3.** Two points  $(a, b)$  and  $(c, d)$  in the plane are said to be

- symmetric about the  $x$ -axis if  $a = c$  and  $b = -d$
- symmetric about the  $y$ -axis if  $a = -c$  and  $b = d$
- symmetric about the origin if  $a = -c$  and  $b = -d$

3. Do Section 1.1.4 Exercises: Exercises 20 and 21 on p.15 in the textbook. The answers can be found on pp. 18-19, Section 1.1.5 in the textbook.

## Wednesday

1. Read textbook pp. 11-13: Chapter One - Section 1.1.3 (Relations and Functions: Sets of Real Numbers and the Cartesian Coordinate Planes - Distance in the Plane).
2. Notes:  $2^2 = 4$  and  $(-2)^2 = 4$  ; therefore, when we extract the square root of 4, we should write  $\pm 2$  . So, remember, when we extract the square root of a number, we must always consider two possibilities: the positive and the negative numbers.
3. Copy this:

section 1.1.3

p. 11

Equation 1.1. The Distance Formula: The distance  $d$  between the points  $P(x_0, y_0)$  and  $Q(x_1, y_1)$  is:

$$d = \sqrt{(x_1 - x_0)^2 + (y_1 - y_0)^2}$$

section 1.1.3

p. 13

Equation 1.2. The Midpoint Formula: The midpoint  $M$  of the line segment connecting  $P(x_0, y_0)$  and  $Q(x_1, y_1)$  is:

$$M = \left( \frac{x_0 + x_1}{2}, \frac{y_0 + y_1}{2} \right)$$

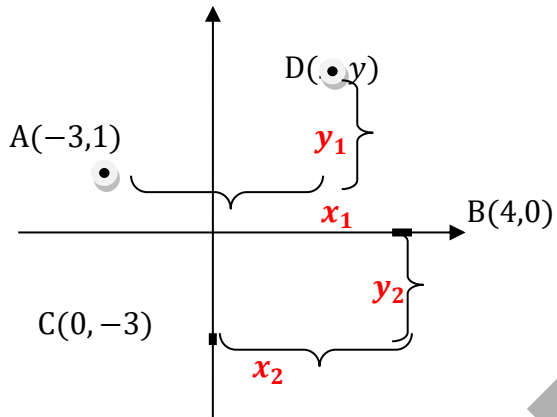
4. Do Section 1.1.4 Exercises: Exercises 22-29 on p. 16 in the textbook. The answers can be found on p. 19, Section 1.1.5 in the textbook.

## Thursday

1. Do Section 1.1.4 Exercises: Exercises 30-38 on p. 16 in the textbook. The answers for Exercises 30-34 and 37 can be found on p. 19, Section 1.1.5 in the textbook. The solution for Exercise 38 can be found below.

Exercise 38:

First, let's plot points A, B, C on the graph.



To form a square with ABC, D should be somewhere here and  $AC = BD$  and  $AD = BC$ . For the ease of calculation, we can also think of  $x_1 = x_2$  and  $y_1 = y_2$

$x_1 = x_2$ $x - (-3) = 4 - 0$ $x + 3 = 4$ $x = 1$	$y_1 = y_2$ $y - 1 = 0 - (-3)$ $y - 1 = 3$ $x = 4$
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So, D is (1,4).

## Friday

1. Read textbook pp. 20-23: Chapter One - Section 1.2 (Relations and Functions: Relations). Stop before section 1.2.1.
2. Copy this:

section 1.2

p. 20

**Definition 1.4.** A relation is a set of points in the plane.

section 1.2

p. 23

### Equations of Vertical and Horizontal Lines

- The graph of the equation  $x = a$  is a vertical line through  $(a, 0)$ .
- The graph of the equation  $y = b$  is a horizontal line through  $(0, b)$ .

3. Do Section 1.2.2 Exercises: Exercises 1-10 on p. 29 in the textbook. The answers can be found on pp. 33-34, section 1.2.3 in the textbook.