01-22-25 MTH 161-C06N

26 class meetings, not counting exam days
27 textbook sections
27/26=1.0385
About 1 textbook section per class meeting

1 Relations and Functions

1.1 Sets of Real Numbers and the Cartesian Coordinate Plane

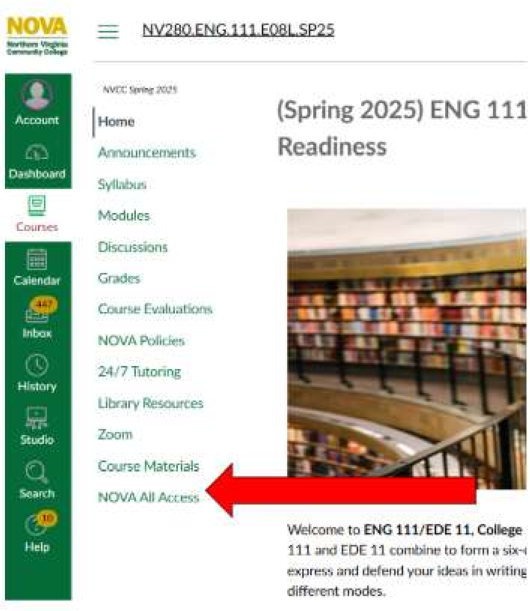
1.1.4 Exercises

page 14: 1, 3, 5, 11, 17, 23, 31

NOVA ALL ACCESS TEXTBOOK PROGRAM: When you register for classes each semester, you're automatically enrolled in NOVA All Access and charged a fee of $22.50 per credit hour. The fee will appear on your student account, along with your tuition and other fees. **YOU** need to decide if the fee benefits you. And **YOU** need to opt out if it does not save you money. Complete details about the NOVA All Access program are available here.

How do you determine if the program saves you money? Use this Google Sheets calculator tool to decide whether the All Access cost is higher than your materials would cost to get on your own. Here is a video tutorial about how to use the Google Sheets calculator tool.

How do you opt out if it does not save you money? If the program does not save you money, YOU CAN OPT OUT and get your money back to buy your textbooks independently. For most students, the opt out deadline will be February 6. Click here and click a SMALL link just above FREQUENTLY ASKED QUESTIONS that says "Opt Out of NOVA All-Access."



EXPLAIN TO YOUR STUDENTS HOW TO USE THE "CALCULATOR" TOOL: The NOVA All Access Calculator Tool is designed to guide students to make an informed choice about their textbooks. When they click on the link, they will be asked "Would you like to make a copy of NOVA All Access Calculator?" That will lead them to a tool to guide them through figuring out whether the program benefits them. Here is a video tutorial to guide students.

Copy of NOVA All Access Calculator

File Edit View Insert Format Data Tools Extensions Help

1. Make sure you have read your syllabi for all classes and consulted with the professor to ensure you know all the required books and materials.

NOVA All Access

Use this calculator to make an informed decision about the value of NOVA All Access for you. If you opt-out, you will need to obtain your textbooks (physical or digital) on your own (by the college bookstore or another source).

1. Make sure you have read your syllabi for all classes and consulted with the professor to ensure you know all the **required** books and materials.
2. In column 1, enter the names all of the courses you are taking this term.
3. In column 2, enter the names for all the required books.
4. In column 3, enter the number of credits each course contains;
   you can find this number on the NOVA schedule of classes (look for a number followed by CR immediately following the course number -- i.e. **ENG 111 - College Composition I (3 CR)) or your student schedule in SIS. (look for the column that lists "units")
5. In column 4, enter the TOTAL cost for the books in this course. You can use the college store, nvcc.bncollege.com or the cost at whatever store you use to buy books.
6. Finally, in column 5, you will see the cost for each class to use NOVA All Access.

Course	Required books	Number of credits	Cost of materials (available on nvcc.bncollege.com or wherever you get your materials)	NOVA All Access cost ($22.50/credit)	
Example 101	Examples and other examples	2	$150.00	$45.00	
Example 102	None	3	$0.00	$67.50	
Example 104	More examples and references	3	$75.00	$67.50	
Example 105	Digital examples by subscription	3	$200.00	$67.50	
				$0.00	
				$0.00	
				$0.00	
				$0.00	
				$0.00	Difference
	Total	11	$425.00	$247.50	$177.50

If the Difference category is red, you should opt-out of All Access. If it is green, you should stay in All Access.

1.1

Memorize

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.

Ways to Describe Sets

1. **The Verbal Method:** Use a sentence to define a set.
2. **The Roster Method:** Begin with a left brace '{', list each element of the set *only once* and then end with a right brace '}'.
3. **The Set-Builder Method:** A combination of the verbal and roster methods using a "dummy variable" such as x.

$A_1 = \{1, 2, 3\} = \{3, 2, 1\} = \{1, 2, 3, 1\}$

$A_2 = \{x \mid 1 \le x \le 3\}$

= the set of all x such that
x is greater than or equal to 1
and x is less than or equal to 3

$x \in A_1$ x is an element (member) of set A

$x \notin A_1$ " " not "

$1 \in A_1$ True

$4 \in A_1$ False

$1.5 \notin A_1$

$1.5 \in A_2$

$A_2 = \{x \mid x$ is an integer and $1 \le x \le 3\}$

use list notation for B = set of all stars use list notation for B = set of all stars in our galaxy

use set builder for C = { ice cream cone, π, California, dog }

memorize

Sets of Numbers

1. The **Empty Set**: $\emptyset = \{\} = \{x \mid x \neq x\}$. This is the set with no elements. Like the number '0,' it plays a vital role in mathematics.[a]

2. The **Natural Numbers**: $\mathbb{N} = \{1, 2, 3, \ldots\}$ The periods of ellipsis here indicate that the natural numbers contain 1, 2, 3, 'and so forth'.

3. The **Whole Numbers**: $\mathbb{W} = \{0, 1, 2, \ldots\}$

4. The **Integers**: $\mathbb{Z} = \{\ldots, -3, -2, -1, 0, 1, 2, 3, \ldots\}$

5. The **Rational Numbers**: $\mathbb{Q} = \left\{\frac{a}{b} \mid a \in \mathbb{Z} \,\text{and}\, b \in \mathbb{Z}\right\}$. Rational numbers are the ratios of integers (provided the denominator is not zero!) It turns out that another way to describe the rational numbers[b] is:

$$\mathbb{Q} = \{x \mid x \text{ possesses a repeating or terminating decimal representation.}\}$$

6. The **Real Numbers**: $\mathbb{R} = \{x \mid x \text{ possesses a decimal representation.}\}$

7. The **Irrational Numbers**: $\mathbb{P} = \{x \mid x \text{ is a non-rational real number.}\}$ Said another way, an irrational number is a decimal which neither repeats nor terminates.[c]

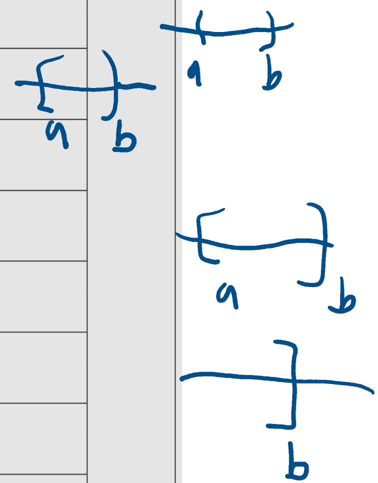
8. The **Complex Numbers**: $\mathbb{C} = \{a + bi \mid a, b \in \mathbb{R} \text{ and } i = \sqrt{-1}\}$ Despite their importance, the complex numbers play only a minor role in the text.[d]

[a] . . . which, sadly, we will not explore in this text.
[b] See Section 9.2.
[c] The classic example is the number π (See Section 10.1), but numbers like $\sqrt{2}$ and $0.101001000100001\ldots$ are other fine representatives.
[d] They first appear in Section 3.4 and return in Section 11.7.

Interval Notation

Let a and b be real numbers with $a < b$.

Set of Real Numbers	Interval Notation	Region on the Real Number Line
$\{x \mid a < x < b\}$	(a, b)	a b
$\{x \mid a \le x < b\}$	$[a, b)$	a b
$\{x \mid a < x \le b\}$	$(a, b]$	a b
$\{x \mid a \le x \le b\}$	$[a, b]$	a b
$\{x \mid x < b\}$	$(-\infty, b)$	b
$\{x \mid x \le b\}$	$(-\infty, b]$	b
$\{x \mid x > a\}$	(a, ∞)	a
$\{x \mid x \ge a\}$	$[a, \infty)$	a
$\mathbb{R}$	$(-\infty, \infty)$	



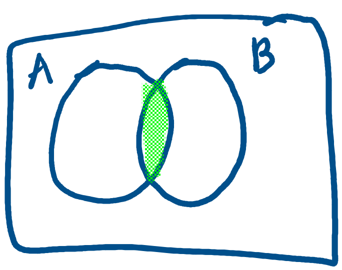
Memorize

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: $A \cup B = \{x \mid x \in A \text{ or } x \in B \text{ (or both)}\}$

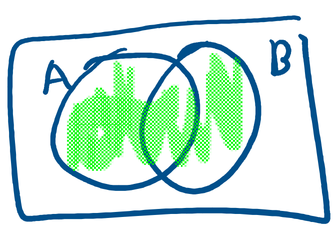
Venn diagram

$A \cap B$



U = universe of discourse

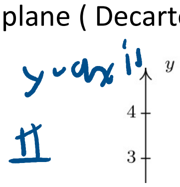
$A \cup B$



U

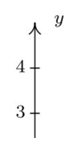
Memorize

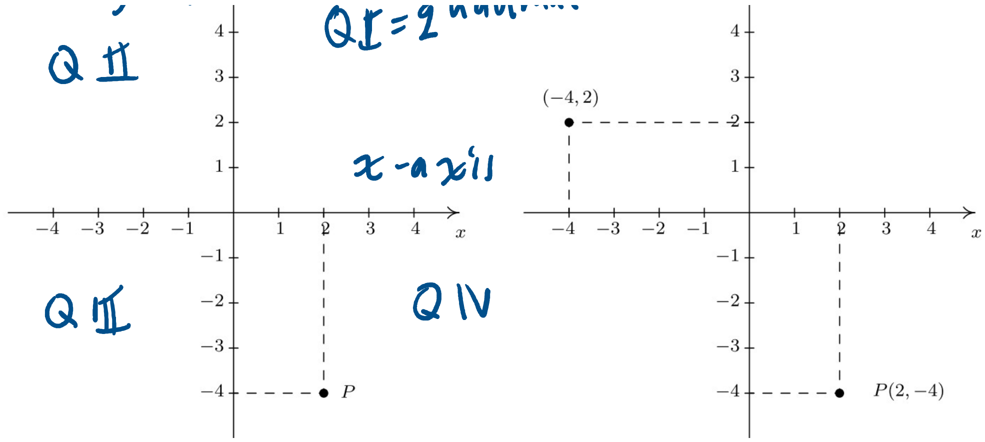
Cartesian plane (Decartes)



QI = quadrant I

$(-4, 2)$

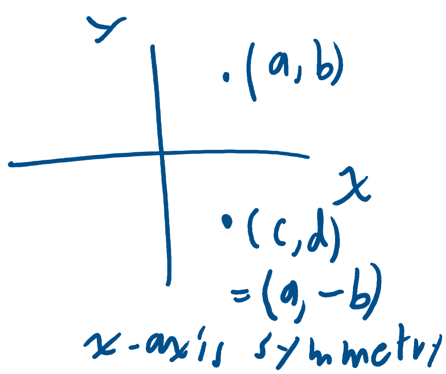




Memorize

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

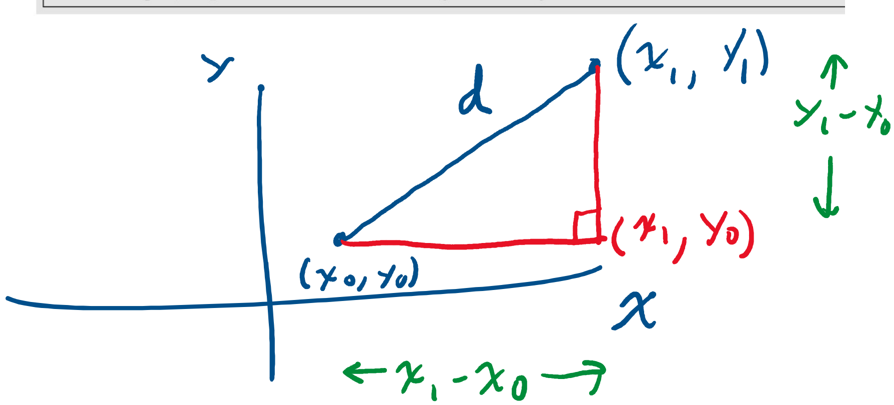
- **symmetric about the x-axis** if $a = c$ and $b = -d$
- **symmetric about the y-axis** if $a = -c$ and $b = d$
- **symmetric about the origin** if $a = -c$ and $b = -d$



Reflections

To reflect a point (x, y) about the:

- x-axis, replace y with $-y$.
- y-axis, replace x with $-x$.
- origin, replace x with $-x$ and y with $-y$.



Pythagorean theorem

$$(x_1 - x_0)^2 + (y_1 - y_0)^2 = d^2$$

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

memorize

distance formula

Memorize

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:

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

[Don Goral Home Page]