

It's A Parallelogram, You Say?

ID: 11647

Time Required
20 minutes

Activity Overview

In this interactive activity, students represent complex numbers in the complex plane as points or vectors and display the sum and difference of two complex numbers as diagonals of the parallelograms they define.

Topic: Complex Numbers

- *Addition/Subtraction of Complex Numbers*
- *Vector Addition/Subtraction*
- *Parallelogram Method*
- *Resultant*

Teacher Preparation and Notes

- *Problems 1 and 2 may be done in class, and Problem 3 could either be done in class or assigned as homework. Questions may be answered on the associated worksheet.*
- *Use `ctrl` + `▶` to move to the next page and use `ctrl` + `tab` to move between regions on a split screen page.*
- ***To download the student and solution TI-Nspire documents (.tns files) and student worksheet, go to education.ti.com/exchange and enter "11647" in the keyword search box.***

Associated Materials

- *ItsAParallelogramYouSay_Student.doc*
- *ItsAParallelogramYouSay.tns*
- *ItsAParallelogramYouSay_Soln.tns*

Suggested Related Activity

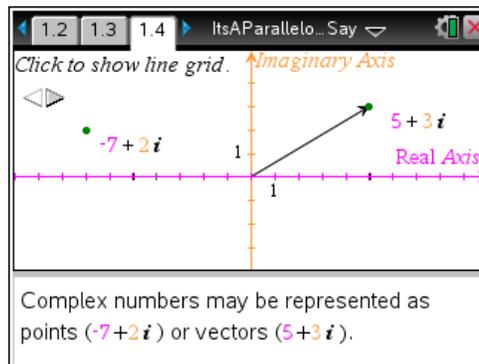
To download any activity listed, go to education.ti.com/exchange and enter the number in the keyword search box.

- *Complex Numbers (TI-Nspire technology) — 10888*

Problem 1 – Adding Complex Numbers

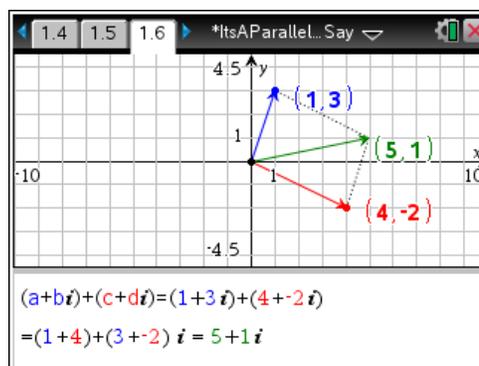
In this activity, students are introduced to representing complex numbers in the complex coordinate plane both as points and as vectors.

Explain to students that the coordinate for both the end of the vector and the point is (real, imaginary). So on page 1.4, the coordinate for $-7 + 2i$ is $(-7, 2)$ and for $5 + 3i$ is $(5, 3)$. Students can verify this using the **Coordinates and Equations** tool. Students can move the point or vector to explore other values. They can click the slider to show the line grid.

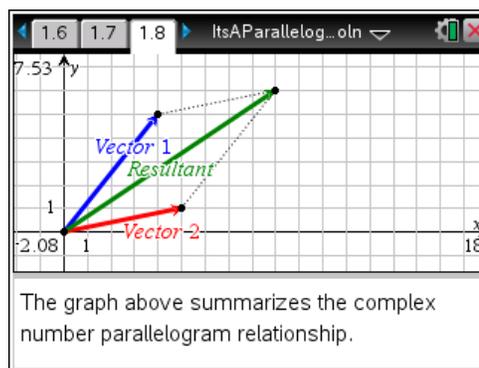


On page 1.6 students may explore the addition of $(a + bi)$ and $(c + di)$ by grabbing the point at the tip of a complex number vector and dragging it on the graph.

Encourage students to explore addition of complex numbers on this page. If TI-Nspire software is available, display and modify this graph with students as a class. Ask students to come up with four of their own complex number addition problems with solutions in each of the four quadrants.



Students should develop the understanding that the resultant is the sum of the complex numbers represented by the two consecutive sides joined at the origin. After students have completed the first problem, share with them the diagram from the solution TI-Nspire document page 1.8, which explains the relationship between the coordinates of the tip of the resultant and the values of the complex numbers being added.

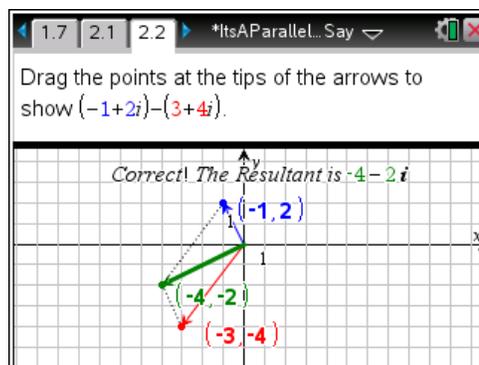


Problem 2 – Subtracting Complex Numbers

Page 2.1 explains how to change the subtraction of two complex numbers to addition by changing the signs of the second number.

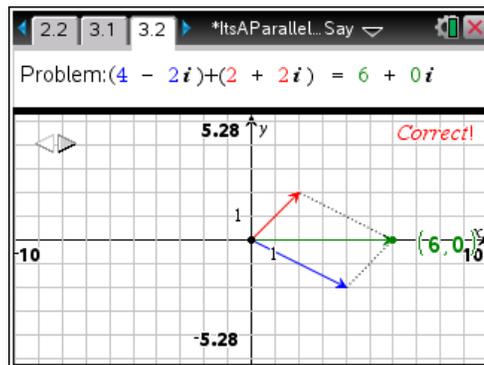
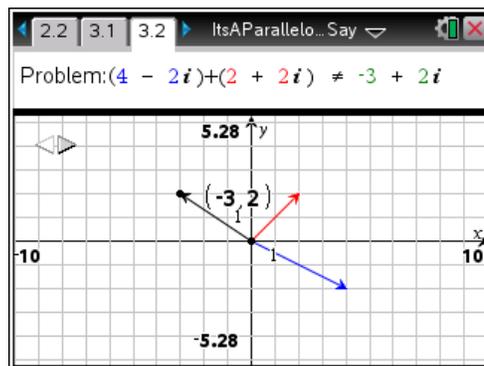
$$(a + bi) - (c + di) = (a + bi) + (-c - di)$$

On page 2.2, students will practice the subtraction of two complex numbers graphically by starting with a vector parallelogram and dragging the tips to the locations that correspond to the given complex numbers.



Problem 3 – Random Addition Practice

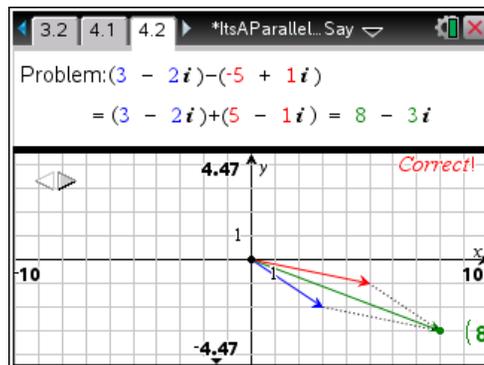
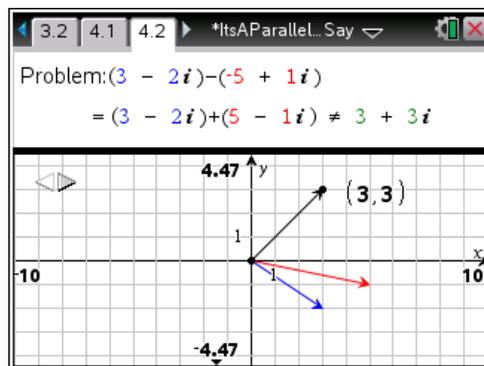
Problem 3 provides an opportunity for additional practice with using parallelograms to add complex numbers. They are to grab and drag the points of the resultant vector to the appropriate coordinates for the sum. Challenge students to also find the sum algebraically. Students can click on the slider to get a new problem as many times as they like. Once a student finds the correct answer the notes page shows an equal sign and they will get a correct message on the graphs screen.



Problem 4 – Random Subtraction Practice

Problem 4 provides an opportunity for additional practice with using parallelograms to subtract complex numbers. They are to grab and drag the points of the resultant vector to the appropriate coordinates for the subtraction. Challenge students to also find the subtraction algebraically. Students can click on the slider to get a new problem as many times as they like. Once a student finds the correct answer the notes page shows an equal sign and they will get a correct message on the graphs screen.

Note that the vector drawn is the opposite of the vector being subtracted.



There are 7 addition and subtraction problems that may be done in class or assigned as homework. Questions may be answered on the associated worksheet.

1. $-3 + 5i$

2. $7 + i$

3. $-7 + 3i$

4. $-5 - i$

5. $-4 - 4.3i$

6. $1.6 - 0.9i$

7. 0