Complex Numbers

ID: 10888

Time required
15 minutes

Activity Overview

In this activity, students calculate problems from the student worksheet to determine the rules for adding, subtracting, multiplying, and dividing complex numbers.

Topic: Numbers & Number Systems

- *Operations with Complex Numbers*

Teacher Preparation and Notes

- *A TI-Nspire™ document is provided, but is not necessary for students to complete this activity. If you wish, the file should be downloaded to student calculators. You will need to edit the student worksheet if you do not use the pre-made TI-Nspire document.*
- *Tech notes: Use [ctrl] + ▶ or [ctrl] + ◀ to change pages. Also, use the [π▸] and select **i** to enter the imaginary number.*
- *Students have space on the handout to write solutions. If you are using TI-Nspire™, students can insert a Notes application Page and type their explanations for collection.*
- *Multiplying by the complex conjugate is not a part of this activity. It is a natural extension for after this activity.*
- ***To download the student TI-Nspire document (.tns file) and student worksheet, go to education.ti.com/exchange and enter "10888" in the Search by Keyword Box.***

Associated Materials

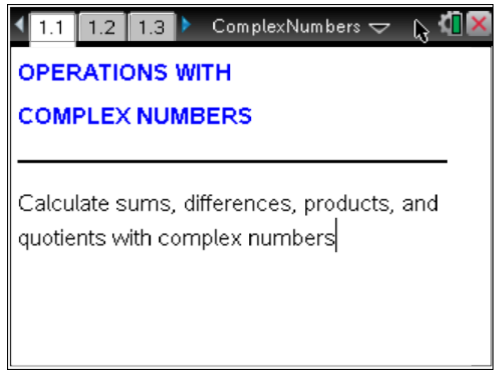
- *ComplexNumbers_Student.doc*
- *ComplexNumbers.tns*
- *ComplexNumbers_Teacher.doc*

Suggested Related Activities

To download any activity listed, go to education.ti.com/exchange and enter the number in the Search by Keyword Box.

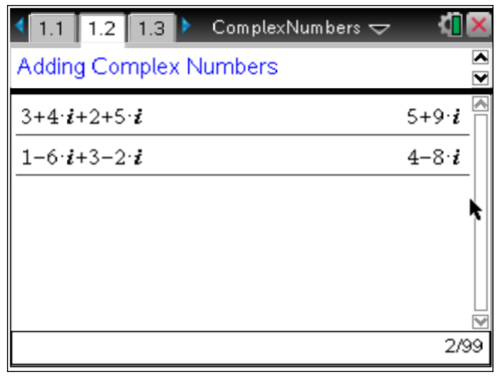
- *Complex Numbers: Plotting and Polar Form (TI-Nspire technology) — 8908*
- *Steady State Circuit Analysis & Filter Design (TI-89 Titanium) — 3063*

Students will enter problems in the *Calculator* application and record answers on the student worksheet. Student should work in pairs or small groups in order to help look for patterns and determine an algorithm for operations with complex numbers.



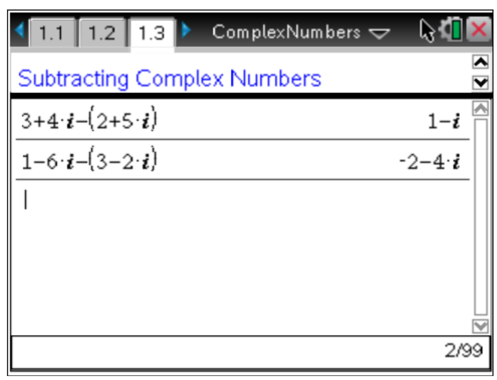
Adding Complex Numbers

Students will use page 1.2 to find an algorithm for adding complex numbers and solve some addition problems. Encourage students to try solving the problems on their own before entering the problems in the *Calculator* application. Students may mention that adding two complex numbers is similar to adding two binomial expressions, such as
(2 + 3*x*) + (5 – 4*x*)



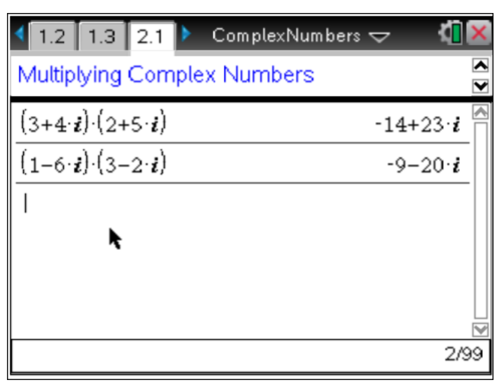
Subtracting Complex Numbers

On page 1.3, students will explore subtracting complex numbers. Students should discover that subtracting complex numbers is similar to adding complex numbers.



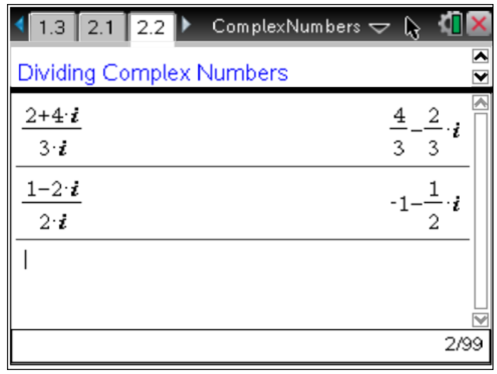
Multiplying Complex Numbers

Students will move on to multiplying complex numbers. If students have trouble seeing why there is no i^2 term in the answers, encourage them to work through the problems by hand and use $\sqrt{-1}$ instead of *i*. Students should see $i^2 = i \cdot i = \sqrt{-1} \cdot \sqrt{-1} = -1$.



Dividing Complex Numbers

Students will divide a complex number by another complex number. In order to explain why *i* is not in the denominator of the answers, tell students to think of possible ways to eliminate the *i* in the denominator. Students should recall $i \cdot i = \sqrt{-1} \cdot \sqrt{-1} = -1$. What happens if this was changed to *i* • –*i*?



Solutions – Student worksheet

Adding Complex Numbers

1. 5 + 9*i*
2. 4 – 8*i*
3. 8 – 3*i*
4. –1 + *i*
5. –1 –10*i*
6. Sample answer: when adding two complex numbers, add the real parts together and then add complex parts together.

Subtracting Complex Numbers

1. 1 – *i*
2. –2 – 4*i*
3. –4 + 13*i*
4. –3 + 5*i*
5. 9 + 4*i*
6. Sample answer: when subtracting two complex numbers, subtract the real parts and then subtract complex parts.

Multiplying Complex Numbers

1. –14 + 23*i*
2. –9 – 20*i*
3. Sample answer: there is no i^2 in the answers because $i^2 = i \cdot i = \sqrt{-1} \cdot \sqrt{-1} = -1$
4. 52 + 14*i*
5. 4 + 7*i*
6. –41 – 13*i*
7. Sample answer: when multiplying two complex numbers, apply the Distributive Property, and replace i^2 with –1, and simplify.

Dividing Complex Numbers

1. $\frac{4}{3} - \frac{2}{3}i$
2. $-1 - \frac{1}{2}i$
3. Sample answer: there is no *i* in the denominator because *i* is its own reciprocal. This is shown here: $\frac{1}{i} = i^{-1} = \left(\sqrt{-1}\right)^{-1} = \left((-1)^{\frac{1}{2}}\right)^{-1} = (-1)^{-\frac{1}{2}} = \left((-1)^{-1}\right)^{\frac{1}{2}} = (-1)^{\frac{1}{2}} = \sqrt{-1} = i$
4. Sample answer: multiplying the denominator by –*i* will eliminate the imaginary part. If the denominator is multiplied by –*i*, then the numerator must also be multiplied by –*i*.
5. $\frac{-3}{4} - \frac{1}{2}i$
6. $\frac{7}{3} + \frac{4}{3}i$
7. $\frac{-5}{2} + 4i$
8. Sample answer: when dividing two complex numbers, if there is an *i* in the denominator, multiply the numerator and the denominator by *i* to eliminate the imaginary part in the denominator. * Complex conjugates will be studied at another time.