**Curriculum Sample Template**
Max.8Pages

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|---|---|---|---|
| **Grade Level** | 11 | **Content Area** | Mathematics |
| **Course Title** (grades9-12Only) | Algebra II | | |
| **Expected Prior Knowledge**<br>*The knowledge/skills mastered earlier in the year foundational to the mastery of the required Standard in the current sample.* | Students are expected to be able to find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers. | | |
| **Alignment to Program of Instruction**<br>*Briefly outline methods of instruction found in this sequence of lessons that align to the Program of Instruction described in A.3.* | As project based learning is a key feature in the school's mission, students will apply knowledge gained in math to complete projects and solve real world issues, and some may even be cross curricular. Lessons are aligned to both the program of instruction and common core standards by scaffolding knowledge, engaging students and requiring them to use higher depths of knowledge to demonstrate mastery and solve real world problems. | | |
| **Standard Number and Description**<br>*List the Number* and full description for the required Standard.* | N.CN.4<br>Represent complex numbers on the complex plane in rectangular and polar form (including real and imaginary numbers), and explain why the rectangular and polar forms of a given complex number represent the same number. | | |
| **Materials/Resources Needed** | All required class worksheets and tests | | |

****StandardNumber**:ForEnglishLanguageArts(ReadingandWriting),useGrade,Strand,Standard(e.g.,3.RI.2).ForK-8Math,useGrade,Domain,Standard(e.g.,6.EE.7).ForHSMath,useConceptualCategory-Domain,Standard(e.g.,A-REI.6).ForScience,useGrade,Strand,Concept,PO(e.g.,4.1.3.1).*

| **Lesson** (add as needed | **Instruction** | **Student Activities** |
|---|---|---|
| **1** | **Objective: SWBAT Represent complex numbers on the complex plane in rectangular and polar form (including real and imaginary numbers), and explain why the rectangular and polar forms of a given complex number represent the same number.**<br>Teacher introduces the standard and vocabulary and definition of rectangular and polar forms and shows how to represent complex numbers on a complex plane in both forms. Teacher instructs students to take notes in their math notebooks. Teacher gives students a practice worksheet with practice problems, and facilitates guided practice. After students complete the worksheet of practice problems, Teacher then allows students time to review their answers with a partner, correcting work as needed. | Students will learn and take notes on the topic of representing complex numbers on a complex plane both in rectangular and polar form. Students will take notes on instruction and follow along with practice problems on the board by taking notes in their math notebooks. Students then complete an independent practice worksheet. After completion of the worksheet, students will then have the opportunity to compare answers with a partner and correct any incorrect work. |
| **2** | **Objective: SWBAT Represent complex numbers on the complex plane in rectangular and polar form (including real and imaginary numbers), and explain why the rectangular and polar forms of a given complex number represent the same number.**<br>Teacher instructs students to recall the differences between representing a complex number in polar form and in rectangular form. Teacher draws a T-chart, labels each side rectangular and polar, and students pair up and write, in teams, one fact about either the polar or rectangular form; the fact may be how they differentiate. Teacher will introduce method for converting between the forms, demonstrating they are the same number, and instruct students to take notes. Teacher will then give guided practice on worksheet in which students must convert between rectangular and polar forms, showing the same number represented. Teacher will then instruct students to write a total of 6 complex numbers, 3 represented as rectangular forms, and 3 represented as polar forms. Teacher will facilitate activity in which students circulate around the room, each converting another students number until all 6 have been converted, and the student themselves have converted 6 complex numbers. | After Students recall the differences between representing complex numbers on a complex plane in polar and rectangular form, students will share their answer with a neighbor. Pairs will then participate in writing one difference on either side of the T-chart written on the board, which may include a fact or how one form differs from another. Students will then take notes on how to convert between the two forms, learning they both represent the same number. Students will complete a guided practice worksheet, solving to convert between rectangular and polar forms. Students will then write 6 complex numbers, and represent them as 3 of them written in rectangular form, and 3 of them written in complex form. Students will then circulate the room and find another student and will each convert one of the other students; written complex numbers, and write their name next to it. Once students meet up with 6 students, they should have all of their numbers converted, and will have converted 6 other students' complex numbers, one per student. |

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| **3** | **Objective: SWBAT Represent complex numbers on the complex plane in rectangular and polar form (including real and imaginary numbers), and explain why the rectangular and polar forms of a given complex number represent the same number.**<br>Teacher will assign student first summative assessment project, which is to create a how to poster explaining background vocabulary (complex number), the two forms the complex number which may be represented on a complex plane (rectangular or polar) and a description with examples about how to convert between the two forms. Poster must have examples demonstrating the entire process. Teacher will facilitate the beginning of this project during class time, and will provide incentive, such as a prize, for the winning poster that will be laminated and hung in the room after the summative assessment. | Students begin their first summative assessment, in which they will create a poster detailing what a complex number is, how it can be represented on a complex plane (rectangular and polar), and how to convert between the two forms. Students will include an example demonstrating the entire process of representing and converting, while explaining why the two forms represent the same number. |
| **4** | **Objective: SWBAT Represent complex numbers on the complex plane in rectangular and polar form (including real and imaginary numbers), and explain why the rectangular and polar forms of a given complex number represent the same number.**<br>Teacher will distribute second summative assessment in which students write an extended response explaining in detail explaining how to represent complex number on a complex plane in rectangular and polar forms, and the difference between the two. Students must then explain how the same number can be represented in two different forms, and how one can be | Students will complete an extended writing summative assessment during the entire class period. |
| **5** | **Objective: SWBAT Represent complex numbers on the complex plane in rectangular and polar form (including real and imaginary numbers), and explain why the rectangular and polar forms of a given complex number represent the same number.**<br>Teacher will distribute third summative assessment, a written comprehensive assessment. | Students will complete a written comprehensive summative assessment during the entire class period. |

***Paste Summative Assessment Here:***

***1. How To Poster***

| Category | Level 4:<br>Achieves Standards at a High Level | Level 3:<br>Performance at Standard | Level 2:<br>Performance below Standard | Level 1:<br>Demonstrates Minimal Success |
|---|---|---|---|---|
| Mathematical Concepts | Explanation shows complete understanding of the mathematical concepts used to solve the problem(s). 25 points | Explanation shows substantial understanding of the mathematical concepts used to solve the problem(s). 20 points | Explanation shows some understanding of the mathematical concepts needed to solve the problem(s). 15 points | Explanation shows very limited understanding of the underlying concepts needed to solve the problem(s) OR is not written. 10 points |
| Explanation | Explanation is detailed and clear. 25 points | Explanation is clear. 20 points | Explanation is a little difficult to understand, but includes critical components. | Explanation is difficult to understand and is missing several components OR was not included. 10 points |
| Required Elements | Contains all required elements including explanation, conversion and examples. 25 points | Contains required elements but some steps are not clear or are missing. 20 points | Missing one required element. 15 points | Missing two required elements.10 points |
| Mathematical Terminology and Notation | Correct terminology and notation are always used, making it easy to understand what was done. 25 points | Correct terminology and notation are usually used, making it fairly easy to understand what was done. 20 points | Correct terminology and notation are used, but it is sometimes not easy to understand what was done. 15 points | There is little use, or a lot of inappropriate use, of terminology and notation. 10 points |

***2. Extended Writing Summative Assessment***

| Category | Level 4:<br>Achieves Standards at a<br>High Level | Level 3:<br>Performance at Standard | Level 2:<br>Performance below<br>Standard | Level 1:<br>Demonstrates<br>Minimal Success |
|---|---|---|---|---|
| Mathematical Concepts | Explanation shows complete understanding of the mathematical concepts used to solve the problem(s). 25 points. | Explanation shows substantial understanding of the mathematical concepts used to solve the problem(s). 20 points | Explanation shows some understanding of the mathematical concepts needed to solve the problem(s). 15 points | Explanation shows very limited understanding of the underlying concepts needed to solve the problem(s) OR is not written. 10 points |
| Explanation | Explanation is detailed and clear. 25 points | Explanation is clear. 20 points | Explanation is a little difficult to understand, but includes critical components. 15 points | Explanation is difficult to understand and is missing several components OR was not included. 10 points |
| Strategy/ Procedures | Uses an efficient and effective strategy to solve the problem(s). 25 points | Uses an effective strategy to solve the problem(s). 20 points | Sometimes uses an effective strategy to solve problems, but does not do it consistently. 15 points | Rarely uses an effective strategy to solve problems. 10 points |
| Mathematical Terminology and Notation | Correct terminology and notation are always used, making it easy to understand what was done. 25 points | Correct terminology and notation are usually used, making it fairly easy to understand what was done. 20 points | Correct terminology and notation are used, but it is sometimes not easy to understand what was done. 15 points | There is little use, or a lot of inappropriate use, of terminology and notation. 10 points |

***3. Comprehensive Written Assessment***

Select the best answer for each question.

1. Which Polar coordinates correspond to the point below?

$$\left(\frac{3}{2}, \frac{3\sqrt{3}}{2}\right)$$

A $(3, \frac{\pi}{3})$

B $(6, \frac{2\pi}{3})$

C $(3, \frac{2\pi}{3})$

D $(6, \frac{\pi}{3})$

2. Which is the polar form of the following complex number?

$$z = \sqrt{3} - i$$

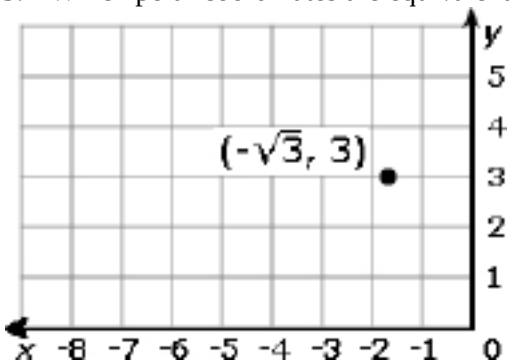
A $z = 2e^{\frac{\pi}{6}i}$

B $z = \sqrt{2}e^{-\frac{\pi}{6}i}$

C $z = 2e^{\frac{11\pi}{6}i}$

D $z = \frac{11\pi}{6}e^{2i}$

3. Which polar coordinates are equivalent to the point below?




A $z = 2e^{\frac{\pi}{6}i}$

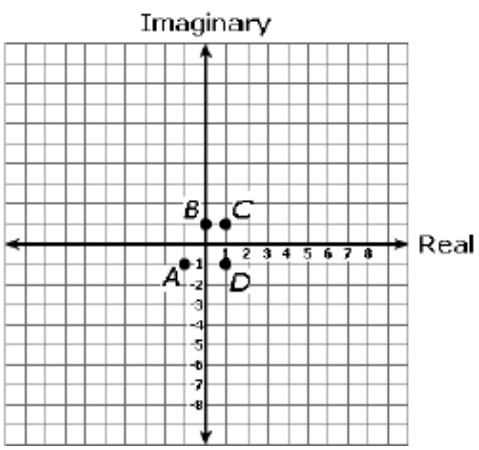
B $z = \sqrt{2}e^{-\frac{\pi}{6}i}$

C $z = 2e^{\frac{11\pi}{6}i}$

D $z = \frac{11\pi}{6}e^{2i}$

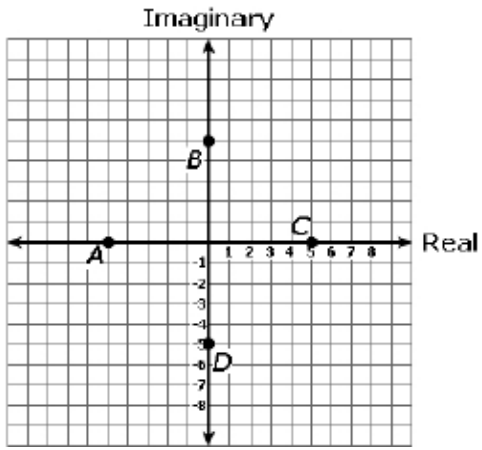
4.

If $i = \sqrt{-1}$, which point shows the location of $-1-i$ on the plane?




A. Point A
B. Point B
C. Point C
D. Point D

5.
If $i = \sqrt{-1}$, which point shows the location of $5i$ on the plane?




A. Point A
B. Point B
C. Point C
D. Point D

Answer Key: 1. A 2.C 3.C 4.A 5.B