**This key should allow you to understand why you choose the option you did (beyond just getting a question right or wrong). More instructions on how to use this key can be found here.**

**If you have a suggestion to make the keys better, please fill out the short survey here.**

*Note: This key is auto-generated and may contain issues and/or errors. The keys are reviewed after each exam to ensure grading is done accurately. If there are issues (like duplicate options), they are noted in the offline gradebook. The keys are a work-in-progress to give students as many resources to improve as possible.*

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1. Choose the **smallest** set of Real numbers that the number below belongs to.

$$-\sqrt{\frac{-2548}{14}}$$

The solution is Not a Real number

A. Not a Real number

   * This is the correct option!

B. Whole

   These are the counting numbers with 0 (0, 1, 2, 3, ...)

C. Rational

   These are numbers that can be written as fraction of Integers (e.g., -2/3)

D. Irrational

   These cannot be written as a fraction of Integers.

E. Integer

   These are the negative and positive counting numbers (..., -3, -2, -1, 0, 1, 2, 3, ...)

**General Comment:** First, you **NEED** to simplify the expression. This question simplifies to $-\sqrt{182}i$.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.

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2. Simplify the expression below into the form $a + bi$. Then, choose the intervals that $a$ and $b$ belong to.

$$\frac{-18 + 33i}{6 + 4i}$$

The solution is $0.46 + 5.19i$

A. $a \in [-1, 3]$ and $b \in [3.4, 5.6]$

   * $0.46 + 5.19i$, which is the correct option.

B. $a \in [-1, 3]$ and $b \in [268.2, 270.5]$

   $0.46 + 270.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

C. $a \in [-4, 0]$ and $b \in [5.9, 9.6]$

$-3.00 + 8.25i$, which corresponds to just dividing the first term by the first term and the second by the second.

D. $a \in [-7, -4]$ and $b \in [-1.6, 4.3]$

$-4.62 + 2.42i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

E. $a \in [20, 26]$ and $b \in [3.4, 5.6]$

$24.00 + 5.19i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

**General Comment:** Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.

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3. Simplify the expression below and choose the interval the simplification is contained within.

$$19 - 9^2 + 18 \div 15 * 20 \div 7$$

The solution is $-58.571$

A. $[-62.1, -59.9]$

-61.991, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

B. $[102.7, 105.8]$

103.429, which corresponds to an Order of Operations error: multiplying by negative before squaring. For example: $(-3)^2 \neq -3^2$

C. $[98.5, 100.2]$

100.009, which corresponds to two Order of Operations errors.

D. $[-61.2, -56.5]$

* -58.571, this is the correct option

E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

**General Comment:** While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.

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4. Simplify the expression below into the form $a + bi$. Then, choose the intervals that $a$ and $b$ belong to.

$$(-6 + 8i)(-2 + 5i)$$

The solution is $-28 - 46i$

A. $a \in [4, 15]$ and $b \in [38, 45]$

$12 + 40i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

B. $a \in [-36, -24]$ and $b \in [42, 48]$

$-28 + 46i$, which corresponds to adding a minus sign in both terms.

C. $a \in [-36, -24]$ and $b \in [-47, -39]$

* $-28 - 46i$, which is the correct option.

D. $a \in [48, 61]$ and $b \in [10, 17]$

$52 + 14i$, which corresponds to adding a minus sign in the second term.

E. $a \in [48, 61]$ and $b \in [-22, -10]$

$52 - 14i$, which corresponds to adding a minus sign in the first term.

**General Comment:** You can treat $i$ as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

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0. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{-825}{0}}i + \sqrt{112}i$$

The solution is Not a Complex Number

A. Nonreal Complex

This is a Complex number $(a + bi)$ that is not Real (has $i$ as part of the number).

B. Not a Complex Number

* This is the correct option!

C. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3 + 5)

D. Irrational

These cannot be written as a fraction of Integers. Remember: $\pi$ is not an Integer!

E. Pure Imaginary

This is a Complex number $(a + bi)$ that **only** has an imaginary part like $2i$.

**General Comment:** Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.

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