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

$$\frac{-9 - 55i}{-4 - 6i}$$

The solution is $7.04 + 3.19i$

A. $a \in [6, 14]$ and $b \in [164, 166.4]$

$7.04 + 166.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

B. $a \in [6, 14]$ and $b \in [1.8, 3.6]$

* $7.04 + 3.19i$, which is the correct option.

C. $a \in [-11, -4]$ and $b \in [4.2, 6.3]$

$-5.65 + 5.27i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

D. $a \in [365, 372]$ and $b \in [1.8, 3.6]$

$366.00 + 3.19i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

E. $a \in [0, 3]$ and $b \in [8, 11.2]$

$2.25 + 9.17i$, which corresponds to just dividing the first term by the first term and the second by the second.

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

$$(8 - 10i)(-7 + 4i)$$

The solution is $-16 + 102i$

A. $a \in [-60, -54]$ and $b \in [-40.1, -38.4]$

$-56 - 40i$, 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. $a \in [-99, -92]$ and $b \in [37.5, 39.2]$

$-96 + 38i$, which corresponds to adding a minus sign in the second term.

C. $a \in [-25, -9]$ and $b \in [99.7, 102.2]$

* $-16 + 102i$, which is the correct option.

D. $a \in [-25, -9]$ and $b \in [-104.1, -101.4]$

$-16 - 102i$, which corresponds to adding a minus sign in both terms.

E. $a \in [-99, -92]$ and $b \in [-39.8, -36.2]$

$-96 - 38i$, which corresponds to adding a minus sign in the first term.

General Comments: 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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3. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{-660}{11}}i + \sqrt{90}i$$

The solution is Nonreal Complex

A. Nonreal Complex

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

B. Irrational

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

C. Pure Imaginary

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

D. Not a Complex Number

This is not a number. The only non-Complex number we know is dividing by 0 as this is not a number!

E. Rational

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

General Comments: 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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4. Simplify the expression below and choose the interval the simplification is contained within.

$$17 - 1^2 + 5 \div 15 * 3 \div 8$$

The solution is 16.125

A. $[17.97, 18.03]$

18.014000, which corresponds to two Order of Operations errors.

B. $[15.96, 16.03]$

16.014000, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

C. $[16.09, 16.3]$

* 16.125000, this is the correct option

D. $[18.08, 18.16]$

18.125000, which corresponds to an Order of Operations error: multiplying by negative before squaring. For example: $(-3)^2 \neq -3^2$

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 Comments: 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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5. Choose the **smallest** set of Real numbers that the number below belongs to.

$$\sqrt{\frac{720}{12}}$$

The solution is Irrational

A. Irrational

These cannot be written as a fraction of Integers.

B. Rational

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

C. Whole

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

D. Integer

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

E. Not a Real number

These are Nonreal Complex numbers OR things that are not numbers (dividing by 0).

General Comments: First, you **NEED** to simplify the expression. This question simplifies to $\sqrt{60}$.

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.
