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.

$$(-7 + 4i)(-5 + 10i)$$

The solution is $-5 - 90i$

A. $a \in [73, 81]$ and $b \in [49, 51]$

$75 + 50i$, which corresponds to adding a minus sign in the second term.

B. $a \in [73, 81]$ and $b \in [-56, -49]$

$75 - 50i$, which corresponds to adding a minus sign in the first term.

C. $a \in [-9, -1]$ and $b \in [-91, -82]$

* $-5 - 90i$, which is the correct option.

D. $a \in [32, 41]$ and $b \in [32, 41]$

$35 + 40i$, 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.

E. $a \in [-9, -1]$ and $b \in [86, 94]$

$-5 + 90i$, which corresponds to adding a minus sign in both terms.

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

$$14 - 4 \div 12 * 17 - (5 * 16)$$

The solution is -71.667

A. $[-80, -70]$

* -71.667, which is the correct option.

B. $[-71, -60]$

-66.020, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

C. $[51, 59]$

53.333, which corresponds to not distributing a negative correctly.

D. $[87, 95]$

93.980, which corresponds to not distributing addition and subtraction correctly.

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

$$\sqrt{\frac{1020}{12}} + 6i^2$$

The solution is Irrational

A. Pure Imaginary

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

B. Nonreal Complex

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

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: π is not an Integer!

E. 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!

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

$$\sqrt{\frac{22}{0}}$$

The solution is Not a Real Number

A. Integer

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

B. Not a Real number

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

C. Whole

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

D. Rational

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

E. Irrational

These cannot be written as a fraction of Integers.

General Comments: First, you **NEED** to simplify the expression. This question simplifies to $\sqrt{\frac{22}{0}}$.

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

$$\frac{54 + 55i}{-2 - 4i}$$

The solution is $-16.40 + 5.30i$

A. $a \in [5, 13]$ and $b \in [-17, -15.6]$

   $5.60 - 16.30i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

B. $a \in [-22, -14]$ and $b \in [104.6, 109.5]$

   $-16.40 + 106.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

C. $a \in [-22, -14]$ and $b \in [4.8, 7.8]$

   * $-16.40 + 5.30i$, which is the correct option.

D. $a \in [-33, -26]$ and $b \in [-14.2, -13.7]$

   $-27.00 - 13.75i$, which corresponds to just dividing the first term by the first term and the second by the second.

E. $a \in [-331, -322]$ and $b \in [4.8, 7.8]$

   $-328.00 + 5.30i$, 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 $2 - 3i$.
