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.

$$\frac{-27 - 44i}{-5 + 2i}$$

The solution is $1.62 + 9.45i$, which is option B.

A. $a \in [4, 6.5]$ and $b \in [-23, -21.5]$ $5.40 - 22.00i$, which corresponds to just dividing the first term by the first term and the second by the second.

B. $a \in [1, 2]$ and $b \in [8.5, 10]$* $1.62 + 9.45i$, which is the correct option.

C. $a \in [6.5, 8.5]$ and $b \in [4, 6.5]$ $7.69+5.72i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

D. $a \in [1, 2]$ and $b \in [273.5, 275.5]$ $1.62 + 274.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

E. $a \in [46, 48]$ and $b \in [8.5, 10]$ $47.00 + 9.45i$, 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 $2-3i$.

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

$$(10 + 9i)(-5 + 8i)$$

The solution is $-122 + 35i$, which is option B.

A. $a \in [-52, -49]$ and $b \in [66, 76]$ $-50 + 72i$, 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. $a \in [-125, -120]$ and $b \in [34, 39]$* $-122 + 35i$, which is the correct option.

C. $a \in [22, 26]$ and $b \in [122, 130]$ $22 + 125i$, which corresponds to adding a minus sign in the first term.

D. $a \in [22, 26]$ and $b \in [-131, -121]$ $22 - 125i$, which corresponds to adding a minus sign in the second term.

E. $a \in [-125, -120]$ and $b \in [-36, -33]$ $-122 - 35i$, which corresponds to adding a minus sign in both terms.

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.

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

$$12 - 2 \div 19 * 15 - (16 * 8)$$

The solution is -117.579, which is option C.

A. $[-116.69, -114.87]$ -116.007, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

B. $[-45.23, -43.82]$ -44.632, which corresponds to not distributing a negative correctly.

C. $[-119.32, -116.81]$* -117.579, which is the correct option.

D. $[138.83, 140.78]$ 139.993, 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 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.

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

$$\frac{0}{-9\pi} + \sqrt{9}i$$

The solution is Pure Imaginary, which is option C.

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

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

C. Pure Imaginary* This is the correct option!

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

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

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.

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

$$-\sqrt{\frac{-1170}{13}}$$

The solution is Not a Real number, which is option B.

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

B. Not a Real number* This is the correct option!

C. IrrationalThese cannot be written as a fraction of Integers.

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

E. IntegerThese 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 $-\sqrt{90}i$.

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.