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.

$$\frac{-18-44i}{-8+5i}$$

The solution is $-0.85+4.97i$, which is option B.

A. $a \in [1.5, 3]$ and $b \in [-9.5, -8]$ $2.25-8.80i$, which corresponds to just dividing the first term by the first term and the second by the second.

B. $a \in [-2, -0.5]$ and $b \in [4, 5.5]$* $-0.85+4.97i$, which is the correct option.

C. $a \in [2.5, 4.5]$ and $b \in [1.5, 3.5]$ $4.09+2.94i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

D. $a \in [-76.5, -75]$ and $b \in [4, 5.5]$ $-76.00+4.97i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

E. $a \in [-2, -0.5]$ and $b \in [441, 442.5]$ $-0.85+442.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

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.

$$(-4+3i)(-9+8i)$$

The solution is $12-59i$, which is option B.

A. $a \in [60, 64]$ and $b \in [-12, -3]$ $60-5i$, which corresponds to adding a minus sign in the first term.

B. $a \in [7, 13]$ and $b \in [-59, -58]$* $12-59i$, which is the correct option.

C. $a \in [60, 64]$ and $b \in [4, 6]$ $60+5i$, which corresponds to adding a minus sign in the second term.

D. $a \in [36, 37]$ and $b \in [24, 28]$ $36+24i$, 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. $a \in [7, 13]$ and $b \in [57, 65]$ $12+59i$, 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.

$$2-13^2+12 \div 7 * 18 \div 16$$

The solution is -165.071, which is option D.

A. $[172.37, 173.16]$ 172.929, which corresponds to an Order of Operations error: multiplying by negative before squaring. For example: $(-3)^2 \neq -3^2$

B. $[169.59, 171.39]$ 171.006, which corresponds to two Order of Operations errors.

C. $[-167.31, -165.85]$ -166.994, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

D. $[-165.65, -164.49]$* -165.071, 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.

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

$$\sqrt{\frac{980}{0}} + \sqrt{221}i$$

The solution is Not a Complex Number, which is option D.

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

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

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

D. Not a Complex Number* This is the correct option!

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.

$$-\sqrt{\frac{304704}{576}}$$

The solution is Integer, which is option B.

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

B. Integer* This is the correct option!

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

D. Not a Real numberThese are Nonreal Complex numbers **OR** things that are not numbers (e.g., dividing by 0).

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

General Comment: First, you **NEED** to simplify the expression. This question simplifies to -552.

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.