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.

$$\frac{-36 - 88i}{6 + i}$$

The solution is $-8.22 - 13.30i$

A. $a \in [-3.87, -3.45]$ and $b \in [-16.4, -14.5]$

$-3.46 - 15.24i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

B. $a \in [-8.27, -7.2]$ and $b \in [-493.1, -490.7]$

$-8.22 - 492.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

C. $a \in [-8.27, -7.2]$ and $b \in [-13.8, -12.2]$

* $-8.22 - 13.30i$, which is the correct option.

D. $a \in [-304.04, -303.28]$ and $b \in [-13.8, -12.2]$

$-304.00 - 13.30i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

E. $a \in [-6.36, -5.23]$ and $b \in [-88.9, -86.1]$

$-6.00 - 88.00i$, 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.

$$(7 + 9i)(2 + 6i)$$

The solution is $-40 + 60i$

A. $a \in [-43, -34]$ and $b \in [57, 63]$

* $-40 + 60i$, which is the correct option.

B. $a \in [12, 17]$ and $b \in [51, 57]$

$14 + 54i$, 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.

C. $a \in [64, 69]$ and $b \in [19, 27]$

$68 + 24i$, which corresponds to adding a minus sign in the first term.

D. $a \in [-43, -34]$ and $b \in [-66, -54]$

$-40 - 60i$, which corresponds to adding a minus sign in both terms.

E. $a \in [64, 69]$ and $b \in [-27, -17]$

$68 - 24i$, which corresponds to adding a minus sign in the second 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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3. Simplify the expression below and choose the interval the simplification is contained within.

$$1 - 20 \div 17 * 13 - (12 * 16)$$

The solution is -206.294

A. $[188, 195]$

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

B. $[-196, -186]$

-191.090, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

C. $[-421, -420]$

-420.706, which corresponds to not distributing a negative correctly.

D. $[-218, -202]$

* -206.294, which 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. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\frac{\sqrt{55}}{17} + \sqrt{-6}i$$

The solution is Irrational

A. Pure Imaginary

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

B. Rational

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

C. 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!

D. Nonreal Complex

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

E. Irrational

* This is the correct option!

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

$$\sqrt{\frac{23104}{361}}$$

The solution is Whole

A. Whole

* This is the correct option!

B. Integer

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

C. Rational

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

D. Not a Real number

These are Nonreal Complex numbers **OR** things that are not numbers (e.g., dividing by 0).

E. Irrational

These cannot be written as a fraction of Integers.

General Comment: First, you **NEED** to simplify the expression. This question simplifies to 152.

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.
