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 and choose the interval the simplification is contained within.

$$2 - 14^2 + 10 \div 8 * 7 \div 15$$

The solution is -193.417

A. $[-193.9, -192.74]$

* -193.417000, this is the correct option

B. $[197.02, 198.21]$

198.012000, which corresponds to two Order of Operations errors.

C. $[-194.43, -193.68]$

-193.988000, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

D. $[198.41, 199.08]$

198.583000, 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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2. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\frac{\sqrt{90}}{5} + \sqrt{-4}i$$

The solution is Irrational

A. Rational

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

B. 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!

C. Irrational

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

D. Pure Imaginary

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

E. Nonreal Complex

This is a Complex number $(a + bi)$ that is not Real (has i as part of the 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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3. Choose the **smallest** set of Real numbers that the number below belongs to.

$$-\sqrt{\frac{14400}{64}}$$

The solution is Integer

A. Not a Real number

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

B. Irrational

These cannot be written as a fraction of Integers.

C. Integer

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

D. Whole

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

E. Rational

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

General Comments: First, you **NEED** to simplify the expression. This question simplifies to -120.

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

$$(-5 + 3i)(9 - 6i)$$

The solution is $-27 + 57i$

A. $a \in [-28, -25]$ and $b \in [54, 60]$

* $-27 + 57i$, which is the correct option.

B. $a \in [-64, -62]$ and $b \in [-4, 1]$

$-63 - 3i$, which corresponds to adding a minus sign in the second term.

C. $a \in [-64, -62]$ and $b \in [0, 6]$

$-63 + 3i$, which corresponds to adding a minus sign in the first term.

D. $a \in [-28, -25]$ and $b \in [-60, -55]$

$-27 - 57i$, which corresponds to adding a minus sign in both terms.

E. $a \in [-52, -43]$ and $b \in [-23, -16]$

$-45 - 18i$, 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.

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

$$\frac{9 - 44i}{-6 + 2i}$$

The solution is $-3.55 + 6.15i$

A. $a \in [-0.7, 2.6]$ and $b \in [6.5, 7.3]$

$0.85 + 7.05i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

B. $a \in [-143.2, -138.8]$ and $b \in [5.7, 6.9]$

$-142.00 + 6.15i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

C. $a \in [-1.6, 0.6]$ and $b \in [-24.8, -20.6]$

$-1.50 - 22.00i$, which corresponds to just dividing the first term by the first term and the second by the second.

D. $a \in [-5, -3.2]$ and $b \in [5.7, 6.9]$

* $-3.55 + 6.15i$, which is the correct option.

E. $a \in [-5, -3.2]$ and $b \in [245.9, 248]$

$-3.55 + 246.00i$, 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 $2 - 3i$.
