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.

$$9 - 1 \div 8 * 14 - (15 * 20)$$

The solution is -292.75

A. $[-291.5, -290.6]$

-291.009, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

B. $[-156.9, -152]$

-155.000, which corresponds to not distributing a negative correctly.

C. $[307.8, 311.1]$

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

D. $[-294, -291.8]$

* -292.750, 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 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. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(-8 + 7i)(9 + 10i)$$

The solution is $-142 - 17i$

A. $a \in [-3, 3]$ and $b \in [138, 144]$

$-2 + 143i$, which corresponds to adding a minus sign in the second term.

B. $a \in [-76, -68]$ and $b \in [68, 71]$

$-72 + 70i$, 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. $a \in [-145, -140]$ and $b \in [-27, -12]$

* $-142 - 17i$, which is the correct option.

D. $a \in [-3, 3]$ and $b \in [-146, -139]$

$-2 - 143i$, which corresponds to adding a minus sign in the first term.

E. $a \in [-145, -140]$ and $b \in [13, 26]$

$-142 + 17i$, 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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3. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{18 - 44i}{3 - 5i}$$

The solution is $8.06 - 1.24i$

A. $a \in [5.1, 8]$ and $b \in [6, 9]$

$6.00 + 8.80i$, which corresponds to just dividing the first term by the first term and the second by the second.

B. $a \in [7.6, 9.2]$ and $b \in [-45, -35]$

$8.06 - 42.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

C. $a \in [270.9, 277]$ and $b \in [-4, 4]$

$274.00 - 1.24i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

D. $a \in [7.6, 9.2]$ and $b \in [-4, 4]$

* $8.06 - 1.24i$, which is the correct option.

E. $a \in [-7.2, -2.7]$ and $b \in [-11, -3]$

$-4.88 - 6.53i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

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

$$\frac{-17}{4} + \sqrt{-36}i$$

The solution is Rational

A. Nonreal Complex

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

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. Rational

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

D. Pure Imaginary

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

E. Irrational

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

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

$$-\sqrt{\frac{13689}{81}}$$

The solution is Integer

A. Irrational

These cannot be written as a fraction of Integers.

B. Rational

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

C. Not a Real number

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

D. Whole

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

E. Integer

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

General Comments: First, you **NEED** to simplify the expression. This question simplifies to -117.

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.
