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.

$$8 - 4^2 + 11 \div 3 * 20 \div 5$$

The solution is 6.667

A. $[29, 42]$

38.667000, which corresponds to an Order of Operations error: multiplying by negative before squaring. For example: $(-3)^2 \neq -3^2$

B. $[5, 10]$

* 6.667000, this is the correct option

C. $[-11, -5]$

-7.963000, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

D. $[20, 29]$

24.037000, which corresponds to two Order of Operations errors.

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.

$$\frac{2}{-5} + 100i^2$$

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. Irrational

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

E. Pure Imaginary

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

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

$$\frac{-9 + 44i}{-5 - 3i}$$

The solution is $-2.56 - 7.26i$

A. $a \in [4.7, 7.3]$ and $b \in [-7, -5]$

$5.21 - 5.68i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

B. $a \in [-3.3, -1.8]$ and $b \in [-248.8, -245.9]$

$-2.56 - 247.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

C. $a \in [-3.3, -1.8]$ and $b \in [-7.4, -7.1]$

* $-2.56 - 7.26i$, which is the correct option.

D. $a \in [-0.3, 3.4]$ and $b \in [-17.3, -13.5]$

$1.80 - 14.67i$, which corresponds to just dividing the first term by the first term and the second by the second.

E. $a \in [-87.3, -83.8]$ and $b \in [-7.4, -7.1]$

$-87.00 - 7.26i$, 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 $2 - 3i$.

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

$$(-4 + 6i)(7 + 5i)$$

The solution is $-58 + 22i$

A. $a \in [-30, -25]$ and $b \in [29, 33]$

$-28 + 30i$, 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. $a \in [-64, -46]$ and $b \in [-25, -18]$

$-58 - 22i$, which corresponds to adding a minus sign in both terms.

C. $a \in [1, 4]$ and $b \in [57, 63]$

$2 + 62i$, which corresponds to adding a minus sign in the second term.

D. $a \in [-64, -46]$ and $b \in [17, 25]$

* $-58 + 22i$, which is the correct option.

E. $a \in [1, 4]$ and $b \in [-63, -56]$

$2 - 62i$, which corresponds to adding a minus sign in the first term.

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

$$\sqrt{\frac{8}{0}}$$

The solution is Not a Real Number

A. Integer

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

B. Irrational

These cannot be written as a fraction of Integers.

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 (dividing by 0).

E. Whole

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

General Comments: First, you **NEED** to simplify the expression. This question simplifies to $\sqrt{\frac{8}{0}}$.

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.
