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.

$$(2 - 9i)(3 - 4i)$$

The solution is $-30 - 35i$

A. $a \in [-31, -26]$ and $b \in [34.79, 35.16]$

$-30 + 35i$, which corresponds to adding a minus sign in both terms.

B. $a \in [3, 9]$ and $b \in [35.23, 36.44]$

$6 + 36i$, 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. $a \in [-31, -26]$ and $b \in [-35.11, -34.58]$

* $-30 - 35i$, which is the correct option.

D. $a \in [39, 44]$ and $b \in [-19.64, -17.85]$

$42 - 19i$, which corresponds to adding a minus sign in the second term.

E. $a \in [39, 44]$ and $b \in [18.29, 19.65]$

$42 + 19i$, 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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2. Simplify the expression below and choose the interval the simplification is contained within.

$$11 - 16^2 + 20 \div 18 * 10 \div 9$$

The solution is -243.765

A. $[-245.79, -244.45]$

-244.988000, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

B. $[267.63, 268.64]$

268.235000, which corresponds to an Order of Operations error: multiplying by negative before squaring. For example: $(-3)^2 \neq -3^2$

C. $[-244.59, -243.38]$

* -243.765000, this is the correct option

D. $[266.76, 267.03]$

267.012000, 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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3. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{-600}{10}}i + \sqrt{55}i$$

The solution is Nonreal Complex

A. Pure Imaginary

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

B. Nonreal Complex

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

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. Rational

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

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

$$\sqrt{\frac{160000}{256}}$$

The solution is Whole

A. Irrational

These cannot be written as a fraction of Integers.

B. Whole

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

C. Rational

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

D. Integer

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

E. Not a Real number

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

General Comments: First, you **NEED** to simplify the expression. This question simplifies to 400.

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

$$\frac{45 - 11i}{6 - 4i}$$

The solution is $6.04 + 2.19i$

A. $a \in [4.45, 7.1]$ and $b \in [1.7, 2.49]$

   * $6.04 + 2.19i$, which is the correct option.

B. $a \in [7.19, 8.49]$ and $b \in [2.44, 2.88]$

   $7.50 + 2.75i$, which corresponds to just dividing the first term by the first term and the second by the second.

C. $a \in [3.04, 5.42]$ and $b \in [-6.6, -2.63]$

   $4.35 - 4.73i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

D. $a \in [313.65, 314.89]$ and $b \in [1.7, 2.49]$

   $314.00 + 2.19i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

E. $a \in [4.45, 7.1]$ and $b \in [112.96, 114.87]$

   $6.04 + 114.00i$, 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 $2 - 3i$.
