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

$$\sqrt{\frac{441}{256}}$$

The solution is Rational

A. Irrational

These cannot be written as a fraction of Integers.

B. Not a Real number

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

C. Integer

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

D. Rational

* This is the correct option!

E. Whole

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

General Comment: First, you **NEED** to simplify the expression. This question simplifies to $\frac{21}{16}$.

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

$$\frac{-54 + 33i}{8 - i}$$

The solution is $-7.15 + 3.23i$

A. $a \in [-465.35, -464.5]$ and $b \in [2.5, 4.2]$

$-465.00 + 3.23i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

B. $a \in [-6.21, -5.3]$ and $b \in [4.4, 8.7]$

$-6.14 + 4.89i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

C. $a \in [-7.36, -6.96]$ and $b \in [2.5, 4.2]$

* $-7.15 + 3.23i$, which is the correct option.

D. $a \in [-7.36, -6.96]$ and $b \in [209.6, 211.9]$

$-7.15 + 210.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

E. $a \in [-7.07, -6.29]$ and $b \in [-34.7, -31.8]$

$-6.75 - 33.00i$, 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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3. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\frac{0}{2\pi} + \sqrt{8}i$$

The solution is Pure Imaginary

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

$$(4 - 8i)(2 + 6i)$$

The solution is $56 + 8i$

A. $a \in [52, 62]$ and $b \in [-12, -4]$

$56 - 8i$, which corresponds to adding a minus sign in both terms.

B. $a \in [-42, -35]$ and $b \in [-42, -36]$

$-40 - 40i$, which corresponds to adding a minus sign in the second term.

C. $a \in [7, 10]$ and $b \in [-57, -47]$

$8 - 48i$, 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.

D. $a \in [52, 62]$ and $b \in [6, 11]$

   * $56 + 8i$, which is the correct option.

E. $a \in [-42, -35]$ and $b \in [39, 42]$

   $-40 + 40i$, which corresponds to adding a minus sign in the first 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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0. Simplify the expression below and choose the interval the simplification is contained within.

$$10 - 15 \div 12 * 3 - (5 * 13)$$

The solution is -58.750

A. $[16.2, 17.5]$

   16.250, which corresponds to not distributing a negative correctly.

B. $[-57.1, -52.9]$

   -55.417, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

C. $[-60.3, -57.3]$

   * -58.750, which is the correct option.

D. $[74.4, 74.8]$

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

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.
