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.

$$\sqrt{\frac{13225}{529}}$$

The solution is Whole

A. Not a Real number

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

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. Irrational

These cannot be written as a fraction of Integers.

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 115.

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.

$$(-3 + 6i)(-4 + 2i)$$

The solution is $0 - 30i$

A. $a \in [11, 17]$ and $b \in [6, 14]$

$12 + 12i$, 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. $a \in [-3, 1]$ and $b \in [-34, -25]$

* $0 - 30i$, which is the correct option.

C. $a \in [16, 29]$ and $b \in [17, 25]$

$24 + 18i$, which corresponds to adding a minus sign in the first term.

D. $a \in [-3, 1]$ and $b \in [26, 36]$

$0 + 30i$, which corresponds to adding a minus sign in both terms.

E. $a \in [16, 29]$ and $b \in [-21, -16]$

$24 - 18i$, which corresponds to adding a minus sign in the second 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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3. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\frac{0}{-17\pi} + \sqrt{8}i$$

The solution is Pure Imaginary

A. 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!

B. Irrational

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

C. Pure Imaginary

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

D. Nonreal Complex

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

E. Rational

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

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. Simplify the expression below and choose the interval the simplification is contained within.

$$5 - 18 \div 20 * 3 - (16 * 11)$$

The solution is -173.7

A. $[-177.1, -172.6]$

* -173.700, which is the correct option.

B. $[-153.2, -147.2]$

-150.700, which corresponds to not distributing a negative correctly.

C. $[-173, -170]$

-171.300, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

D. $[178.5, 181.8]$

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

$$\frac{-36 - 11i}{2 + 6i}$$

The solution is $-3.45 + 4.85i$

A. $a \in [-21.1, -17]$ and $b \in [-4.2, 1.5]$

$-18.00 - 1.83i$, which corresponds to just dividing the first term by the first term and the second by the second.

B. $a \in [-1.3, 0.2]$ and $b \in [-6.9, -4.1]$

$-0.15 - 5.95i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

C. $a \in [-139.3, -136.4]$ and $b \in [4.6, 7.9]$

$-138.00 + 4.85i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

D. $a \in [-4.8, -1.8]$ and $b \in [191.2, 197.3]$

$-3.45 + 194.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

E. $a \in [-4.8, -1.8]$ and $b \in [4.6, 7.9]$

* $-3.45 + 4.85i$, which is the correct option.

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 $2 - 3i$.
