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.

$$-\sqrt{\frac{190969}{529}}$$

The solution is Integer, which is option E.

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. Rational

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

D. Whole

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

E. Integer

* This is the correct option!

General Comment: First, you **NEED** to simplify the expression. This question simplifies to -437.

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.

$$(7 + 8i)(-10 - 5i)$$

The solution is $-30 - 115i$, which is option C.

A. $a \in [-117, -107]$ and $b \in [43, 51]$

$-110 + 45i$, which corresponds to adding a minus sign in the first term.

B. $a \in [-117, -107]$ and $b \in [-46, -43]$

$-110 - 45i$, which corresponds to adding a minus sign in the second term.

C. $a \in [-32, -28]$ and $b \in [-117, -112]$

* $-30 - 115i$, which is the correct option.

D. $a \in [-72, -67]$ and $b \in [-40, -37]$

$-70 - 40i$, 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.

E. $a \in [-32, -28]$ and $b \in [114, 117]$

$-30 + 115i$, which corresponds to adding a minus sign in both terms.

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

$$\frac{63 + 66i}{-3 + i}$$

The solution is $-12.30 - 26.10i$, which is option E.

A. $a \in [-123.5, -122.5]$ and $b \in [-27, -25.5]$

$-123.00 - 26.10i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

B. $a \in [-26.5, -24]$ and $b \in [-14, -13]$

$-25.50 - 13.50i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

C. $a \in [-22.5, -20.5]$ and $b \in [65, 67]$

$-21.00 + 66.00i$, which corresponds to just dividing the first term by the first term and the second by the second.

D. $a \in [-14, -12]$ and $b \in [-262, -260.5]$

$-12.30 - 261.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

E. $a \in [-14, -12]$ and $b \in [-27, -25.5]$

* $-12.30 - 26.10i$, 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 $2 - 3i$.

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

$$\sqrt{\frac{-300}{5}}i + \sqrt{126}i$$

The solution is Nonreal Complex, which is option E.

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. Rational

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

C. Pure Imaginary

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

D. Irrational

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

E. Nonreal Complex

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

$$\frac{9 + 33i}{4 - 5i}$$

The solution is $-3.15 + 4.32i$, which is option C.

A. $a \in [-130.5, -127.5]$ and $b \in [4, 6]$

$-129.00 + 4.32i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

B. $a \in [-3.5, -2.5]$ and $b \in [176.5, 177.5]$

$-3.15 + 177.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

C. $a \in [-3.5, -2.5]$ and $b \in [4, 6]$

* $-3.15 + 4.32i$, which is the correct option.

D. $a \in [4.5, 5.5]$ and $b \in [1.5, 3.5]$

$4.90 + 2.12i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

E. $a \in [1.5, 3.5]$ and $b \in [-7.5, -6]$

$2.25 - 6.60i$, 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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6. Simplify the expression below and choose the interval the simplification is contained within.

$$3 - 8^2 + 1 \div 14 * 17 \div 6$$

The solution is -60.798, which is option D.

A. $[-61.17, -60.85]$

-60.999, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

B. $[67.12, 67.21]$

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

C. $[66.98, 67.09]$

67.001, which corresponds to two Order of Operations errors.

D. $[-60.81, -60.7]$

* -60.798, this 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 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.

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

$$-\sqrt{\frac{213444}{441}}$$

The solution is Integer, which is option D.

A. Whole

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

B. Rational

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

C. Irrational

These cannot be written as a fraction of Integers.

D. Integer

* This is the correct option!

E. Not a Real number

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

General Comment: First, you **NEED** to simplify the expression. This question simplifies to -462.

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

$$\frac{-8}{-9} + 64i^2$$

The solution is Rational, which is option B.

A. Pure Imaginary

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

B. Rational

* This is the correct option!

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. Irrational

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

E. Nonreal Complex

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

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

$$13 - 12^2 + 9 \div 3 * 20 \div 14$$

The solution is -126.714, which is option B.

A. $[157.29, 165.29]$

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

B. $[-127.71, -125.71]$

* -126.714, this is the correct option

C. $[-137.99, -127.99]$

-130.989, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

D. $[152.01, 159.01]$

157.011, 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 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.

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

$$(-8 + 3i)(-9 - 10i)$$

The solution is $102 + 53i$, which is option A.

A. $a \in [100, 107]$ and $b \in [50, 56]$

   * $102 + 53i$, which is the correct option.

B. $a \in [42, 47]$ and $b \in [104, 108]$

   $42 + 107i$, which corresponds to adding a minus sign in the first term.

C. $a \in [100, 107]$ and $b \in [-53, -48]$

   $102 - 53i$, which corresponds to adding a minus sign in both terms.

D. $a \in [42, 47]$ and $b \in [-111, -102]$

   $42 - 107i$, which corresponds to adding a minus sign in the second term.

E. $a \in [72, 77]$ and $b \in [-34, -27]$

   $72 - 30i$, 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.

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.
