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 Complex numbers that the number below belongs to.

$$\sqrt{\frac{-3094}{0}}i + \sqrt{165}i$$

The solution is Not a Complex Number, which is option C.

A. Rational

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

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 the correct option!

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

$$12 - 18 \div 11 * 15 - (8 * 4)$$

The solution is -44.545, which is option A.

A. $[-45.55, -41.55]$

* -44.545, which is the correct option.

B. $[42.89, 48.89]$

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

C. $[-85.18, -75.18]$

-82.182, which corresponds to not distributing a negative correctly.

D. $[-20.11, -16.11]$

-20.109, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

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

$$6 - 16 \div 20 * 10 - (19 * 5)$$

The solution is -97.000, which is option C.

A. $[-109, -104]$

-105.000, which corresponds to not distributing a negative correctly.

B. $[-90.08, -83.08]$

-89.080, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

C. $[-102, -92]$

* -97.000, which is the correct option.

D. $[98.92, 107.92]$

100.920, 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.

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

$$\sqrt{\frac{43681}{361}}$$

The solution is Whole, which is option E.

A. Integer

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

B. Rational

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

C. Not a Real number

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

D. Irrational

These cannot be written as a fraction of Integers.

E. Whole

* This is the correct option!

General Comment: First, you **NEED** to simplify the expression. This question simplifies to 209.

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.

$$\frac{27 + 66i}{5 + 7i}$$

The solution is $8.07 + 1.91i$, which is option E.

A. $a \in [-5, -3.5]$ and $b \in [6.5, 7.5]$

$-4.42 + 7.01i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

B. $a \in [596.5, 597.5]$ and $b \in [1, 4]$

$597.00 + 1.91i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

C. $a \in [7, 9]$ and $b \in [140.5, 142]$

$8.07 + 141.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

D. $a \in [4.5, 6]$ and $b \in [8, 10.5]$

$5.40 + 9.43i$, which corresponds to just dividing the first term by the first term and the second by the second.

E. $a \in [7, 9]$ and $b \in [1, 4]$

* $8.07 + 1.91i$, 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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6. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{0}{196}} + \sqrt{6}i$$

The solution is Pure Imaginary, which is option B.

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. Pure Imaginary

* This is the correct option!

C. Nonreal Complex

This is a Complex number $(a + bi)$ that is not Real (has i as part of the 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 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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7. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(-3 + 6i)(-2 - 10i)$$

The solution is $66 + 18i$, which is option D.

A. $a \in [6, 9]$ and $b \in [-62, -57]$

$6 - 60i$, 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. $a \in [57, 70]$ and $b \in [-22, -11]$

$66 - 18i$, which corresponds to adding a minus sign in both terms.

C. $a \in [-55, -53]$ and $b \in [-46, -38]$

$-54 - 42i$, which corresponds to adding a minus sign in the second term.

D. $a \in [57, 70]$ and $b \in [15, 27]$

* $66 + 18i$, which is the correct option.

E. $a \in [-55, -53]$ and $b \in [34, 49]$

$-54 + 42i$, 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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8. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{-27 - 55i}{4 - 7i}$$

The solution is $4.26 - 6.29i$, which is option D.

A. $a \in [-8, -7]$ and $b \in [-2, 0]$

$-7.58 - 0.48i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

B. $a \in [3.5, 5.5]$ and $b \in [-409.5, -407.5]$

$4.26 - 409.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

C. $a \in [-7.5, -5.5]$ and $b \in [7, 8.5]$

$-6.75 + 7.86i$, which corresponds to just dividing the first term by the first term and the second by the second.

D. $a \in [3.5, 5.5]$ and $b \in [-8, -5.5]$

* $4.26 - 6.29i$, which is the correct option.

E. $a \in [276.5, 278.5]$ and $b \in [-8, -5.5]$

$277.00 - 6.29i$, 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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9. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(8 - 7i)(-10 + 9i)$$

The solution is $-17 + 142i$, which is option D.

A. $a \in [-145, -141]$ and $b \in [-2, 0]$

$-143 - 2i$, which corresponds to adding a minus sign in the second term.

B. $a \in [-145, -141]$ and $b \in [1, 3]$

$-143 + 2i$, which corresponds to adding a minus sign in the first term.

C. $a \in [-20, -8]$ and $b \in [-145, -139]$

$-17 - 142i$, which corresponds to adding a minus sign in both terms.

D. $a \in [-20, -8]$ and $b \in [141, 146]$

* $-17 + 142i$, which is the correct option.

E. $a \in [-85, -77]$ and $b \in [-71, -58]$

$-80 - 63i$, 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.

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

$$-\sqrt{\frac{50625}{81}}$$

The solution is Integer, which is option C.

A. Whole

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

B. Not a Real number

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

C. Integer

* This is the correct option!

D. Irrational

These cannot be written as a fraction of Integers.

E. Rational

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

General Comment: First, you **NEED** to simplify the expression. This question simplifies to -225.

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.
