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.

$$\sqrt{\frac{990}{11}} + \sqrt{90}i$$

The solution is Nonreal Complex, which is option C.

A. Pure Imaginary

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

B. Irrational

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

C. Nonreal Complex

* This is the correct option!

D. Rational

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

E. 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!

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

$$\frac{-36 + 77i}{3 - 6i}$$

The solution is $-12.67 + 0.33i$, which is option D.

A. $a \in [6.9, 8.7]$ and $b \in [9, 10.5]$

$7.87 + 9.93i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

B. $a \in [-12.3, -11.45]$ and $b \in [-14, -12]$

$-12.00 - 12.83i$, which corresponds to just dividing the first term by the first term and the second by the second.

C. $a \in [-12.9, -12.35]$ and $b \in [14.5, 15.5]$

$-12.67 + 15.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

D. $a \in [-12.9, -12.35]$ and $b \in [0, 1]$

* $-12.67 + 0.33i$, which is the correct option.

E. $a \in [-570.35, -569.5]$ and $b \in [0, 1]$

$-570.00 + 0.33i$, 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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3. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(-5 - 3i)(-7 - 10i)$$

The solution is $5 + 71i$, which is option D.

A. $a \in [30, 37]$ and $b \in [29.92, 30.33]$

$35 + 30i$, 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.

B. $a \in [65, 66]$ and $b \in [28.37, 29.97]$

$65 + 29i$, which corresponds to adding a minus sign in the first term.

C. $a \in [0, 15]$ and $b \in [-71.23, -70.52]$

$5 - 71i$, which corresponds to adding a minus sign in both terms.

D. $a \in [0, 15]$ and $b \in [70.75, 71.19]$

* $5 + 71i$, which is the correct option.

E. $a \in [65, 66]$ and $b \in [-30.01, -27.46]$

$65 - 29i$, which corresponds to adding a minus sign in the second 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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4. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\frac{3}{-8} + \sqrt{-16}i$$

The solution is Rational, which is option C.

A. Irrational

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

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

* This is the correct option!

D. Pure Imaginary

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

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

$$(5 - 7i)(-4 - 3i)$$

The solution is $-41 + 13i$, which is option A.

A. $a \in [-46, -39]$ and $b \in [10, 15]$

* $-41 + 13i$, which is the correct option.

B. $a \in [1, 2]$ and $b \in [35, 49]$

$1 + 43i$, which corresponds to adding a minus sign in the second term.

C. $a \in [1, 2]$ and $b \in [-45, -41]$

$1 - 43i$, which corresponds to adding a minus sign in the first term.

D. $a \in [-46, -39]$ and $b \in [-17, -10]$

$-41 - 13i$, which corresponds to adding a minus sign in both terms.

E. $a \in [-26, -15]$ and $b \in [21, 24]$

$-20+21i$, 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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6. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{63 - 44i}{8 + 5i}$$

The solution is $3.19 - 7.49i$, which is option D.

A. $a \in [2.92, 3.33]$ and $b \in [-667.5, -666.5]$

$3.19 - 667.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

B. $a \in [7.94, 8.27]$ and $b \in [-1.5, 0]$

$8.13 - 0.42i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

C. $a \in [283.9, 284.21]$ and $b \in [-8, -6.5]$

$284.00 - 7.49i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

D. $a \in [2.92, 3.33]$ and $b \in [-8, -6.5]$

* $3.19 - 7.49i$, which is the correct option.

E. $a \in [7.72, 7.88]$ and $b \in [-9, -8]$

$7.88 - 8.80i$, 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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7. Simplify the expression below and choose the interval the simplification is contained within.

$$7 - 19^2 + 9 \div 12 * 14 \div 1$$

The solution is -343.500, which is option C.

A. $[375.5, 379.5]$

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

B. $[364.05, 371.05]$

368.054, which corresponds to two Order of Operations errors.

C. $[-345.5, -341.5]$

* -343.500, this is the correct option

D. $[-355.95, -352.95]$

-353.946, 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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8. Choose the **smallest** set of Real numbers that the number below belongs to.

$$-\sqrt{\frac{-1232}{8}}$$

The solution is Not a Real number, which is option C.

A. Rational

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

B. Whole

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

C. Not a Real number

* This is the correct option!

D. Integer

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

E. Irrational

These cannot be written as a fraction of Integers.

General Comment: First, you **NEED** to simplify the expression. This question simplifies to $-\sqrt{154}i$.

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

$$14 - 11^2 + 7 \div 1 * 2 \div 17$$

The solution is -106.176, which is option B.

A. $[135.13, 135.44]$

135.206, which corresponds to two Order of Operations errors.

B. $[-106.21, -105.91]$

* -106.176, this is the correct option

C. $[-107.39, -106.46]$

-106.794, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

D. $[135.74, 136.1]$

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

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

$$\sqrt{\frac{194481}{441}}$$

The solution is Whole, which is option A.

A. Whole

* This is the correct option!

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

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

E. Irrational

These cannot be written as a fraction of Integers.

General Comment: First, you **NEED** to simplify the expression. This question simplifies to 441.

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.
