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

$$17 - 8^2 + 3 \div 5 * 12 \div 15$$

The solution is -46.520, which is option A.

A. $[-46.69, -46.05]$

* -46.520, this is the correct option

B. $[80.42, 81.06]$

81.003, which corresponds to two Order of Operations errors.

C. $[-47.26, -46.63]$

-46.997, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

D. $[81.42, 82.48]$

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

$$\frac{45 + 33i}{-1 - 4i}$$

The solution is $-10.41 + 8.65i$, which is option B.

A. $a \in [-46.5, -44.5]$ and $b \in [-9.5, -7.5]$

$-45.00 - 8.25i$, which corresponds to just dividing the first term by the first term and the second by the second.

B. $a \in [-11, -10]$ and $b \in [8, 9.5]$

* $-10.41 + 8.65i$, which is the correct option.

C. $a \in [4, 5.5]$ and $b \in [-13, -11]$

$5.12 - 12.53i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

D. $a \in [-178.5, -176.5]$ and $b \in [8, 9.5]$

$-177.00 + 8.65i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

E. $a \in [-11, -10]$ and $b \in [146, 147.5]$

$-10.41 + 147.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

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.

$$(-9 + 6i)(5 - 7i)$$

The solution is $-3 + 93i$, which is option D.

A. $a \in [-5, 4]$ and $b \in [-96, -87]$

$-3 - 93i$, which corresponds to adding a minus sign in both terms.

B. $a \in [-45, -39]$ and $b \in [-42, -39]$

$-45 - 42i$, 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.

C. $a \in [-87, -82]$ and $b \in [30, 36]$

$-87 + 33i$, which corresponds to adding a minus sign in the first term.

D. $a \in [-5, 4]$ and $b \in [92, 97]$

* $-3 + 93i$, which is the correct option.

E. $a \in [-87, -82]$ and $b \in [-35, -24]$

$-87 - 33i$, 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. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{-9 - 88i}{4 + 2i}$$

The solution is $-10.60 - 16.70i$, which is option B.

A. $a \in [-11, -9.5]$ and $b \in [-335.5, -332.5]$

$-10.60 - 334.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

B. $a \in [-11, -9.5]$ and $b \in [-17, -15]$

* $-10.60 - 16.70i$, which is the correct option.

C. $a \in [-212.5, -211.5]$ and $b \in [-17, -15]$

$-212.00 - 16.70i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

D. $a \in [6, 9]$ and $b \in [-19, -18]$

$7.00 - 18.50i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

E. $a \in [-4, -2]$ and $b \in [-44.5, -43]$

$-2.25 - 44.00i$, 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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5. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{0}{5}} + \sqrt{8}i$$

The solution is Pure Imaginary, which is option A.

A. Pure Imaginary

* This is the correct option!

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. Nonreal Complex

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

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

$$-\sqrt{\frac{2340}{12}} + 3i^2$$

The solution is Irrational, which is option D.

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. Nonreal Complex

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

C. Pure Imaginary

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

D. Irrational

* This is the correct option!

E. Rational

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

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.

$$(-5 - 7i)(4 - 6i)$$

The solution is $-62 + 2i$, which is option B.

A. $a \in [-62, -56]$ and $b \in [-2.1, -0.2]$

$-62 - 2i$, which corresponds to adding a minus sign in both terms.

B. $a \in [-62, -56]$ and $b \in [1.2, 4.7]$

* $-62 + 2i$, which is the correct option.

C. $a \in [18, 23]$ and $b \in [55.5, 58.3]$

$22 + 58i$, which corresponds to adding a minus sign in the first term.

D. $a \in [-24, -15]$ and $b \in [40.1, 42.2]$

$-20 + 42i$, 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. $a \in [18, 23]$ and $b \in [-59.6, -55.1]$

$22 - 58i$, 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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8. Choose the **smallest** set of Real numbers that the number below belongs to.

$$\sqrt{\frac{-693}{7}}$$

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

A. Not a Real number

* This is the correct option!

B. Integer

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

C. Whole

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

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 $\sqrt{99}i$.

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

$$-\sqrt{\frac{144}{169}}$$

The solution is Rational, which is option D.

A. Not a Real number

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

B. Whole

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

C. Irrational

These cannot be written as a fraction of Integers.

D. Rational

* This is the correct option!

E. Integer

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

General Comment: First, you **NEED** to simplify the expression. This question simplifies to $-\frac{12}{13}$.

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

$$3 - 6^2 + 12 \div 4 * 10 \div 11$$

The solution is -30.273, which is option B.

A. $[40.6, 42.5]$

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

B. $[-32.9, -27.4]$

   * -30.273, this is the correct option

C. $[-33.5, -31.3]$

   -32.973, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

D. $[38.3, 39.1]$

   39.027, 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.
