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

$$(3 + 4i)(-9 - 10i)$$

The solution is $13 - 66i$, which is option A.

A. $a \in [13, 21]$ and $b \in [-70, -58]$

* $13 - 66i$, which is the correct option.

B. $a \in [-70, -63]$ and $b \in [2, 14]$

$-67 + 6i$, which corresponds to adding a minus sign in the first term.

C. $a \in [13, 21]$ and $b \in [65, 70]$

$13 + 66i$, which corresponds to adding a minus sign in both terms.

D. $a \in [-27, -26]$ and $b \in [-43, -38]$

$-27 - 40i$, 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. $a \in [-70, -63]$ and $b \in [-10, -1]$

$-67 - 6i$, 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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2. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\frac{\sqrt{154}}{19} + 3i^2$$

The solution is Irrational, which is option B.

A. Nonreal Complex

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

B. Irrational

* This is the correct option!

C. Rational

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

D. 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!

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

$$17 - 5 \div 10 * 2 - (13 * 15)$$

The solution is -179.000, which is option A.

A. $[-179.78, -178.41]$

* -179.000, which is the correct option.

B. $[44.85, 45.3]$

45.000, which corresponds to not distributing a negative correctly.

C. $[210.63, 212.51]$

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

D. $[-178.61, -178.11]$

-178.250, 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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4. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\frac{-4}{-19} + \sqrt{-36}i$$

The solution is Rational, which is option A.

A. Rational

* 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. Nonreal Complex

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

D. Pure Imaginary

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

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

$$-\sqrt{\frac{1456}{7}}$$

The solution is Irrational, which is option D.

A. Integer

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

B. Whole

These are the counting numbers with 0 (0, 1, 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

* This is the correct option!

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 $-\sqrt{208}$.

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

$$-\sqrt{\frac{-1870}{10}}$$

The solution is Not a Real number, 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. Whole

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

D. Irrational

These cannot be written as a fraction of Integers.

E. Not a Real number

* This is the correct option!

General Comment: First, you **NEED** to simplify the expression. This question simplifies to $-\sqrt{187}i$.

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

$$\frac{-54 + 88i}{-4 - 5i}$$

The solution is $-5.46 - 15.17i$, which is option B.

A. $a \in [12, 14]$ and $b \in [-18.5, -16.5]$

$13.50 - 17.60i$, which corresponds to just dividing the first term by the first term and the second by the second.

B. $a \in [-6, -4.5]$ and $b \in [-16, -14]$

* $-5.46 - 15.17i$, which is the correct option.

C. $a \in [-224.5, -223.5]$ and $b \in [-16, -14]$

$-224.00 - 15.17i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

D. $a \in [15.5, 16.5]$ and $b \in [-3, -0.5]$

$16.00 - 2.00i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

E. $a \in [-6, -4.5]$ and $b \in [-623.5, -621]$

$-5.46 - 622.00i$, 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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8. Simplify the expression below and choose the interval the simplification is contained within.

$$18 - 6 \div 8 * 4 - (15 * 19)$$

The solution is -270.000, which is option B.

A. $[-267.9, -266.2]$

-267.188, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

B. $[-271.8, -269.1]$

* -270.000, which is the correct option.

C. $[-1, 2.4]$

0.000, which corresponds to not distributing a negative correctly.

D. $[302.4, 305]$

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

$$\frac{-72 - 22i}{7 - i}$$

The solution is $-9.64 - 4.52i$, which is option E.

A. $a \in [-9.9, -9.54]$ and $b \in [-227, -224.5]$

$-9.64 - 226.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

B. $a \in [-10.42, -10.19]$ and $b \in [20.5, 22.5]$

$-10.29 + 22.00i$, which corresponds to just dividing the first term by the first term and the second by the second.

C. $a \in [-482.38, -481.94]$ and $b \in [-6, -4]$

$-482.00 - 4.52i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

D. $a \in [-10.64, -10.47]$ and $b \in [-2, -1]$

$-10.52 - 1.64i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

E. $a \in [-9.9, -9.54]$ and $b \in [-6, -4]$

* $-9.64 - 4.52i$, 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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10. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(-2 - 3i)(-7 - 9i)$$

The solution is $-13 + 39i$, which is option D.

A. $a \in [38, 47]$ and $b \in [-4, 0]$

$41 - 3i$, which corresponds to adding a minus sign in the first term.

B. $a \in [14, 17]$ and $b \in [24, 30]$

$14 + 27i$, 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. $a \in [38, 47]$ and $b \in [0, 7]$

$41 + 3i$, which corresponds to adding a minus sign in the second term.

D. $a \in [-17, -10]$ and $b \in [39, 45]$

* $-13 + 39i$, which is the correct option.

E. $a \in [-17, -10]$ and $b \in [-42, -38]$

$-13 - 39i$, 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.
