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.

$$\frac{-27 - 11i}{6 + 8i}$$

The solution is $-2.50 + 1.50i$, which is option D.

A. $a \in [-5, -4]$ and $b \in [-2.5, 0]$

$-4.50 - 1.38i$, which corresponds to just dividing the first term by the first term and the second by the second.

B. $a \in [-1, -0.5]$ and $b \in [-4, -2]$

$-0.74 - 2.82i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

C. $a \in [-3, -1.5]$ and $b \in [149.5, 151]$

$-2.50 + 150.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

D. $a \in [-3, -1.5]$ and $b \in [1, 2]$

* $-2.50 + 1.50i$, which is the correct option.

E. $a \in [-252, -249]$ and $b \in [1, 2]$

$-250.00 + 1.50i$, 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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2. Choose the **smallest** set of Real numbers that the number below belongs to.

$$\sqrt{\frac{53361}{121}}$$

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 231.

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

$$\sqrt{\frac{-1092}{6}}i + \sqrt{238}i$$

The solution is Nonreal Complex, which is option B.

A. Rational

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

B. Nonreal Complex

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

$$(-5 + 4i)(9 + 6i)$$

The solution is $-69 + 6i$, which is option A.

A. $a \in [-69, -68]$ and $b \in [4, 12]$

* $-69 + 6i$, which is the correct option.

B. $a \in [-46, -38]$ and $b \in [22, 25]$

$-45 + 24i$, 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. $a \in [-69, -68]$ and $b \in [-10, -2]$

$-69 - 6i$, which corresponds to adding a minus sign in both terms.

D. $a \in [-24, -16]$ and $b \in [-67, -65]$

$-21 - 66i$, which corresponds to adding a minus sign in the first term.

E. $a \in [-24, -16]$ and $b \in [61, 69]$

$-21 + 66i$, 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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5. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(-2 + 6i)(9 + 7i)$$

The solution is $-60 + 40i$, which is option B.

A. $a \in [20, 26]$ and $b \in [-70.3, -65]$

$24 - 68i$, which corresponds to adding a minus sign in the first term.

B. $a \in [-60, -58]$ and $b \in [37.7, 40.5]$

* $-60 + 40i$, which is the correct option.

C. $a \in [20, 26]$ and $b \in [66, 69.5]$

$24 + 68i$, which corresponds to adding a minus sign in the second term.

D. $a \in [-60, -58]$ and $b \in [-41.4, -39.2]$

$-60 - 40i$, which corresponds to adding a minus sign in both terms.

E. $a \in [-18, -16]$ and $b \in [40.7, 44.7]$

$-18 + 42i$, 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.

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 and choose the interval the simplification is contained within.

$$11 - 20^2 + 12 \div 5 * 14 \div 4$$

The solution is -380.600, which is option C.

A. $[411.04, 415.04]$

411.043, which corresponds to two Order of Operations errors.

B. $[-393.96, -386.96]$

-388.957, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

C. $[-381.6, -372.6]$

* -380.600, this is the correct option

D. $[417.4, 423.4]$

419.400, 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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7. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{-595}{7}} + \sqrt{0}i$$

The solution is Pure Imaginary, which is option E.

A. Irrational

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

B. Nonreal Complex

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

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

$$19 - 4 \div 1 * 9 - (5 * 8)$$

The solution is -57.000, which is option B.

A. $[-177, -169]$

-176.000, which corresponds to not distributing a negative correctly.

B. $[-62, -56]$

* -57.000, which is the correct option.

C. $[-24.44, -18.44]$

-21.444, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

D. $[52.56, 61.56]$

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

$$-\sqrt{\frac{119025}{529}}$$

The solution is Integer, which is option C.

A. Rational

These are numbers that can be written as fraction of Integers (e.g., -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. Whole

These are the counting numbers with 0 (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 -345.

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

$$\frac{36 - 22i}{5 + 6i}$$

The solution is $0.79 - 5.34i$, which is option E.

A. $a \in [3.5, 6]$ and $b \in [1.5, 3.5]$

$5.11 + 1.74i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

B. $a \in [47, 48.5]$ and $b \in [-7, -4]$

$48.00 - 5.34i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

C. $a \in [6.5, 8]$ and $b \in [-4.5, -3]$

$7.20 - 3.67i$, which corresponds to just dividing the first term by the first term and the second by the second.

D. $a \in [0.5, 2.5]$ and $b \in [-328, -325.5]$

$0.79 - 326.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

E. $a \in [0.5, 2.5]$ and $b \in [-7, -4]$

* $0.79 - 5.34i$, 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 $2 - 3i$.
