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.

$$19 - 11 \div 12 * 17 - (6 * 18)$$

The solution is -104.583, which is option D.

A. $[-51.5, -42.5]$

-46.500, which corresponds to not distributing a negative correctly.

B. $[122.95, 129.95]$

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

C. $[-93.05, -87.05]$

-89.054, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

D. $[-107.58, -102.58]$

* -104.583, which is the correct option.

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.

$$(2 + 4i)(10 + 5i)$$

The solution is $0 + 50i$, which is option B.

A. $a \in [15, 24]$ and $b \in [16, 21]$

$20 + 20i$, 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. $a \in [-3, 7]$ and $b \in [50, 51]$

* $0 + 50i$, which is the correct option.

C. $a \in [36, 45]$ and $b \in [27, 34]$

$40 + 30i$, which corresponds to adding a minus sign in the second term.

D. $a \in [-3, 7]$ and $b \in [-53, -49]$

$0 - 50i$, which corresponds to adding a minus sign in both terms.

E. $a \in [36, 45]$ and $b \in [-33, -25]$

$40 - 30i$, 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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3. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\frac{-22}{16} + \sqrt{126}i$$

The solution is Nonreal Complex, 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. Rational

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

C. Irrational

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

D. Nonreal Complex

* This is the correct option!

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

$$-\sqrt{\frac{40000}{100}}$$

The solution is Integer, which is option D.

A. Whole

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

B. Irrational

These cannot be written as a fraction of Integers.

C. Rational

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

D. Integer

* This is the correct option!

E. Not a Real number

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

General Comment: First, you **NEED** to simplify the expression. This question simplifies to -200.

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.

$$\frac{9 - 33i}{7 - 6i}$$

The solution is $3.07 - 2.08i$, which is option E.

A. $a \in [2.5, 4]$ and $b \in [-178.5, -176.5]$

$3.07 - 177.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

B. $a \in [260.5, 262]$ and $b \in [-3, -1.5]$

$261.00 - 2.08i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

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

$1.29 + 5.50i$, which corresponds to just dividing the first term by the first term and the second by the second.

D. $a \in [-2.5, -1]$ and $b \in [-4.5, -2.5]$

$-1.59 - 3.35i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

E. $a \in [2.5, 4]$ and $b \in [-3, -1.5]$

* $3.07 - 2.08i$, 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. Simplify the expression below and choose the interval the simplification is contained within.

$$2 - 17^2 + 10 \div 4 * 18 \div 19$$

The solution is -284.632, which is option A.

A. $[-285.19, -284.38]$

* -284.632, this is the correct option

B. $[-288.43, -285.77]$

-286.993, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

C. $[289.87, 291.34]$

291.007, which corresponds to two Order of Operations errors.

D. $[293.29, 293.53]$

293.368, 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.

$$-\sqrt{\frac{1232}{8}} + 7i^2$$

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

$$-\sqrt{\frac{-600}{10}}$$

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

A. Not a Real number

* This is the correct option!

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

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

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 $-\sqrt{60}i$.

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

$$(-7 - 10i)(-5 - 6i)$$

The solution is $-25 + 92i$, which is option A.

A. $a \in [-28, -23]$ and $b \in [91, 95]$

* $-25 + 92i$, which is the correct option.

B. $a \in [-28, -23]$ and $b \in [-92, -85]$

$-25 - 92i$, which corresponds to adding a minus sign in both terms.

C. $a \in [95, 101]$ and $b \in [-15, -3]$

$95 - 8i$, which corresponds to adding a minus sign in the first term.

D. $a \in [33, 41]$ and $b \in [60, 61]$

$35 + 60i$, 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.

E. $a \in [95, 101]$ and $b \in [4, 10]$

$95 + 8i$, 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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10. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{36 + 22i}{-7 - 8i}$$

The solution is $-3.79 + 1.19i$, which is option C.

A. $a \in [-428.5, -427.5]$ and $b \in [1, 1.5]$

$-428.00 + 1.19i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

B. $a \in [-2, 0]$ and $b \in [-4, -3.5]$

$-0.67 - 3.91i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

C. $a \in [-4.5, -2.5]$ and $b \in [1, 1.5]$

* $-3.79 + 1.19i$, which is the correct option.

D. $a \in [-4.5, -2.5]$ and $b \in [133.5, 135]$

$-3.79 + 134.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

E. $a \in [-6, -4.5]$ and $b \in [-3, -2.5]$

$-5.14 - 2.75i$, 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 $2 - 3i$.
