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 Real numbers that the number below belongs to.

$$-\sqrt{\frac{8100}{25}}$$

The solution is Integer, which is option C.

A. Not a Real number

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

B. Irrational

These cannot be written as a fraction of Integers.

C. Integer

* This is the correct option!

D. Whole

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

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 -90.

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

$$19 - 6 \div 16 * 17 - (11 * 20)$$

The solution is -207.375, which is option B.

A. $[233.98, 240.98]$

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

B. $[-210.38, -206.38]$

* -207.375, which is the correct option.

C. $[-202.02, -198.02]$

-201.022, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

D. $[29.5, 40.5]$

32.500, which corresponds to not distributing a negative 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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3. Simplify the expression below and choose the interval the simplification is contained within.

$$12 - 13 \div 5 * 9 - (6 * 18)$$

The solution is -119.400, which is option A.

A. $[-124.4, -115.4]$

* -119.400, which is the correct option.

B. $[113.71, 127.71]$

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

C. $[-315.2, -310.2]$

-313.200, which corresponds to not distributing a negative correctly.

D. $[-98.29, -91.29]$

-96.289, 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.

$$\frac{-7}{5} + \sqrt{-36}i$$

The solution is Rational, 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. Pure Imaginary

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

C. Irrational

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

D. Rational

* This is the correct option!

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.

$$(8 - 5i)(2 + 9i)$$

The solution is $61 + 62i$, which is option A.

A. $a \in [59, 62]$ and $b \in [58, 63]$

* $61 + 62i$, which is the correct option.

B. $a \in [13, 20]$ and $b \in [-49, -44]$

$16 - 45i$, 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. $a \in [-29, -24]$ and $b \in [-86, -72]$

$-29 - 82i$, which corresponds to adding a minus sign in the second term.

D. $a \in [-29, -24]$ and $b \in [76, 86]$

$-29 + 82i$, which corresponds to adding a minus sign in the first term.

E. $a \in [59, 62]$ and $b \in [-64, -61]$

$61 - 62i$, 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.

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

$$\frac{-27 + 77i}{-8 + 6i}$$

The solution is $6.78 - 4.54i$, which is option A.

A. $a \in [6, 7.5]$ and $b \in [-5.5, -3.5]$

* $6.78 - 4.54i$, which is the correct option.

B. $a \in [6, 7.5]$ and $b \in [-455, -452.5]$

$6.78 - 454.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

C. $a \in [-3.5, -2]$ and $b \in [-8.5, -7.5]$

$-2.46 - 7.78i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

D. $a \in [677.5, 678.5]$ and $b \in [-5.5, -3.5]$

$678.00 - 4.54i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

E. $a \in [2.5, 4]$ and $b \in [11.5, 13.5]$

$3.38 + 12.83i$, 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. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\frac{-11}{22} + \sqrt{77}i$$

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. Irrational

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

C. Rational

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

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

$$(10 - 3i)(9 - 2i)$$

The solution is $84 - 47i$, which is option A.

A. $a \in [82.6, 84.1]$ and $b \in [-47.66, -46.81]$

* $84 - 47i$, which is the correct option.

B. $a \in [93.2, 97.7]$ and $b \in [6.8, 7.95]$

$96 + 7i$, which corresponds to adding a minus sign in the first term.

C. $a \in [93.2, 97.7]$ and $b \in [-7.15, -4.69]$

$96 - 7i$, which corresponds to adding a minus sign in the second term.

D. $a \in [82.6, 84.1]$ and $b \in [46.23, 47.92]$

$84 + 47i$, which corresponds to adding a minus sign in both terms.

E. $a \in [85.4, 90.6]$ and $b \in [4.47, 6.03]$

$90 + 6i$, 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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9. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{72 + 22i}{-6 - i}$$

The solution is $-12.27 - 1.62i$, which is option A.

A. $a \in [-12.45, -12.05]$ and $b \in [-2.5, -1]$

* $-12.27 - 1.62i$, which is the correct option.

B. $a \in [-11.17, -10.85]$ and $b \in [-6, -4.5]$

$-11.08 - 5.51i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

C. $a \in [-12.12, -11.76]$ and $b \in [-23, -21.5]$

$-12.00 - 22.00i$, which corresponds to just dividing the first term by the first term and the second by the second.

D. $a \in [-12.45, -12.05]$ and $b \in [-60.5, -59.5]$

$-12.27 - 60.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

E. $a \in [-454.37, -453.81]$ and $b \in [-2.5, -1]$

$-454.00 - 1.62i$, 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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10. Choose the **smallest** set of Real numbers that the number below belongs to.

$$-\sqrt{\frac{1560}{12}}$$

The solution is Irrational, which is option B.

A. Not a Real number

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

B. Irrational

* This is the correct option!

C. Whole

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

D. Integer

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

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 $-\sqrt{130}$.

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.
