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 Complex numbers that the number below belongs to.

$$\sqrt{\frac{-450}{0}} + \sqrt{130}$$

The solution is Not a Complex Number, which is option D.

A. Rational

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

B. Irrational

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

C. Pure Imaginary

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

D. Not a Complex Number

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

$$7 - 2 \div 20 * 6 - (18 * 14)$$

The solution is -245.600, which is option D.

A. $[-245.31, -244.11]$

-245.017, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

B. $[-162.58, -161.38]$

-162.400, which corresponds to not distributing a negative correctly.

C. $[258.34, 259.56]$

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

D. $[-245.62, -245.55]$

* -245.600, 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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3. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\frac{18}{5} + \sqrt{65}i$$

The solution is Nonreal Complex, which is option A.

A. Nonreal Complex

* 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. 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.

$$\frac{9 + 55i}{-8 + 6i}$$

The solution is $2.58 - 4.94i$, which is option C.

A. $a \in [-2, 0]$ and $b \in [8.95, 9.8]$

$-1.12 + 9.17i$, which corresponds to just dividing the first term by the first term and the second by the second.

B. $a \in [-6, -4]$ and $b \in [-4.25, -3.4]$

$-4.02 - 3.86i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

C. $a \in [2, 4]$ and $b \in [-5.3, -4.35]$

* $2.58 - 4.94i$, which is the correct option.

D. $a \in [257.5, 259]$ and $b \in [-5.3, -4.35]$

$258.00 - 4.94i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

E. $a \in [2, 4]$ and $b \in [-494.15, -493.75]$

$2.58 - 494.00i$, 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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5. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{54 - 77i}{-1 + 4i}$$

The solution is $-21.29 - 8.18i$, which is option A.

A. $a \in [-22, -21]$ and $b \in [-9, -7.5]$

* $-21.29 - 8.18i$, which is the correct option.

B. $a \in [-55, -53]$ and $b \in [-21, -18.5]$

$-54.00 - 19.25i$, which corresponds to just dividing the first term by the first term and the second by the second.

C. $a \in [14.5, 15.5]$ and $b \in [16, 18]$

$14.94 + 17.24i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

D. $a \in [-22, -21]$ and $b \in [-140.5, -138]$

$-21.29 - 139.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

E. $a \in [-363, -361.5]$ and $b \in [-9, -7.5]$

$-362.00 - 8.18i$, 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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6. Simplify the expression below and choose the interval the simplification is contained within.

$$11 - 5^2 + 4 \div 16 * 14 \div 8$$

The solution is -13.562, which is option D.

A. $[35.89, 36.11]$

36.002, which corresponds to two Order of Operations errors.

B. $[-14.25, -13.84]$

-13.998, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

C. $[36.09, 36.83]$

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

D. $[-13.66, -13.37]$

* -13.562, this 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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7. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(7 - 9i)(-10 - 8i)$$

The solution is $-142 + 34i$, which is option C.

A. $a \in [-144, -140]$ and $b \in [-34, -33]$

$-142 - 34i$, which corresponds to adding a minus sign in both terms.

B. $a \in [-75, -65]$ and $b \in [72, 76]$

$-70 + 72i$, 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. $a \in [-144, -140]$ and $b \in [30, 36]$

* $-142 + 34i$, which is the correct option.

D. $a \in [-4, 5]$ and $b \in [-152, -145]$

$2 - 146i$, which corresponds to adding a minus sign in the first term.

E. $a \in [-4, 5]$ and $b \in [141, 150]$

$2 + 146i$, 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.

$$\sqrt{\frac{30625}{625}}$$

The solution is Whole, which is option D.

A. Irrational

These cannot be written as a fraction of Integers.

B. Not a Real number

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

C. Rational

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

D. Whole

* 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 175.

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.

$$(-3 - 2i)(-5 - 8i)$$

The solution is $-1 + 34i$, which is option B.

A. $a \in [-3, 0]$ and $b \in [-39, -28]$

$-1 - 34i$, which corresponds to adding a minus sign in both terms.

B. $a \in [-3, 0]$ and $b \in [31, 38]$

* $-1 + 34i$, which is the correct option.

C. $a \in [27, 36]$ and $b \in [-14, -10]$

$31 - 14i$, which corresponds to adding a minus sign in the second term.

D. $a \in [27, 36]$ and $b \in [10, 15]$

$31 + 14i$, which corresponds to adding a minus sign in the first term.

E. $a \in [14, 21]$ and $b \in [16, 21]$

$15 + 16i$, 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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10. Choose the **smallest** set of Real numbers that the number below belongs to.

$$-\sqrt{\frac{18}{0}}$$

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

A. Integer

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

B. Not a Real number

* This is the correct option!

C. Whole

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

D. Rational

These are numbers that can be written as fraction of Integers (e.g., -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 $-\sqrt{\frac{18}{0}}$.

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.
