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.

$$\frac{54 + 44i}{7 - 5i}$$

The solution is $2.14 + 7.81i$, which is option B.

A. $a \in [7.75, 8.5]$ and $b \in [0, 1]$

$8.08 + 0.51i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

B. $a \in [1.9, 2.35]$ and $b \in [6.5, 9]$

* $2.14 + 7.81i$, which is the correct option.

C. $a \in [7.25, 7.9]$ and $b \in [-9, -8]$

$7.71 - 8.80i$, which corresponds to just dividing the first term by the first term and the second by the second.

D. $a \in [1.9, 2.35]$ and $b \in [577.5, 578.5]$

$2.14 + 578.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

E. $a \in [157.75, 158.4]$ and $b \in [6.5, 9]$

$158.00 + 7.81i$, 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.

$$\sqrt{\frac{-1980}{10}}$$

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

A. Irrational

These cannot be written as a fraction of Integers.

B. Whole

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

C. Integer

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

D. Not a Real number

* 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 $\sqrt{198}i$.

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

$$\sqrt{\frac{-935}{11}} + \sqrt{0}i$$

The solution is Pure Imaginary, which is option D.

A. Nonreal Complex

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

* This is the correct option!

E. 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!

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.

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

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

A. $a \in [-92, -89]$ and $b \in [-27, -23]$

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

B. $a \in [-8, -5]$ and $b \in [90, 99]$

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

C. $a \in [-92, -89]$ and $b \in [24, 29]$

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

D. $a \in [-50, -47]$ and $b \in [41, 47]$

$-50+42i$, 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.

E. $a \in [-8, -5]$ and $b \in [-98, -92]$

$-8 - 95i$, 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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5. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(-7 + 8i)(4 + 6i)$$

The solution is $-76 - 10i$, which is option B.

A. $a \in [18, 22]$ and $b \in [-74, -69]$

$20 - 74i$, which corresponds to adding a minus sign in the first term.

B. $a \in [-79, -66]$ and $b \in [-15, -9]$

* $-76 - 10i$, which is the correct option.

C. $a \in [-79, -66]$ and $b \in [8, 11]$

$-76 + 10i$, which corresponds to adding a minus sign in both terms.

D. $a \in [-31, -25]$ and $b \in [43, 49]$

$-28+48i$, 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. $a \in [18, 22]$ and $b \in [70, 80]$

$20 + 74i$, 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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6. Simplify the expression below and choose the interval the simplification is contained within.

$$14 - 12^2 + 9 \div 5 * 10 \div 16$$

The solution is -128.875, which is option D.

A. $[-130.14, -129.96]$

-129.989, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

B. $[157.37, 158.98]$

158.011, which corresponds to two Order of Operations errors.

C. $[158.86, 159.16]$

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

D. $[-129.04, -128.32]$

* -128.875, 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. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{1815}{11}} + 2i^2$$

The solution is Irrational, which is option A.

A. Irrational

* This is the correct option!

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

$$10 - 6^2 + 4 \div 8 * 5 \div 18$$

The solution is -25.861, which is option D.

A. $[46.1, 46.2]$

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

B. $[-26.02, -25.89]$

-25.994, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

C. $[46, 46.06]$

46.006, which corresponds to two Order of Operations errors.

D. $[-25.92, -25.83]$

* -25.861, 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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9. Choose the **smallest** set of Real numbers that the number below belongs to.

$$-\sqrt{\frac{57600}{144}}$$

The solution is Integer, which is option A.

A. Integer

* This is the correct option!

B. Irrational

These cannot be written as a fraction of Integers.

C. Whole

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

D. Not a Real number

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

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 -240.

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.

$$\frac{-36 - 77i}{8 + 6i}$$

The solution is $-7.50 - 4.00i$, which is option B.

A. $a \in [-9, -6.5]$ and $b \in [-401, -399.5]$

$-7.50 - 400.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

B. $a \in [-9, -6.5]$ and $b \in [-5, -3]$

   * $-7.50 - 4.00i$, which is the correct option.

C. $a \in [-750.5, -749.5]$ and $b \in [-5, -3]$

   $-750.00 - 4.00i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

D. $a \in [-5, -3.5]$ and $b \in [-14, -12]$

   $-4.50 - 12.83i$, which corresponds to just dividing the first term by the first term and the second by the second.

E. $a \in [0.5, 3]$ and $b \in [-9, -7.5]$

   $1.74 - 8.32i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

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 $2 - 3i$.
