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.

$$\frac{-21}{0} + \sqrt{156}i$$

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

A. Rational

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

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

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

E. Not a Complex Number

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

$$\sqrt{\frac{-833}{0}}i + \sqrt{195}i$$

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

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

E. Not a Complex Number

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

$$14 - 3^2 + 11 \div 19 * 8 \div 9$$

The solution is 5.515, which is option A.

A. $[5.28, 5.63]$

* 5.515, this is the correct option

B. $[4.7, 5.38]$

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

C. $[23.49, 23.58]$

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

D. $[22.8, 23.28]$

23.008, which corresponds to two Order of Operations errors.

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

$$15 - 9 \div 6 * 11 - (7 * 19)$$

The solution is -134.500, which is option A.

A. $[-136.5, -132.5]$

* -134.500, which is the correct option.

B. $[146.86, 151.86]$

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

C. $[-165.5, -155.5]$

-161.500, which corresponds to not distributing a negative correctly.

D. $[-118.14, -109.14]$

-118.136, 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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5. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(5 - 4i)(-7 - 10i)$$

The solution is $-75 - 22i$, which is option B.

A. $a \in [2, 6]$ and $b \in [74, 82]$

$5 + 78i$, which corresponds to adding a minus sign in the second term.

B. $a \in [-78, -72]$ and $b \in [-24, -18]$

* $-75 - 22i$, which is the correct option.

C. $a \in [-78, -72]$ and $b \in [22, 30]$

$-75 + 22i$, which corresponds to adding a minus sign in both terms.

D. $a \in [2, 6]$ and $b \in [-84, -77]$

$5 - 78i$, which corresponds to adding a minus sign in the first term.

E. $a \in [-36, -33]$ and $b \in [39, 47]$

$-35 + 40i$, 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. Choose the **smallest** set of Real numbers that the number below belongs to.

$$-\sqrt{\frac{1848}{14}}$$

The solution is Irrational, 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. Whole

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

C. Irrational

* This is the correct option!

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 $-\sqrt{132}$.

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

$$\frac{-36 - 66i}{2 + 7i}$$

The solution is $-10.08 + 2.26i$, which is option A.

A. $a \in [-11.5, -9]$ and $b \in [1.5, 3]$

* $-10.08 + 2.26i$, which is the correct option.

B. $a \in [-18.5, -17.5]$ and $b \in [-10, -8]$

$-18.00 - 9.43i$, which corresponds to just dividing the first term by the first term and the second by the second.

C. $a \in [6.5, 8]$ and $b \in [-8.5, -7]$

$7.36 - 7.25i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

D. $a \in [-536, -533.5]$ and $b \in [1.5, 3]$

$-534.00 + 2.26i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

E. $a \in [-11.5, -9]$ and $b \in [119, 120.5]$

$-10.08 + 120.00i$, 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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8. Choose the **smallest** set of Real numbers that the number below belongs to.

$$-\sqrt{\frac{6}{0}}$$

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

A. Not a Real number

* 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. 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 $-\sqrt{\frac{6}{0}}$.

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.

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

$$\frac{-72 + 55i}{7 - 3i}$$

The solution is $-11.53 + 2.91i$, which is option E.

A. $a \in [-671, -668]$ and $b \in [1.5, 4]$

$-669.00 + 2.91i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

B. $a \in [-12.5, -10.5]$ and $b \in [168, 170]$

$-11.53 + 169.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

C. $a \in [-11, -9.5]$ and $b \in [-19, -17]$

$-10.29 - 18.33i$, which corresponds to just dividing the first term by the first term and the second by the second.

D. $a \in [-7, -5.5]$ and $b \in [9, 11]$

$-5.84 + 10.36i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

E. $a \in [-12.5, -10.5]$ and $b \in [1.5, 4]$

* $-11.53 + 2.91i$, 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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10. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(-2 - 4i)(10 - 3i)$$

The solution is $-32 - 34i$, which is option B.

A. $a \in [-37, -28]$ and $b \in [29, 35]$

$-32 + 34i$, which corresponds to adding a minus sign in both terms.

B. $a \in [-37, -28]$ and $b \in [-34, -33]$

* $-32 - 34i$, which is the correct option.

C. $a \in [-24, -16]$ and $b \in [12, 18]$

$-20+12i$, 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.

D. $a \in [-9, -5]$ and $b \in [-46, -42]$

$-8 - 46i$, which corresponds to adding a minus sign in the second term.

E. $a \in [-9, -5]$ and $b \in [40, 48]$

$-8 + 46i$, 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.
