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.

$$\sqrt{\frac{-2730}{0}} + \sqrt{221}$$

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

A. Nonreal Complex

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

B. Not a Complex Number

* This is the correct option!

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

$$\frac{-9 + 66i}{2 + 8i}$$

The solution is $7.50 + 3.00i$, which is option C.

A. $a \in [509.5, 511.5]$ and $b \in [2.5, 3.5]$

$510.00 + 3.00i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

B. $a \in [7, 9]$ and $b \in [203.5, 205]$

$7.50 + 204.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

C. $a \in [7, 9]$ and $b \in [2.5, 3.5]$

* $7.50 + 3.00i$, which is the correct option.

D. $a \in [-7, -4]$ and $b \in [8, 9]$

$-4.50 + 8.25i$, which corresponds to just dividing the first term by the first term and the second by the second.

E. $a \in [-9, -7.5]$ and $b \in [-1, 1.5]$

$-8.03 + 0.88i$, 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 $2 - 3i$.

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

$$(-6 - 3i)(-4 + 8i)$$

The solution is $48 - 36i$, which is option E.

A. $a \in [0, 3]$ and $b \in [-61, -59]$

$0 - 60i$, which corresponds to adding a minus sign in the first term.

B. $a \in [22, 30]$ and $b \in [-27, -19]$

$24 - 24i$, 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. $a \in [42, 50]$ and $b \in [36, 41]$

$48 + 36i$, which corresponds to adding a minus sign in both terms.

D. $a \in [0, 3]$ and $b \in [55, 62]$

$0 + 60i$, which corresponds to adding a minus sign in the second term.

E. $a \in [42, 50]$ and $b \in [-39, -31]$

* $48 - 36i$, which is the correct option.

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

$$\sqrt{\frac{-3570}{0}}i + \sqrt{130}i$$

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. Nonreal Complex

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

C. Irrational

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

D. Not a Complex Number

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

$$(8 + 5i)(-4 - 9i)$$

The solution is $13 - 92i$, which is option D.

A. $a \in [-79, -73]$ and $b \in [-52, -49]$

$-77 - 52i$, which corresponds to adding a minus sign in the first term.

B. $a \in [-79, -73]$ and $b \in [50, 55]$

$-77 + 52i$, which corresponds to adding a minus sign in the second term.

C. $a \in [-35, -29]$ and $b \in [-45, -41]$

$-32 - 45i$, 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.

D. $a \in [5, 14]$ and $b \in [-95, -89]$

* $13 - 92i$, which is the correct option.

E. $a \in [5, 14]$ and $b \in [90, 96]$

$13 + 92i$, 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.

$$\frac{9 - 66i}{-3 - 4i}$$

The solution is $9.48 + 9.36i$, which is option B.

A. $a \in [236, 238.5]$ and $b \in [8.5, 10.5]$

$237.00 + 9.36i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

B. $a \in [8.5, 10]$ and $b \in [8.5, 10.5]$

* $9.48 + 9.36i$, which is the correct option.

C. $a \in [-3.5, -1.5]$ and $b \in [16, 17.5]$

$-3.00 + 16.50i$, which corresponds to just dividing the first term by the first term and the second by the second.

D. $a \in [8.5, 10]$ and $b \in [233, 235.5]$

$9.48 + 234.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

E. $a \in [-13, -11]$ and $b \in [5, 6.5]$

$-11.64 + 6.48i$, 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 $2 - 3i$.

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

$$11 - 18 \div 19 * 2 - (6 * 17)$$

The solution is -92.895, which is option D.

A. $[49.1, 55.9]$

52.789, which corresponds to not distributing a negative correctly.

B. $[112.2, 113.7]$

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

C. $[-92, -86.8]$

-91.474, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

D. $[-94.5, -92.1]$

* -92.895, 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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8. Choose the **smallest** set of Real numbers that the number below belongs to.

$$\sqrt{\frac{1664}{8}}$$

The solution is Irrational, which is option C.

A. Integer

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

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. 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 $\sqrt{208}$.

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 and choose the interval the simplification is contained within.

$$11 - 15 \div 3 * 12 - (6 * 5)$$

The solution is -79.000, which is option B.

A. $[-279, -274]$

-275.000, which corresponds to not distributing a negative correctly.

B. $[-81, -77]$

* -79.000, which is the correct option.

C. $[40.58, 45.58]$

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

D. $[-19.42, -18.42]$

-19.417, 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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10. Choose the **smallest** set of Real numbers that the number below belongs to.

$$-\sqrt{\frac{400}{529}}$$

The solution is Rational, 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. Integer

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

D. Rational

* This is the correct option!

E. Whole

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

General Comment: First, you **NEED** to simplify the expression. This question simplifies to $-\frac{20}{23}$.

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.
