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.

$$(-7 + 3i)(-4 - 10i)$$

The solution is $58 + 58i$, which is option E.

A. $a \in [24, 31]$ and $b \in [-31, -27]$

$28 - 30i$, 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.

B. $a \in [-3, 3]$ and $b \in [76, 84]$

$-2 + 82i$, which corresponds to adding a minus sign in the first term.

C. $a \in [57, 61]$ and $b \in [-65, -57]$

$58 - 58i$, which corresponds to adding a minus sign in both terms.

D. $a \in [-3, 3]$ and $b \in [-85, -75]$

$-2 - 82i$, which corresponds to adding a minus sign in the second term.

E. $a \in [57, 61]$ and $b \in [58, 62]$

* $58 + 58i$, 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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2. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{-660}{0}} + \sqrt{143}$$

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

A. Pure Imaginary

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

B. Not a Complex Number

* This is the correct option!

C. Irrational

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

D. Nonreal Complex

This is a Complex number $(a + bi)$ that is not Real (has i as part of the 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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3. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{54 - 77i}{-2 + 5i}$$

The solution is $-17.00 - 4.00i$, which is option D.

A. $a \in [-28.5, -26.5]$ and $b \in [-16.5, -14.5]$

$-27.00 - 15.40i$, which corresponds to just dividing the first term by the first term and the second by the second.

B. $a \in [9, 10]$ and $b \in [14, 16]$

$9.55 + 14.62i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

C. $a \in [-493.5, -492]$ and $b \in [-4.5, -3]$

$-493.00 - 4.00i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

D. $a \in [-17.5, -16]$ and $b \in [-4.5, -3]$

* $-17.00 - 4.00i$, which is the correct option.

E. $a \in [-17.5, -16]$ and $b \in [-116.5, -115]$

$-17.00 - 116.00i$, 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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4. Choose the **smallest** set of Real numbers that the number below belongs to.

$$-\sqrt{\frac{300}{5}}$$

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. 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 $-\sqrt{60}$.

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

$$\frac{54 + 22i}{-4 - 3i}$$

The solution is $-11.28 + 2.96i$, which is option E.

A. $a \in [-7, -5.5]$ and $b \in [-10.5, -8.5]$

$-6.00 - 10.00i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

B. $a \in [-11.5, -10.5]$ and $b \in [73.5, 75]$

$-11.28 + 74.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

C. $a \in [-14.5, -13]$ and $b \in [-8, -6.5]$

$-13.50 - 7.33i$, which corresponds to just dividing the first term by the first term and the second by the second.

D. $a \in [-282.5, -280.5]$ and $b \in [2.5, 4]$

$-282.00 + 2.96i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

E. $a \in [-11.5, -10.5]$ and $b \in [2.5, 4]$

* $-11.28 + 2.96i$, 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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6. Simplify the expression below and choose the interval the simplification is contained within.

$$13 - 19 \div 5 * 4 - (2 * 9)$$

The solution is -20.200, which is option A.

A. $[-20.2, -18.2]$

* -20.200, which is the correct option.

B. $[-7.95, -3.95]$

-5.950, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

C. $[29.05, 34.05]$

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

D. $[-42.8, -34.8]$

-37.800, 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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7. Choose the **smallest** set of Real numbers that the number below belongs to.

$$\sqrt{\frac{46656}{81}}$$

The solution is Whole, which is option D.

A. Integer

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

B. Rational

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

C. Not a Real number

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

D. Whole

* This is the correct option!

E. Irrational

These cannot be written as a fraction of Integers.

General Comment: First, you **NEED** to simplify the expression. This question simplifies to 216.

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

$$13 - 19^2 + 18 \div 12 * 11 \div 3$$

The solution is -342.500, which is option B.

A. $[-350.95, -342.95]$

-347.955, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

B. $[-347.5, -336.5]$

* -342.500, this is the correct option

C. $[376.5, 382.5]$

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

D. $[372.05, 375.05]$

374.045, 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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9. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{-880}{0}}i + \sqrt{130}i$$

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

A. Not a Complex Number

* This is the correct option!

B. Rational

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

C. Nonreal Complex

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

D. Pure Imaginary

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

E. Irrational

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

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

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

The solution is $-95 - 40i$, which is option D.

A. $a \in [-97, -90]$ and $b \in [38, 46]$

$-95 + 40i$, which corresponds to adding a minus sign in both terms.

B. $a \in [-60, -56]$ and $b \in [35, 36]$

$-60 + 35i$, 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 $b \in [-101, -97]$

$-25 - 100i$, which corresponds to adding a minus sign in the first term.

D. $a \in [-97, -90]$ and $b \in [-42, -34]$

* $-95 - 40i$, which is the correct option.

E. $a \in [-29, -24]$ and $b \in [97, 101]$

$-25 + 100i$, 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.
