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.

$$(2 - 4i)(-5 + 6i)$$

The solution is $14 + 32i$, which is option B.

A. $a \in [13, 17]$ and $b \in [-32, -31]$

$14 - 32i$, which corresponds to adding a minus sign in both terms.

B. $a \in [13, 17]$ and $b \in [32, 35]$

* $14 + 32i$, which is the correct option.

C. $a \in [-34, -32]$ and $b \in [-11, -7]$

$-34 - 8i$, which corresponds to adding a minus sign in the first term.

D. $a \in [-12, -7]$ and $b \in [-27, -21]$

$-10 - 24i$, 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.

E. $a \in [-34, -32]$ and $b \in [8, 9]$

$-34 + 8i$, 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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2. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{45 + 88i}{-1 - 2i}$$

The solution is $-44.20 + 0.40i$, which is option A.

A. $a \in [-44.5, -44]$ and $b \in [-0.5, 1]$

* $-44.20 + 0.40i$, which is the correct option.

B. $a \in [26, 26.5]$ and $b \in [-36, -35]$

$26.20 - 35.60i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

C. $a \in [-44.5, -44]$ and $b \in [1.5, 2.5]$

$-44.20 + 2.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

D. $a \in [-222, -220.5]$ and $b \in [-0.5, 1]$

$-221.00 + 0.40i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

E. $a \in [-45.5, -44.5]$ and $b \in [-45.5, -43.5]$

$-45.00 - 44.00i$, which corresponds to just dividing the first term by the first term and the second by the second.

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

$$\sqrt{\frac{361}{0}} + \sqrt{45}i$$

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

A. Not a Complex Number

* 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. Rational

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

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

$$9 - 1 \div 12 * 6 - (11 * 10)$$

The solution is -101.500, which is option A.

A. $[-101.87, -101.23]$

* -101.500, which is the correct option.

B. $[-101.49, -101]$

-101.014, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

C. $[118.87, 119.35]$

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

D. $[-25.17, -24.88]$

-25.000, 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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5. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{-1078}{14}}i + \sqrt{156}i$$

The solution is Nonreal Complex, which is option E.

A. Pure Imaginary

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

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. 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. Nonreal Complex

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

$$\frac{18 - 55i}{-7 - 8i}$$

The solution is $2.78 + 4.68i$, which is option B.

A. $a \in [-3, -1.5]$ and $b \in [6.5, 8]$

$-2.57 + 6.88i$, which corresponds to just dividing the first term by the first term and the second by the second.

B. $a \in [1.5, 3.5]$ and $b \in [4, 5.5]$

* $2.78 + 4.68i$, which is the correct option.

C. $a \in [312.5, 314.5]$ and $b \in [4, 5.5]$

$314.00 + 4.68i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

D. $a \in [1.5, 3.5]$ and $b \in [528, 529.5]$

$2.78 + 529.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

E. $a \in [-5.5, -4.5]$ and $b \in [1.5, 3.5]$

$-5.01 + 2.13i$, 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.

$$9 - 15 \div 14 * 8 - (16 * 4)$$

The solution is -63.571, which is option A.

A. $[-64.05, -63.43]$

* -63.571, which is the correct option.

B. $[-62.63, -61.8]$

-62.286, which corresponds to not distributing a negative correctly.

C. $[-56.03, -54.58]$

-55.134, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

D. $[72.84, 74.4]$

72.866, which corresponds to not distributing addition and subtraction 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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8. Choose the **smallest** set of Real numbers that the number below belongs to.

$$-\sqrt{\frac{490}{7}}$$

The solution is Irrational, which is option E.

A. Integer

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

B. Not a Real number

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

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

* This is the correct option!

General Comment: First, you **NEED** to simplify the expression. This question simplifies to $-\sqrt{70}$.

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.

$$(-4 + 10i)(2 + 8i)$$

The solution is $-88 - 12i$, which is option E.

A. $a \in [70, 78]$ and $b \in [-56, -48]$

$72 - 52i$, which corresponds to adding a minus sign in the first term.

B. $a \in [70, 78]$ and $b \in [46, 55]$

$72 + 52i$, which corresponds to adding a minus sign in the second term.

C. $a \in [-88, -83]$ and $b \in [6, 15]$

$-88 + 12i$, which corresponds to adding a minus sign in both terms.

D. $a \in [-12, -7]$ and $b \in [80, 83]$

$-8 + 80i$, 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. $a \in [-88, -83]$ and $b \in [-15, -7]$

* $-88 - 12i$, 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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10. Choose the **smallest** set of Real numbers that the number below belongs to.

$$\sqrt{\frac{896}{8}}$$

The solution is Irrational, which is option A.

A. Irrational

* This is the correct option!

B. Integer

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

C. Rational

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

D. Whole

These are the counting numbers with 0 (0, 1, 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 $\sqrt{112}$.

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.
