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 and choose the interval the simplification is contained within.

$$16 - 1 \div 14 * 10 - (6 * 12)$$

The solution is -56.714, which is option B.

A. $[111.34, 113.19]$

111.429, which corresponds to not distributing a negative correctly.

B. $[-56.77, -56.66]$

* -56.714, which is the correct option.

C. $[86.76, 88.44]$

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

D. $[-56.05, -55.02]$

-56.007, 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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2. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(-2 + 8i)(-3 + 7i)$$

The solution is $-50 - 38i$, which is option A.

A. $a \in [-53, -42]$ and $b \in [-42, -37]$

* $-50 - 38i$, which is the correct option.

B. $a \in [58, 67]$ and $b \in [10, 13]$

$62 + 10i$, which corresponds to adding a minus sign in the first term.

C. $a \in [58, 67]$ and $b \in [-10, -9]$

$62 - 10i$, which corresponds to adding a minus sign in the second term.

D. $a \in [5, 7]$ and $b \in [55, 59]$

$6 + 56i$, 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. $a \in [-53, -42]$ and $b \in [36, 40]$

$-50 + 38i$, 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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3. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{18 + 44i}{-3 - 5i}$$

The solution is $-8.06 - 1.24i$, which is option C.

A. $a \in [-6.5, -5]$ and $b \in [-10.5, -8]$

$-6.00 - 8.80i$, which corresponds to just dividing the first term by the first term and the second by the second.

B. $a \in [4, 6]$ and $b \in [-8.5, -5.5]$

$4.88 - 6.53i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

C. $a \in [-8.5, -7.5]$ and $b \in [-2, -0.5]$

* $-8.06 - 1.24i$, which is the correct option.

D. $a \in [-8.5, -7.5]$ and $b \in [-42.5, -40.5]$

$-8.06 - 42.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

E. $a \in [-274.5, -273]$ and $b \in [-2, -0.5]$

$-274.00 - 1.24i$, 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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4. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\frac{-16}{-4} + \sqrt{-49}i$$

The solution is Rational, which is option C.

A. Irrational

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

B. Nonreal Complex

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

C. Rational

* This is the correct option!

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. 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.

$$(3 - 4i)(9 + 8i)$$

The solution is $59 - 12i$, which is option C.

A. $a \in [-8, -4]$ and $b \in [-62, -58]$

$-5 - 60i$, which corresponds to adding a minus sign in the second term.

B. $a \in [-8, -4]$ and $b \in [57, 65]$

$-5 + 60i$, which corresponds to adding a minus sign in the first term.

C. $a \in [58, 60]$ and $b \in [-13, -9]$

* $59 - 12i$, which is the correct option.

D. $a \in [25, 29]$ and $b \in [-33, -31]$

$27 - 32i$, 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. $a \in [58, 60]$ and $b \in [12, 15]$

$59 + 12i$, 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.

$$\frac{27 - 44i}{1 - 8i}$$

The solution is $5.83 + 2.65i$, which is option E.

A. $a \in [-6, -4]$ and $b \in [-5, -3.5]$

$-5.00 - 4.00i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

B. $a \in [26, 28]$ and $b \in [3, 7]$

$27.00 + 5.50i$, which corresponds to just dividing the first term by the first term and the second by the second.

C. $a \in [5, 6]$ and $b \in [171, 172.5]$

$5.83 + 172.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

D. $a \in [378.5, 380]$ and $b \in [2, 3.5]$

$379.00 + 2.65i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

E. $a \in [5, 6]$ and $b \in [2, 3.5]$

* $5.83 + 2.65i$, 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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7. Simplify the expression below and choose the interval the simplification is contained within.

$$17 - 13 \div 6 * 5 - (8 * 9)$$

The solution is -65.833, which is option D.

A. $[86.57, 89.57]$

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

B. $[-20.5, -9.5]$

-16.500, which corresponds to not distributing a negative correctly.

C. $[-56.43, -54.43]$

-55.433, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

D. $[-72.83, -61.83]$

* -65.833, 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.

$$-\sqrt{\frac{9}{0}}$$

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

A. Irrational

These cannot be written as a fraction of Integers.

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

* This is the correct option!

General Comment: First, you **NEED** to simplify the expression. This question simplifies to $-\sqrt{\frac{9}{0}}$.

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

$$-\sqrt{\frac{1716}{13}}$$

The solution is Irrational, which is option E.

A. Whole

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

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. Not a Real number

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

E. Irrational

* This is the correct option!

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

$$\frac{\sqrt{91}}{13} + 8i^2$$

The solution is Irrational, which is option B.

A. 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!

B. Irrational

* This is the correct option!

C. Rational

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

D. Nonreal Complex

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

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.
