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.

$$11 - 10 \div 6 * 13 - (8 * 12)$$

The solution is -106.667, which is option A.

A. $[-106.67, -102.67]$

* -106.667, which is the correct option.

B. $[-225, -220]$

-224.000, which corresponds to not distributing a negative correctly.

C. $[101.87, 112.87]$

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

D. $[-92.13, -82.13]$

-85.128, 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.

$$(-5 + 4i)(6 + 3i)$$

The solution is $-42 + 9i$, which is option E.

A. $a \in [-27, -17]$ and $b \in [37.2, 40.7]$

$-18 + 39i$, which corresponds to adding a minus sign in the second term.

B. $a \in [-33, -28]$ and $b \in [9.9, 14.8]$

$-30 + 12i$, 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.

C. $a \in [-42, -41]$ and $b \in [-10.5, -6.4]$

$-42 - 9i$, which corresponds to adding a minus sign in both terms.

D. $a \in [-27, -17]$ and $b \in [-39.8, -38.7]$

$-18 - 39i$, which corresponds to adding a minus sign in the first term.

E. $a \in [-42, -41]$ and $b \in [8.5, 9.7]$

* $-42 + 9i$, 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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3. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{36 - 11i}{-6 + 3i}$$

The solution is $-5.53 - 0.93i$, which is option B.

A. $a \in [-5.7, -5.2]$ and $b \in [-43, -41.5]$

$-5.53 - 42.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

B. $a \in [-5.7, -5.2]$ and $b \in [-1.5, 0.5]$

* $-5.53 - 0.93i$, which is the correct option.

C. $a \in [-6.15, -5.75]$ and $b \in [-4, -3]$

$-6.00 - 3.67i$, which corresponds to just dividing the first term by the first term and the second by the second.

D. $a \in [-4.7, -3.55]$ and $b \in [2.5, 4.5]$

$-4.07 + 3.87i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

E. $a \in [-249.7, -248.95]$ and $b \in [-1.5, 0.5]$

$-249.00 - 0.93i$, 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.

$$\frac{20}{-9} + \sqrt{-49}i$$

The solution is Rational, which is option D.

A. Pure Imaginary

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

B. Irrational

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

C. Nonreal Complex

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

D. Rational

* This is the correct option!

E. 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!

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.

$$(4 - 10i)(-9 + 6i)$$

The solution is $24 + 114i$, which is option C.

A. $a \in [-100, -94]$ and $b \in [-71, -63]$

$-96 - 66i$, which corresponds to adding a minus sign in the first term.

B. $a \in [19, 30]$ and $b \in [-114, -113]$

$24 - 114i$, which corresponds to adding a minus sign in both terms.

C. $a \in [19, 30]$ and $b \in [105, 120]$

* $24 + 114i$, which is the correct option.

D. $a \in [-100, -94]$ and $b \in [65, 72]$

$-96 + 66i$, which corresponds to adding a minus sign in the second term.

E. $a \in [-37, -29]$ and $b \in [-63, -57]$

$-36 - 60i$, 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. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{-72 - 33i}{-7 + 6i}$$

The solution is $3.60 + 7.80i$, which is option B.

A. $a \in [3, 4.5]$ and $b \in [662, 663.5]$

$3.60 + 663.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

B. $a \in [3, 4.5]$ and $b \in [6.5, 8.5]$

* $3.60 + 7.80i$, which is the correct option.

C. $a \in [305, 306.5]$ and $b \in [6.5, 8.5]$

$306.00 + 7.80i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

D. $a \in [7.5, 9]$ and $b \in [-3, -2]$

$8.26 - 2.36i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

E. $a \in [10, 12]$ and $b \in [-7, -4.5]$

$10.29 - 5.50i$, 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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7. Simplify the expression below and choose the interval the simplification is contained within.

$$9 - 5 \div 15 * 12 - (18 * 4)$$

The solution is -67.000, which is option D.

A. $[-53.2, -48.2]$

-52.000, which corresponds to not distributing a negative correctly.

B. $[80.9, 82]$

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

C. $[-63.8, -62]$

-63.028, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

D. $[-70.4, -64.2]$

* -67.000, 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.

$$\sqrt{\frac{93636}{289}}$$

The solution is Whole, which is option A.

A. Whole

* This is the correct option!

B. Integer

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

C. Not a Real number

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

D. Rational

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

E. Irrational

These cannot be written as a fraction of Integers.

General Comment: First, you **NEED** to simplify the expression. This question simplifies to 306.

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.

$$-\sqrt{\frac{74529}{441}}$$

The solution is Integer, which is option A.

A. Integer

* This is the correct option!

B. Whole

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

C. Irrational

These cannot be written as a fraction of Integers.

D. Not a Real number

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

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 -273.

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.

$$\frac{0}{7\pi} + \sqrt{5}i$$

The solution is Pure Imaginary, which is option C.

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. 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 the correct option!

D. Irrational

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

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.
