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.

$$9 - 14 \div 15 * 19 - (16 * 11)$$

The solution is -184.733, which is option C.

A. $[-277.07, -265.07]$

-272.067, which corresponds to not distributing a negative correctly.

B. $[181.95, 185.95]$

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

C. $[-188.73, -180.73]$

* -184.733, which is the correct option.

D. $[-168.05, -156.05]$

-167.049, 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.

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

The solution is $58 - 19i$, which is option D.

A. $a \in [52, 62]$ and $b \in [14, 21]$

$58 + 19i$, which corresponds to adding a minus sign in both terms.

B. $a \in [2, 6]$ and $b \in [61, 69]$

$2 + 61i$, which corresponds to adding a minus sign in the first term.

C. $a \in [29, 33]$ and $b \in [-31, -24]$

$30 - 28i$, 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. $a \in [52, 62]$ and $b \in [-21, -17]$

* $58 - 19i$, which is the correct option.

E. $a \in [2, 6]$ and $b \in [-62, -51]$

$2 - 61i$, 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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3. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{-1210}{11}} + \sqrt{85}$$

The solution is Nonreal Complex, which is option C.

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 the correct option!

D. Rational

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

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

$$\sqrt{\frac{12100}{484}}$$

The solution is Whole, which is option E.

A. Not a Real number

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

B. Rational

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

C. Integer

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

D. Irrational

These cannot be written as a fraction of Integers.

E. Whole

* This is the correct option!

General Comment: First, you **NEED** to simplify the expression. This question simplifies to 110.

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.

$$\frac{63 - 44i}{-5 - 8i}$$

The solution is $0.42 + 8.13i$, which is option E.

A. $a \in [36.5, 38.5]$ and $b \in [8, 9.5]$

$37.00 + 8.13i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

B. $a \in [-13.5, -12]$ and $b \in [4, 6.5]$

$-12.60 + 5.50i$, which corresponds to just dividing the first term by the first term and the second by the second.

C. $a \in [-8, -5.5]$ and $b \in [-4, -1.5]$

$-7.49 - 3.19i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

D. $a \in [-0.5, 1]$ and $b \in [722.5, 724.5]$

$0.42 + 724.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

E. $a \in [-0.5, 1]$ and $b \in [8, 9.5]$

* $0.42 + 8.13i$, 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.

$$10 - 15^2 + 14 \div 4 * 8 \div 16$$

The solution is -213.250, which is option A.

A. $[-213.35, -211.36]$

* -213.250, this is the correct option

B. $[234.26, 235.58]$

235.027, which corresponds to two Order of Operations errors.

C. $[-217.03, -214.29]$

-214.973, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

D. $[236.03, 238.16]$

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

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 Complex numbers that the number below belongs to.

$$\frac{0}{18\pi} + \sqrt{5}i$$

The solution is Pure Imaginary, which is option A.

A. Pure Imaginary

* This is the correct option!

B. Irrational

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

C. Rational

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

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 a Complex number $(a + bi)$ that is not Real (has i as part of the 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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8. Choose the **smallest** set of Real numbers that the number below belongs to.

$$-\sqrt{\frac{2805}{11}}$$

The solution is Irrational, which is option B.

A. Integer

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

B. Irrational

* This is the correct option!

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. 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 $-\sqrt{255}$.

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.

$$(-10 - 2i)(7 - 9i)$$

The solution is $-88 + 76i$, which is option A.

A. $a \in [-88, -80]$ and $b \in [69, 82]$

* $-88 + 76i$, which is the correct option.

B. $a \in [-53, -49]$ and $b \in [103, 105]$

$-52 + 104i$, which corresponds to adding a minus sign in the first term.

C. $a \in [-53, -49]$ and $b \in [-105, -100]$

$-52 - 104i$, which corresponds to adding a minus sign in the second term.

D. $a \in [-70, -66]$ and $b \in [15, 24]$

$-70 + 18i$, 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. $a \in [-88, -80]$ and $b \in [-85, -71]$

$-88 - 76i$, 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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10. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{-18 - 77i}{-1 + 4i}$$

The solution is $-17.06 + 8.76i$, which is option A.

A. $a \in [-17.5, -16.5]$ and $b \in [7, 10]$

* $-17.06 + 8.76i$, which is the correct option.

B. $a \in [-290.5, -289.5]$ and $b \in [7, 10]$

$-290.00 + 8.76i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

C. $a \in [-17.5, -16.5]$ and $b \in [148.5, 149.5]$

$-17.06 + 149.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

D. $a \in [17.5, 18.5]$ and $b \in [-20, -19]$

$18.00 - 19.25i$, which corresponds to just dividing the first term by the first term and the second by the second.

E. $a \in [19, 20]$ and $b \in [-0.5, 1]$

$19.18 + 0.29i$, 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 $2 - 3i$.
