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.

$$(-7 - 4i)(3 + 6i)$$

The solution is $3 - 54i$, which is option A.

A. $a \in [3, 5]$ and $b \in [-58, -47]$

* $3 - 54i$, which is the correct option.

B. $a \in [-26, -18]$ and $b \in [-24, -18]$

$-21 - 24i$, 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.

C. $a \in [3, 5]$ and $b \in [50, 61]$

$3 + 54i$, which corresponds to adding a minus sign in both terms.

D. $a \in [-45, -42]$ and $b \in [-31, -29]$

$-45 - 30i$, which corresponds to adding a minus sign in the first term.

E. $a \in [-45, -42]$ and $b \in [27, 34]$

$-45 + 30i$, 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. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{-390}{6}} + \sqrt{234}$$

The solution is Nonreal Complex, which is option B.

A. Rational

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

B. Nonreal Complex

* This is the correct option!

C. Pure Imaginary

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

D. Irrational

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

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

$$6 - 7^2 + 1 \div 10 * 19 \div 4$$

The solution is -42.525, which is option C.

A. $[-43.27, -42.62]$

-42.999, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

B. $[54.92, 55.25]$

55.001, which corresponds to two Order of Operations errors.

C. $[-42.81, -41.74]$

* -42.525, this is the correct option

D. $[55.29, 56.16]$

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

$$-\sqrt{\frac{25}{121}} + 64i^2$$

The solution is Rational, 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. 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. 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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5. Choose the **smallest** set of Real numbers that the number below belongs to.

$$-\sqrt{\frac{6400}{64}}$$

The solution is Integer, which is option B.

A. Irrational

These cannot be written as a fraction of Integers.

B. Integer

* This is the correct option!

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 -80.

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

$$-\sqrt{\frac{17}{0}}$$

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

A. Whole

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

B. Irrational

These cannot be written as a fraction of Integers.

C. Rational

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

D. Integer

These are the negative and positive counting numbers (..., -3, -2, -1, 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 $-\sqrt{\frac{17}{0}}$.

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

$$\frac{-18 - 88i}{3 + 5i}$$

The solution is $-14.53 - 5.12i$, which is option C.

A. $a \in [-7, -5.5]$ and $b \in [-18, -17]$

$-6.00 - 17.60i$, which corresponds to just dividing the first term by the first term and the second by the second.

B. $a \in [-494.5, -493.5]$ and $b \in [-5.5, -4.5]$

$-494.00 - 5.12i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

C. $a \in [-15, -14]$ and $b \in [-5.5, -4.5]$

* $-14.53 - 5.12i$, which is the correct option.

D. $a \in [10.5, 13]$ and $b \in [-11, -9.5]$

$11.35 - 10.41i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

E. $a \in [-15, -14]$ and $b \in [-174.5, -172.5]$

$-14.53 - 174.00i$, 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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8. Simplify the expression below and choose the interval the simplification is contained within.

$$20 - 17^2 + 18 \div 13 * 16 \div 15$$

The solution is -267.523, which is option D.

A. $[310.12, 310.92]$

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

B. $[-269.32, -268.77]$

-268.994, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

C. $[308.47, 309.18]$

309.006, which corresponds to two Order of Operations errors.

D. $[-268.2, -267.38]$

* -267.523, this 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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9. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{-72 - 11i}{-6 + 5i}$$

The solution is $6.18 + 6.98i$, which is option C.

A. $a \in [376, 378]$ and $b \in [6, 8]$

$377.00 + 6.98i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

B. $a \in [5.5, 6.5]$ and $b \in [425, 427.5]$

$6.18 + 426.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

C. $a \in [5.5, 6.5]$ and $b \in [6, 8]$

* $6.18 + 6.98i$, which is the correct option.

D. $a \in [10.5, 13]$ and $b \in [-3, -1.5]$

$12.00 - 2.20i$, which corresponds to just dividing the first term by the first term and the second by the second.

E. $a \in [7.5, 8.5]$ and $b \in [-5, -3.5]$

$7.98 - 4.82i$, 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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10. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(7 + 3i)(2 - 9i)$$

The solution is $41 - 57i$, which is option D.

A. $a \in [14, 20]$ and $b \in [-34, -20]$

$14 - 27i$, 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. $a \in [38, 43]$ and $b \in [53, 59]$

$41 + 57i$, which corresponds to adding a minus sign in both terms.

C. $a \in [-19, -10]$ and $b \in [-72, -65]$

$-13 - 69i$, which corresponds to adding a minus sign in the first term.

D. $a \in [38, 43]$ and $b \in [-59, -50]$

* $41 - 57i$, which is the correct option.

E. $a \in [-19, -10]$ and $b \in [66, 71]$

$-13 + 69i$, 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.