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

$$-\sqrt{\frac{13225}{529}}$$

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. 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 -115.

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

$$\sqrt{\frac{1872}{12}} + \sqrt{154}i$$

The solution is Nonreal Complex, which is option C.

A. Irrational

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

B. Pure Imaginary

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

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

$$-\sqrt{\frac{425}{5}}$$

The solution is Irrational, which is option C.

A. Not a Real number

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

B. Integer

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

C. Irrational

* This is the correct option!

D. Rational

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

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 $-\sqrt{85}$.

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

$$1 - 9^2 + 10 \div 19 * 12 \div 15$$

The solution is -79.579, which is option A.

A. $[-79.87, -79.02]$

* -79.579, this is the correct option

B. $[-80.78, -79.83]$

-79.997, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

C. $[81.56, 82.03]$

82.003, which corresponds to two Order of Operations errors.

D. $[82.39, 82.81]$

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

$$\frac{0}{-9\pi} + \sqrt{9}i$$

The solution is Pure Imaginary, which is option E.

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

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. 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 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.

$$\frac{-9 + 44i}{-3 + 8i}$$

The solution is $5.19 - 0.82i$, which is option C.

A. $a \in [-5, -3.5]$ and $b \in [-4, -2]$

$-4.45 - 2.79i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

B. $a \in [378.5, 379.5]$ and $b \in [-1.5, 0.5]$

$379.00 - 0.82i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

C. $a \in [4.5, 6]$ and $b \in [-1.5, 0.5]$

* $5.19 - 0.82i$, which is the correct option.

D. $a \in [2.5, 3.5]$ and $b \in [5, 6.5]$

$3.00 + 5.50i$, which corresponds to just dividing the first term by the first term and the second by the second.

E. $a \in [4.5, 6]$ and $b \in [-60.5, -59.5]$

$5.19 - 60.00i$, 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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7. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(10 - 6i)(5 - 8i)$$

The solution is $2 - 110i$, which is option E.

A. $a \in [96, 102]$ and $b \in [-50.68, -49.98]$

$98 - 50i$, which corresponds to adding a minus sign in the first term.

B. $a \in [96, 102]$ and $b \in [49.72, 50.97]$

$98 + 50i$, which corresponds to adding a minus sign in the second term.

C. $a \in [-2, 7]$ and $b \in [109.01, 111.53]$

$2 + 110i$, which corresponds to adding a minus sign in both terms.

D. $a \in [49, 55]$ and $b \in [46.97, 49.25]$

$50 + 48i$, 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. $a \in [-2, 7]$ and $b \in [-110.1, -109.19]$

* $2 - 110i$, 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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8. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{-18 - 55i}{-7 + 3i}$$

The solution is $-0.67 + 7.57i$, which is option D.

A. $a \in [-39.5, -38.5]$ and $b \in [6, 8]$

$-39.00 + 7.57i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

B. $a \in [4, 6]$ and $b \in [4.5, 6.5]$

$5.02 + 5.71i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

C. $a \in [-2, 0]$ and $b \in [438.5, 439.5]$

$-0.67 + 439.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

D. $a \in [-2, 0]$ and $b \in [6, 8]$

* $-0.67 + 7.57i$, which is the correct option.

E. $a \in [1.5, 3.5]$ and $b \in [-19, -18]$

$2.57 - 18.33i$, 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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9. Simplify the expression below and choose the interval the simplification is contained within.

$$1 - 6 \div 19 * 8 - (9 * 20)$$

The solution is -181.526, which is option D.

A. $[-215, -209.8]$

-210.526, which corresponds to not distributing a negative correctly.

B. $[-179.4, -177.7]$

-179.039, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

C. $[179.4, 181.8]$

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

D. $[-185.5, -180.3]$

* -181.526, 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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10. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(3 + 9i)(-2 + 8i)$$

The solution is $-78 + 6i$, which is option C.

A. $a \in [66, 69]$ and $b \in [42, 44]$

$66 + 42i$, which corresponds to adding a minus sign in the first term.

B. $a \in [66, 69]$ and $b \in [-45, -37]$

$66 - 42i$, which corresponds to adding a minus sign in the second term.

C. $a \in [-80, -77]$ and $b \in [5, 8]$

* $-78 + 6i$, which is the correct option.

D. $a \in [-80, -77]$ and $b \in [-8, -4]$

$-78 - 6i$, which corresponds to adding a minus sign in both terms.

E. $a \in [-10, -1]$ and $b \in [67, 77]$

$-6 + 72i$, 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.
