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 Complex numbers that the number below belongs to.

$$\sqrt{\frac{1547}{13}} + 10i^2$$

The solution is Irrational, which is option C.

A. Rational

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

B. Nonreal Complex

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

C. Irrational

* This is the correct option!

D. Pure Imaginary

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

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

$$\sqrt{\frac{0}{14}} + \sqrt{10}i$$

The solution is Pure Imaginary, which is option E.

A. Rational

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

B. 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!

C. Nonreal Complex

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

D. Irrational

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

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

$$4 - 8^2 + 15 \div 5 * 10 \div 9$$

The solution is -56.667, which is option B.

A. $[66.4, 68.6]$

68.033, which corresponds to two Order of Operations errors.

B. $[-57.8, -56.4]$

* -56.667, this is the correct option

C. $[-60, -58.8]$

-59.967, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

D. $[69.1, 73.9]$

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

$$8 - 20^2 + 13 \div 18 * 6 \div 1$$

The solution is -387.667, which is option D.

A. $[-392.1, -390.4]$

-391.880, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

B. $[404.2, 408.6]$

408.120, which corresponds to two Order of Operations errors.

C. $[411.3, 413.3]$

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

D. $[-390.7, -387.2]$

* -387.667, 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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5. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

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

The solution is $39 - 18i$, which is option B.

A. $a \in [8, 16]$ and $b \in [-24, -23]$

$15 - 24i$, 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.

B. $a \in [34, 46]$ and $b \in [-22, -17]$

* $39 - 18i$, which is the correct option.

C. $a \in [-9, -4]$ and $b \in [-42, -41]$

$-9 - 42i$, which corresponds to adding a minus sign in the second term.

D. $a \in [34, 46]$ and $b \in [17, 20]$

$39 + 18i$, which corresponds to adding a minus sign in both terms.

E. $a \in [-9, -4]$ and $b \in [42, 43]$

$-9 + 42i$, which corresponds to adding a minus sign in the first 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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6. Choose the **smallest** set of Real numbers that the number below belongs to.

$$\sqrt{\frac{190969}{529}}$$

The solution is Whole, which is option D.

A. Integer

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

B. Rational

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

C. Not a Real number

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

D. Whole

* This is the correct option!

E. Irrational

These cannot be written as a fraction of Integers.

General Comment: First, you **NEED** to simplify the expression. This question simplifies to 437.

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.

$$\frac{-54 + 55i}{2 - 7i}$$

The solution is $-9.30 - 5.06i$, which is option C.

A. $a \in [-10.5, -9]$ and $b \in [-269, -267.5]$

$-9.30 - 268.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

B. $a \in [-28.5, -25.5]$ and $b \in [-8.5, -7]$

$-27.00 - 7.86i$, which corresponds to just dividing the first term by the first term and the second by the second.

C. $a \in [-10.5, -9]$ and $b \in [-6.5, -3.5]$

* $-9.30 - 5.06i$, which is the correct option.

D. $a \in [-493.5, -491.5]$ and $b \in [-6.5, -3.5]$

$-493.00 - 5.06i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

E. $a \in [2.5, 6]$ and $b \in [8, 10]$

$5.23 + 9.21i$, 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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8. Choose the **smallest** set of Real numbers that the number below belongs to.

$$-\sqrt{\frac{48400}{100}}$$

The solution is Integer, which is option A.

A. Integer

* This is the correct option!

B. Rational

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

C. Not a Real number

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

D. Whole

These are the counting numbers with 0 (0, 1, 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 -220.

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.

$$\frac{36 - 33i}{-2 + i}$$

The solution is $-21.00 + 6.00i$, which is option E.

A. $a \in [-22, -19.5]$ and $b \in [29.5, 30.5]$

$-21.00 + 30.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

B. $a \in [-19.5, -17]$ and $b \in [-34.5, -31]$

$-18.00 - 33.00i$, which corresponds to just dividing the first term by the first term and the second by the second.

C. $a \in [-8.5, -7]$ and $b \in [19, 21]$

$-7.80 + 20.40i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

D. $a \in [-105.5, -104]$ and $b \in [4.5, 7]$

$-105.00 + 6.00i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

E. $a \in [-22, -19.5]$ and $b \in [4.5, 7]$

* $-21.00 + 6.00i$, 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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10. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

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

The solution is $-19 + 82i$, which is option C.

A. $a \in [-41, -36]$ and $b \in [-22, -20]$

$-40 - 21i$, 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. $a \in [-19, -16]$ and $b \in [-87, -74]$

$-19 - 82i$, which corresponds to adding a minus sign in both terms.

C. $a \in [-19, -16]$ and $b \in [72, 84]$

* $-19 + 82i$, which is the correct option.

D. $a \in [-65, -57]$ and $b \in [58, 60]$

$-61 + 58i$, which corresponds to adding a minus sign in the second term.

E. $a \in [-65, -57]$ and $b \in [-59, -52]$

$-61 - 58i$, which corresponds to adding a minus sign in the first 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.
