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.

$$\sqrt{\frac{0}{49}} + \sqrt{4}i$$

The solution is Pure Imaginary, which is option E.

A. Nonreal Complex

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

B. Irrational

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

C. 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!

D. Rational

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

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

$$2 - 10^2 + 11 \div 8 * 6 \div 5$$

The solution is -96.350, which is option C.

A. $[-100.3, -96.6]$

-97.954, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

B. $[103, 109.3]$

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

C. $[-97.5, -94.3]$

* -96.350, this is the correct option

D. $[100.5, 102.9]$

102.046, which corresponds to two Order of Operations errors.

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

$$\sqrt{\frac{23104}{361}}$$

The solution is Whole, which is option D.

A. Rational

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

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. 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 152.

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

$$(5 + 9i)(10 + 7i)$$

The solution is $-13 + 125i$, which is option D.

A. $a \in [-13, -9]$ and $b \in [-133, -123]$

$-13 - 125i$, which corresponds to adding a minus sign in both terms.

B. $a \in [112, 117]$ and $b \in [-55, -52]$

$113 - 55i$, which corresponds to adding a minus sign in the first term.

C. $a \in [112, 117]$ and $b \in [55, 61]$

$113 + 55i$, which corresponds to adding a minus sign in the second term.

D. $a \in [-13, -9]$ and $b \in [123, 128]$

* $-13 + 125i$, which is the correct option.

E. $a \in [49, 52]$ and $b \in [63, 66]$

$50 + 63i$, 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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5. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{1584}{0}} + \sqrt{112}i$$

The solution is Not a Complex Number, which is option B.

A. Irrational

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

B. Not a Complex Number

* This is the correct option!

C. Rational

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

D. Pure Imaginary

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

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

$$(4 - 10i)(8 - 2i)$$

The solution is $12 - 88i$, which is option C.

A. $a \in [32, 34]$ and $b \in [18, 26]$

$32 + 20i$, 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. $a \in [51, 58]$ and $b \in [68, 79]$

$52 + 72i$, which corresponds to adding a minus sign in the first term.

C. $a \in [11, 15]$ and $b \in [-93, -85]$

* $12 - 88i$, which is the correct option.

D. $a \in [51, 58]$ and $b \in [-74, -69]$

$52 - 72i$, which corresponds to adding a minus sign in the second term.

E. $a \in [11, 15]$ and $b \in [84, 90]$

$12 + 88i$, 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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7. Choose the **smallest** set of Real numbers that the number below belongs to.

$$\sqrt{\frac{2730}{14}}$$

The solution is Irrational, 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. Irrational

* This is the correct option!

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 $\sqrt{195}$.

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

$$\frac{18 + 44i}{-1 + 7i}$$

The solution is $5.80 - 3.40i$, which is option D.

A. $a \in [-18.5, -17.5]$ and $b \in [5.5, 6.5]$

$-18.00 + 6.29i$, which corresponds to just dividing the first term by the first term and the second by the second.

B. $a \in [289, 290.5]$ and $b \in [-4, -3]$

$290.00 - 3.40i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

C. $a \in [-7, -6.5]$ and $b \in [1, 3]$

$-6.52 + 1.64i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

D. $a \in [4, 6.5]$ and $b \in [-4, -3]$

* $5.80 - 3.40i$, which is the correct option.

E. $a \in [4, 6.5]$ and $b \in [-171, -169]$

$5.80 - 170.00i$, 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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9. Simplify the expression below and choose the interval the simplification is contained within.

$$15 - 16^2 + 6 \div 8 * 20 \div 18$$

The solution is -240.167, which is option C.

A. $[-241.14, -240.53]$

-240.998, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

B. $[270.95, 271.64]$

271.002, which corresponds to two Order of Operations errors.

C. $[-240.18, -239.57]$

* -240.167, this is the correct option

D. $[271.36, 272.12]$

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

$$\frac{18 - 33i}{1 - 7i}$$

The solution is $4.98 + 1.86i$, which is option D.

A. $a \in [247.5, 249.5]$ and $b \in [1, 3]$

$249.00 + 1.86i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

B. $a \in [-6.5, -3.5]$ and $b \in [-3.5, -2.5]$

$-4.26 - 3.18i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

C. $a \in [17, 19]$ and $b \in [4, 5]$

$18.00 + 4.71i$, which corresponds to just dividing the first term by the first term and the second by the second.

D. $a \in [3.5, 5.5]$ and $b \in [1, 3]$

* $4.98 + 1.86i$, which is the correct option.

E. $a \in [3.5, 5.5]$ and $b \in [92, 93.5]$

$4.98 + 93.00i$, 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 $2 - 3i$.