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.

$$\sqrt{\frac{17424}{121}}$$

The solution is Whole, which is option A.

A. Whole

* This is the correct option!

B. Not a Real number

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

C. Integer

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

D. Rational

These are numbers that can be written as fraction of Integers (e.g., -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 132.

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

$$(-6 - 2i)(4 - 7i)$$

The solution is $-38 + 34i$, which is option E.

A. $a \in [-42, -33]$ and $b \in [-35, -32]$

$-38 - 34i$, which corresponds to adding a minus sign in both terms.

B. $a \in [-30, -18]$ and $b \in [12, 25]$

$-24 + 14i$, 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. $a \in [-10, -8]$ and $b \in [47, 53]$

$-10 + 50i$, which corresponds to adding a minus sign in the first term.

D. $a \in [-10, -8]$ and $b \in [-51, -42]$

$-10 - 50i$, which corresponds to adding a minus sign in the second term.

E. $a \in [-42, -33]$ and $b \in [33, 35]$

* $-38 + 34i$, 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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3. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{-1001}{7}} + \sqrt{182}$$

The solution is Nonreal Complex, which is option A.

A. Nonreal Complex

* This is the correct option!

B. Pure Imaginary

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

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. Irrational

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

E. Rational

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

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

$$\frac{-45 - 33i}{2 - i}$$

The solution is $-11.40 - 22.20i$, which is option C.

A. $a \in [-26, -24]$ and $b \in [-5, -3]$

$-24.60 - 4.20i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

B. $a \in [-57.5, -56]$ and $b \in [-23, -22]$

$-57.00 - 22.20i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

C. $a \in [-11.5, -11]$ and $b \in [-23, -22]$

* $-11.40 - 22.20i$, which is the correct option.

D. $a \in [-23, -21.5]$ and $b \in [32, 34]$

$-22.50 + 33.00i$, which corresponds to just dividing the first term by the first term and the second by the second.

E. $a \in [-11.5, -11]$ and $b \in [-111.5, -109.5]$

$-11.40 - 111.00i$, 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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5. Simplify the expression below and choose the interval the simplification is contained within.

$$1 - 13 \div 4 * 11 - (20 * 16)$$

The solution is -354.750, which is option B.

A. $[-876, -874]$

-876.000, which corresponds to not distributing a negative correctly.

B. $[-355.75, -349.75]$

* -354.750, which is the correct option.

C. $[318.7, 322.7]$

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

D. $[-321.3, -311.3]$

-319.295, 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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6. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(2 + 9i)(-6 - 7i)$$

The solution is $51 - 68i$, which is option E.

A. $a \in [45, 53]$ and $b \in [68, 69]$

$51 + 68i$, which corresponds to adding a minus sign in both terms.

B. $a \in [-76, -72]$ and $b \in [-41, -32]$

$-75 - 40i$, which corresponds to adding a minus sign in the second term.

C. $a \in [-76, -72]$ and $b \in [39, 42]$

$-75 + 40i$, which corresponds to adding a minus sign in the first term.

D. $a \in [-15, -7]$ and $b \in [-64, -62]$

$-12-63i$, 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.

E. $a \in [45, 53]$ and $b \in [-68, -64]$

* $51 - 68i$, 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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7. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\frac{\sqrt{65}}{7} + 6i^2$$

The solution is Irrational, which is option B.

A. Nonreal Complex

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

B. Irrational

* This is the correct option!

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. Pure Imaginary

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

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.

$$\sqrt{\frac{116964}{361}}$$

The solution is Whole, which is option C.

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. Whole

* This is the correct option!

D. Not a Real number

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

E. Irrational

These cannot be written as a fraction of Integers.

General Comment: First, you **NEED** to simplify the expression. This question simplifies to 342.

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 and choose the interval the simplification is contained within.

$$5 - 14^2 + 9 \div 8 * 10 \div 3$$

The solution is -187.250, which is option A.

A. $[-188.2, -185.5]$

* -187.250, this is the correct option

B. $[200.9, 202.7]$

201.037, which corresponds to two Order of Operations errors.

C. $[204.2, 206.8]$

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

D. $[-192.3, -187.6]$

-190.963, 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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10. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{-63 + 11i}{-2 - 4i}$$

The solution is $4.10 - 13.70i$, which is option D.

A. $a \in [3.5, 5]$ and $b \in [-274.5, -273.5]$

$4.10 - 274.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

B. $a \in [8, 10.5]$ and $b \in [11, 12.5]$

$8.50 + 11.50i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

C. $a \in [81, 83]$ and $b \in [-14, -13]$

$82.00 - 13.70i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

D. $a \in [3.5, 5]$ and $b \in [-14, -13]$

* $4.10 - 13.70i$, which is the correct option.

E. $a \in [30.5, 32.5]$ and $b \in [-4.5, -2.5]$

$31.50 - 2.75i$, 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 $2 - 3i$.
