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.

$$-\sqrt{\frac{6}{0}}$$

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

A. Irrational

These cannot be written as a fraction of Integers.

B. Rational

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

C. Not a Real number

* This is the correct option!

D. Integer

These are the negative and positive counting numbers (..., -3, -2, -1, 0, 1, 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 $-\sqrt{\frac{6}{0}}$.

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

$$12 - 13^2 + 10 \div 3 * 11 \div 2$$

The solution is -138.667, which is option D.

A. $[198.33, 200.33]$

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

B. $[-158.85, -154.85]$

-156.848, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

C. $[181.15, 188.15]$

181.152, which corresponds to two Order of Operations errors.

D. $[-143.67, -135.67]$

* -138.667, 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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3. Choose the **smallest** set of Real numbers that the number below belongs to.

$$\sqrt{\frac{1190}{14}}$$

The solution is Irrational, which is option A.

A. Irrational

* This is the correct option!

B. Integer

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

C. Whole

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

D. Not a Real number

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

E. Rational

These are numbers that can be written as fraction of Integers (e.g., -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 into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{63 - 55i}{3 - 4i}$$

The solution is $16.36 + 3.48i$, which is option D.

A. $a \in [15.5, 18.5]$ and $b \in [86.5, 88.5]$

$16.36 + 87.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

B. $a \in [20, 22.5]$ and $b \in [13, 14.5]$

$21.00 + 13.75i$, which corresponds to just dividing the first term by the first term and the second by the second.

C. $a \in [-2, -1]$ and $b \in [-17.5, -16]$

$-1.24 - 16.68i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

D. $a \in [15.5, 18.5]$ and $b \in [2.5, 5]$

* $16.36 + 3.48i$, which is the correct option.

E. $a \in [408.5, 409.5]$ and $b \in [2.5, 5]$

$409.00 + 3.48i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

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

$$\frac{54 + 77i}{4 - 3i}$$

The solution is $-0.60 + 18.80i$, which is option D.

A. $a \in [17, 19.5]$ and $b \in [5, 6.5]$

$17.88 + 5.84i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

B. $a \in [-1.5, 0.5]$ and $b \in [469.5, 471.5]$

$-0.60 + 470.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

C. $a \in [-16, -14.5]$ and $b \in [18, 20]$

$-15.00 + 18.80i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

D. $a \in [-1.5, 0.5]$ and $b \in [18, 20]$

* $-0.60 + 18.80i$, which is the correct option.

E. $a \in [13, 16]$ and $b \in [-26.5, -25.5]$

$13.50 - 25.67i$, 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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6. Simplify the expression below and choose the interval the simplification is contained within.

$$1 - 2 \div 4 * 9 - (16 * 5)$$

The solution is -83.500, which is option A.

A. $[-86.5, -81.5]$

* -83.500, which is the correct option.

B. $[-97.5, -93.5]$

-97.500, which corresponds to not distributing a negative correctly.

C. $[-81.06, -78.06]$

-79.056, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

D. $[76.94, 86.94]$

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

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

$$\sqrt{\frac{169}{441}} + \sqrt{165}i$$

The solution is Nonreal Complex, which is option D.

A. Pure Imaginary

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

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. Irrational

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

D. Nonreal Complex

* This is the correct option!

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

$$(-6 - 5i)(4 - 2i)$$

The solution is $-34 - 8i$, which is option C.

A. $a \in [-18, -11]$ and $b \in [30.5, 33.9]$

$-14 + 32i$, which corresponds to adding a minus sign in the first term.

B. $a \in [-29, -18]$ and $b \in [9.4, 10.2]$

$-24 + 10i$, 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. $a \in [-39, -31]$ and $b \in [-11.4, -6.3]$

* $-34 - 8i$, which is the correct option.

D. $a \in [-39, -31]$ and $b \in [7.6, 8.1]$

$-34 + 8i$, which corresponds to adding a minus sign in both terms.

E. $a \in [-18, -11]$ and $b \in [-32.4, -31.5]$

$-14 - 32i$, 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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9. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$-\sqrt{\frac{256}{529}} + 49i^2$$

The solution is Rational, which is option D.

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. 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

* This is the correct option!

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

$$(10 + 4i)(-7 + 6i)$$

The solution is $-94 + 32i$, which is option C.

A. $a \in [-74, -69]$ and $b \in [22, 29]$

$-70+24i$, 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. $a \in [-54, -43]$ and $b \in [-90, -81]$

$-46 - 88i$, which corresponds to adding a minus sign in the second term.

C. $a \in [-97, -92]$ and $b \in [29, 34]$

* $-94 + 32i$, which is the correct option.

D. $a \in [-54, -43]$ and $b \in [85, 90]$

$-46 + 88i$, which corresponds to adding a minus sign in the first term.

E. $a \in [-97, -92]$ and $b \in [-37, -30]$

$-94 - 32i$, 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.
