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.

$$-\sqrt{\frac{625}{49}}$$

The solution is Rational, which is option D.

A. Integer

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

B. Irrational

These cannot be written as a fraction of Integers.

C. Not a Real number

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

D. Rational

* 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 $-\frac{25}{7}$.

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 Real numbers that the number below belongs to.

$$\sqrt{\frac{81}{25}}$$

The solution is Rational, which is option D.

A. Whole

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

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

* 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 $\frac{9}{5}$.

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

$$(-5 + 9i)(8 + 2i)$$

The solution is $-58 + 62i$, which is option B.

A. $a \in [-60, -51]$ and $b \in [-63, -59]$

$-58 - 62i$, which corresponds to adding a minus sign in both terms.

B. $a \in [-60, -51]$ and $b \in [61, 68]$

* $-58 + 62i$, which is the correct option.

C. $a \in [-23, -17]$ and $b \in [78, 86]$

$-22 + 82i$, which corresponds to adding a minus sign in the second term.

D. $a \in [-23, -17]$ and $b \in [-87, -73]$

$-22 - 82i$, which corresponds to adding a minus sign in the first term.

E. $a \in [-42, -34]$ and $b \in [12, 20]$

$-40 + 18i$, 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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4. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{9 + 77i}{4 - 3i}$$

The solution is $-7.80 + 13.40i$, which is option B.

A. $a \in [1.5, 3.5]$ and $b \in [-26.5, -25]$

$2.25 - 25.67i$, which corresponds to just dividing the first term by the first term and the second by the second.

B. $a \in [-9.5, -6.5]$ and $b \in [13, 15]$

* $-7.80 + 13.40i$, which is the correct option.

C. $a \in [10, 11]$ and $b \in [11, 12]$

$10.68 + 11.24i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

D. $a \in [-9.5, -6.5]$ and $b \in [334.5, 336]$

$-7.80 + 335.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

E. $a \in [-195.5, -194.5]$ and $b \in [13, 15]$

$-195.00 + 13.40i$, 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. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\frac{-12}{12} + 25i^2$$

The solution is Rational, 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. Pure Imaginary

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

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. Rational

* 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 and choose the interval the simplification is contained within.

$$17 - 14 \div 20 * 9 - (3 * 19)$$

The solution is -46.300, which is option A.

A. $[-47.3, -43.3]$

* -46.300, which is the correct option.

B. $[-44.08, -37.08]$

-40.078, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

C. $[70.92, 75.92]$

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

D. $[142.3, 151.3]$

146.300, which corresponds to not distributing a negative 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. Simplify the expression below and choose the interval the simplification is contained within.

$$17 - 10 \div 7 * 18 - (9 * 4)$$

The solution is -44.714, which is option C.

A. $[-19.08, -17.08]$

-19.079, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

B. $[-71.86, -66.86]$

-70.857, which corresponds to not distributing a negative correctly.

C. $[-46.71, -43.71]$

* -44.714, which is the correct option.

D. $[49.92, 54.92]$

52.921, 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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8. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\frac{-11}{-6} + 64i^2$$

The solution is Rational, which is option C.

A. Irrational

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

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. Rational

* This is the correct option!

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

$$(-3 + 8i)(6 + 4i)$$

The solution is $-50 + 36i$, which is option E.

A. $a \in [5, 15]$ and $b \in [-62.5, -59.6]$

$14 - 60i$, which corresponds to adding a minus sign in the first term.

B. $a \in [5, 15]$ and $b \in [58.5, 60.7]$

$14 + 60i$, which corresponds to adding a minus sign in the second term.

C. $a \in [-20, -12]$ and $b \in [29.1, 34.4]$

$-18+32i$, 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.

D. $a \in [-52, -44]$ and $b \in [-36.3, -35]$

$-50 - 36i$, which corresponds to adding a minus sign in both terms.

E. $a \in [-52, -44]$ and $b \in [35.9, 37.1]$

* $-50 + 36i$, 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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10. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{54 - 88i}{7 + i}$$

The solution is $5.80 - 13.40i$, which is option C.

A. $a \in [289.5, 291]$ and $b \in [-14, -11.5]$

$290.00 - 13.40i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

B. $a \in [6.5, 8]$ and $b \in [-89, -87.5]$

$7.71 - 88.00i$, which corresponds to just dividing the first term by the first term and the second by the second.

C. $a \in [4, 7]$ and $b \in [-14, -11.5]$

* $5.80 - 13.40i$, which is the correct option.

D. $a \in [8.5, 11]$ and $b \in [-12, -10]$

$9.32 - 11.24i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

E. $a \in [4, 7]$ and $b \in [-670.5, -669.5]$

$5.80 - 670.00i$, 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 $2 - 3i$.
