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.

$$-\sqrt{\frac{186624}{324}}$$

The solution is Integer, which is option D.

A. Whole

These are the counting numbers with 0 (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. Integer

* This is the correct option!

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 -432.

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.

$$(2 + 10i)(-6 + 3i)$$

The solution is $-42 - 54i$, which is option E.

A. $a \in [17, 22]$ and $b \in [65, 68]$

$18 + 66i$, which corresponds to adding a minus sign in the first term.

B. $a \in [-12, -7]$ and $b \in [28, 31]$

$-12 + 30i$, 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. $a \in [17, 22]$ and $b \in [-67, -65]$

$18 - 66i$, which corresponds to adding a minus sign in the second term.

D. $a \in [-43, -41]$ and $b \in [53, 60]$

$-42 + 54i$, which corresponds to adding a minus sign in both terms.

E. $a \in [-43, -41]$ and $b \in [-54, -51]$

* $-42 - 54i$, 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. Simplify the expression below and choose the interval the simplification is contained within.

$$3 - 12 \div 6 * 7 - (1 * 8)$$

The solution is -19.000, which is option A.

A. $[-22, -18]$

* -19.000, which is the correct option.

B. $[-8.29, 0.71]$

-5.286, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

C. $[-97, -94]$

-96.000, which corresponds to not distributing a negative correctly.

D. $[10.71, 12.71]$

10.714, 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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4. Choose the **smallest** set of Real numbers that the number below belongs to.

$$-\sqrt{\frac{-2431}{13}}$$

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

A. Rational

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

B. Irrational

These cannot be written as a fraction of Integers.

C. Whole

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

D. Integer

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

E. Not a Real number

* This is the correct option!

General Comment: First, you **NEED** to simplify the expression. This question simplifies to $-\sqrt{187}i$.

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

$$(-9 + 3i)(-7 - 10i)$$

The solution is $93 + 69i$, which is option A.

A. $a \in [92, 98]$ and $b \in [67, 71]$

* $93 + 69i$, which is the correct option.

B. $a \in [28, 39]$ and $b \in [-116, -108]$

$33 - 111i$, which corresponds to adding a minus sign in the second term.

C. $a \in [28, 39]$ and $b \in [108, 116]$

$33 + 111i$, which corresponds to adding a minus sign in the first term.

D. $a \in [55, 65]$ and $b \in [-31, -28]$

$63 - 30i$, 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. $a \in [92, 98]$ and $b \in [-73, -65]$

$93 - 69i$, 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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6. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{-54 - 77i}{-1 + 8i}$$

The solution is $-8.65 + 7.83i$, which is option B.

A. $a \in [-9.5, -7]$ and $b \in [508, 510]$

$-8.65 + 509.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

B. $a \in [-9.5, -7]$ and $b \in [6.5, 8.5]$

* $-8.65 + 7.83i$, which is the correct option.

C. $a \in [-563.5, -561]$ and $b \in [6.5, 8.5]$

$-562.00 + 7.83i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

D. $a \in [52.5, 54.5]$ and $b \in [-10, -9]$

$54.00 - 9.62i$, which corresponds to just dividing the first term by the first term and the second by the second.

E. $a \in [9.5, 11]$ and $b \in [-6, -4.5]$

$10.31 - 5.46i$, 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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7. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\frac{14}{-5} + \sqrt{-25}i$$

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. 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. Pure Imaginary

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

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

$$15 - 10 \div 1 * 3 - (13 * 6)$$

The solution is -93.000, which is option C.

A. $[-68.33, -61.33]$

-66.333, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

B. $[-168, -163]$

-168.000, which corresponds to not distributing a negative correctly.

C. $[-94, -89]$

* -93.000, which is the correct option.

D. $[86.67, 90.67]$

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

$$\frac{-9 + 55i}{-7 - 3i}$$

The solution is $-1.76 - 7.10i$, which is option C.

A. $a \in [2.5, 5.5]$ and $b \in [-7, -6]$

$3.93 - 6.17i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

B. $a \in [-103, -101]$ and $b \in [-7.5, -6.5]$

$-102.00 - 7.10i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

C. $a \in [-2, 0]$ and $b \in [-7.5, -6.5]$

* $-1.76 - 7.10i$, which is the correct option.

D. $a \in [1, 2]$ and $b \in [-18.5, -17.5]$

$1.29 - 18.33i$, which corresponds to just dividing the first term by the first term and the second by the second.

E. $a \in [-2, 0]$ and $b \in [-413, -411.5]$

$-1.76 - 412.00i$, 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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10. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{-952}{0}}i + \sqrt{110}i$$

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

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. Rational

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

D. Nonreal Complex

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

E. Not a Complex Number

* 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.
