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.

$$-\sqrt{\frac{63504}{196}}$$

The solution is Integer, which is option D.

A. Irrational

These cannot be written as a fraction of Integers.

B. Not a Real number

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

C. Whole

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

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 -252.

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.

$$11 - 4 \div 5 * 6 - (16 * 20)$$

The solution is -313.800, which is option D.

A. $[327.87, 331.87]$

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

B. $[-312.13, -302.13]$

-309.133, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

C. $[-196, -194]$

-196.000, which corresponds to not distributing a negative correctly.

D. $[-317.8, -312.8]$

* -313.800, which 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.

$$-\sqrt{\frac{1547}{7}}$$

The solution is Irrational, which is option A.

A. Irrational

* 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. Whole

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

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 $-\sqrt{221}$.

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.

$$\frac{-18 + 11i}{4 + 5i}$$

The solution is $-0.41 + 3.27i$, which is option B.

A. $a \in [-17.5, -14.5]$ and $b \in [2.5, 4]$

$-17.00 + 3.27i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

B. $a \in [-1.5, 0]$ and $b \in [2.5, 4]$

* $-0.41 + 3.27i$, which is the correct option.

C. $a \in [-1.5, 0]$ and $b \in [133.5, 134.5]$

$-0.41 + 134.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

D. $a \in [-5.5, -4]$ and $b \in [1.5, 3]$

$-4.50 + 2.20i$, which corresponds to just dividing the first term by the first term and the second by the second.

E. $a \in [-3.5, -2.5]$ and $b \in [-2, -0.5]$

$-3.10 - 1.12i$, 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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5. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{9 - 66i}{2 + 3i}$$

The solution is $-13.85 - 12.23i$, which is option D.

A. $a \in [-181, -179.5]$ and $b \in [-13, -12]$

$-180.00 - 12.23i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

B. $a \in [16, 17.5]$ and $b \in [-8.5, -7.5]$

$16.62 - 8.08i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

C. $a \in [3.5, 5.5]$ and $b \in [-22.5, -21]$

$4.50 - 22.00i$, which corresponds to just dividing the first term by the first term and the second by the second.

D. $a \in [-15, -13.5]$ and $b \in [-13, -12]$

* $-13.85 - 12.23i$, which is the correct option.

E. $a \in [-15, -13.5]$ and $b \in [-159.5, -158.5]$

$-13.85 - 159.00i$, 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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6. Simplify the expression below and choose the interval the simplification is contained within.

$$4 - 20 \div 5 * 2 - (12 * 14)$$

The solution is -172.000, which is option C.

A. $[-226.2, -222.1]$

-224.000, which corresponds to not distributing a negative correctly.

B. $[-167, -165.4]$

-166.000, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

C. $[-173.7, -171.1]$

* -172.000, which is the correct option.

D. $[169.6, 170.5]$

170.000, 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.

$$\frac{18}{-14} + \sqrt{-64}i$$

The solution is Rational, which is option A.

A. Rational

* This is the correct option!

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 a Complex number $(a + bi)$ that is not Real (has i as part of the 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. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(6 + 5i)(-7 + 4i)$$

The solution is $-62 - 11i$, which is option E.

A. $a \in [-25, -19]$ and $b \in [-66, -56]$

$-22 - 59i$, which corresponds to adding a minus sign in the second term.

B. $a \in [-25, -19]$ and $b \in [58, 62]$

$-22 + 59i$, which corresponds to adding a minus sign in the first term.

C. $a \in [-42, -41]$ and $b \in [16, 25]$

$-42 + 20i$, 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.

D. $a \in [-63, -56]$ and $b \in [10, 16]$

$-62 + 11i$, which corresponds to adding a minus sign in both terms.

E. $a \in [-63, -56]$ and $b \in [-15, -7]$

* $-62 - 11i$, 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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9. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{-2145}{0}}i + \sqrt{182}i$$

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

A. Not a Complex Number

* This is the correct option!

B. Nonreal Complex

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

C. Pure Imaginary

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

D. Rational

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

E. Irrational

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

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.

$$(7 - 9i)(3 - 5i)$$

The solution is $-24 - 62i$, which is option A.

A. $a \in [-27, -17]$ and $b \in [-65, -61]$

* $-24 - 62i$, which is the correct option.

B. $a \in [62, 67]$ and $b \in [8, 9]$

$66 + 8i$, which corresponds to adding a minus sign in the second term.

C. $a \in [62, 67]$ and $b \in [-13, -7]$

$66 - 8i$, which corresponds to adding a minus sign in the first term.

D. $a \in [21, 22]$ and $b \in [40, 52]$

$21 + 45i$, 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. $a \in [-27, -17]$ and $b \in [59, 64]$

$-24 + 62i$, 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.
