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

$$6 - 20^2 + 10 \div 13 * 17 \div 15$$

The solution is -393.128, which is option D.

A. $[-394.7, -393.3]$

-393.997, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

B. $[406.7, 409.2]$

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

C. $[404.7, 406.2]$

406.003, which corresponds to two Order of Operations errors.

D. $[-393.3, -392.5]$

* -393.128, 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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2. Choose the **smallest** set of Real numbers that the number below belongs to.

$$-\sqrt{\frac{490}{7}}$$

The solution is Irrational, which is option B.

A. Rational

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

B. Irrational

* This is the correct option!

C. Not a Real number

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

D. Whole

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

E. Integer

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

General Comment: First, you **NEED** to simplify the expression. This question simplifies to $-\sqrt{70}$.

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

$$\sqrt{\frac{57600}{576}}$$

The solution is Whole, which is option B.

A. Not a Real number

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

B. Whole

* This is the correct option!

C. Integer

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

D. Irrational

These cannot be written as a fraction of Integers.

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 240.

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

$$\frac{\sqrt{170}}{11} + \sqrt{-2}i$$

The solution is Irrational, which is option D.

A. Nonreal Complex

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

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. Irrational

* This is the correct option!

E. 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!

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

$$7 - 6^2 + 15 \div 1 * 13 \div 9$$

The solution is -7.333, which is option D.

A. $[59.67, 67.67]$

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

B. $[-30.87, -26.87]$

-28.872, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

C. $[42.13, 45.13]$

43.128, which corresponds to two Order of Operations errors.

D. $[-10.33, -5.33]$

* -7.333, 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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6. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{-27 + 77i}{4 - 8i}$$

The solution is $-9.05 + 1.15i$, which is option A.

A. $a \in [-10, -7.5]$ and $b \in [0.5, 2.5]$

* $-9.05 + 1.15i$, which is the correct option.

B. $a \in [-10, -7.5]$ and $b \in [91.5, 92.5]$

$-9.05 + 92.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

C. $a \in [5.5, 8]$ and $b \in [6, 8]$

$6.35 + 6.55i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

D. $a \in [-7.5, -5.5]$ and $b \in [-11, -8.5]$

$-6.75 - 9.62i$, which corresponds to just dividing the first term by the first term and the second by the second.

E. $a \in [-725.5, -723.5]$ and $b \in [0.5, 2.5]$

$-724.00 + 1.15i$, 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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7. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{1664}{8}} + \sqrt{110}i$$

The solution is Nonreal Complex, which is option E.

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. Rational

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

D. Irrational

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

E. Nonreal Complex

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

$$(-7 - 2i)(-5 - 8i)$$

The solution is $19 + 66i$, which is option D.

A. $a \in [16, 26]$ and $b \in [-72, -60]$

$19 - 66i$, which corresponds to adding a minus sign in both terms.

B. $a \in [33, 38]$ and $b \in [15, 27]$

$35 + 16i$, 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. $a \in [50, 60]$ and $b \in [39, 47]$

$51 + 46i$, which corresponds to adding a minus sign in the first term.

D. $a \in [16, 26]$ and $b \in [64, 67]$

* $19 + 66i$, which is the correct option.

E. $a \in [50, 60]$ and $b \in [-46, -44]$

$51 - 46i$, 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. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(-10 + 4i)(-2 + 7i)$$

The solution is $-8 - 78i$, which is option B.

A. $a \in [42, 50]$ and $b \in [62, 66]$

$48 + 62i$, which corresponds to adding a minus sign in the second term.

B. $a \in [-11, -4]$ and $b \in [-80, -75]$

* $-8 - 78i$, which is the correct option.

C. $a \in [20, 24]$ and $b \in [26, 34]$

$20 + 28i$, 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. $a \in [42, 50]$ and $b \in [-66, -56]$

$48 - 62i$, which corresponds to adding a minus sign in the first term.

E. $a \in [-11, -4]$ and $b \in [74, 79]$

$-8 + 78i$, 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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10. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{-9 - 88i}{4 + 2i}$$

The solution is $-10.60 - 16.70i$, which is option E.

A. $a \in [6, 7.5]$ and $b \in [-20, -17.5]$

$7.00 - 18.50i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

B. $a \in [-12, -10]$ and $b \in [-335, -333.5]$

$-10.60 - 334.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

C. $a \in [-212.5, -211.5]$ and $b \in [-18, -16]$

$-212.00 - 16.70i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

D. $a \in [-2.5, -0.5]$ and $b \in [-45, -43.5]$

$-2.25 - 44.00i$, which corresponds to just dividing the first term by the first term and the second by the second.

E. $a \in [-12, -10]$ and $b \in [-18, -16]$

* $-10.60 - 16.70i$, which is the correct option.

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 $2 - 3i$.
