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

$$\frac{9 + 44i}{-6 - 7i}$$

The solution is $-4.26 - 2.36i$, which is option E.

A. $a \in [2, 4]$ and $b \in [-5, -3.5]$

$2.99 - 3.85i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

B. $a \in [-363.5, -361.5]$ and $b \in [-3, -1.5]$

$-362.00 - 2.36i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

C. $a \in [-5.5, -3]$ and $b \in [-201.5, -200.5]$

$-4.26 - 201.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

D. $a \in [-2, -0.5]$ and $b \in [-7, -4.5]$

$-1.50 - 6.29i$, which corresponds to just dividing the first term by the first term and the second by the second.

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

* $-4.26 - 2.36i$, 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 $2 - 3i$.

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2. 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 D.

A. Whole

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

B. Rational

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

C. Irrational

These cannot be written as a fraction of Integers.

D. Not a Real number

* This is the correct option!

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

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

$$\sqrt{\frac{0}{529}} + \sqrt{4}i$$

The solution is Pure Imaginary, which is option B.

A. Rational

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

B. Pure Imaginary

* This is the correct option!

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. Nonreal Complex

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

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

$$(10 - 4i)(3 - 9i)$$

The solution is $-6 - 102i$, which is option D.

A. $a \in [30, 35]$ and $b \in [34, 43]$

$30 + 36i$, 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. $a \in [64, 68]$ and $b \in [77, 84]$

$66 + 78i$, which corresponds to adding a minus sign in the second term.

C. $a \in [-13, -5]$ and $b \in [101, 103]$

$-6 + 102i$, which corresponds to adding a minus sign in both terms.

D. $a \in [-13, -5]$ and $b \in [-104, -95]$

* $-6 - 102i$, which is the correct option.

E. $a \in [64, 68]$ and $b \in [-80, -72]$

$66 - 78i$, which corresponds to adding a minus sign in the first 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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5. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(10 - 8i)(-4 + 7i)$$

The solution is $16 + 102i$, which is option A.

A. $a \in [12, 17]$ and $b \in [94, 103]$

* $16 + 102i$, which is the correct option.

B. $a \in [-43, -37]$ and $b \in [-60, -48]$

$-40 - 56i$, 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. $a \in [-102, -94]$ and $b \in [-40, -34]$

$-96 - 38i$, which corresponds to adding a minus sign in the second term.

D. $a \in [-102, -94]$ and $b \in [36, 42]$

$-96 + 38i$, which corresponds to adding a minus sign in the first term.

E. $a \in [12, 17]$ and $b \in [-103, -100]$

$16 - 102i$, 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 and choose the interval the simplification is contained within.

$$8 - 6^2 + 5 \div 15 * 4 \div 13$$

The solution is -27.897, which is option A.

A. $[-27.9, -27.84]$

* -27.897, this is the correct option

B. $[43.98, 44.01]$

44.006, which corresponds to two Order of Operations errors.

C. $[-28.02, -27.98]$

-27.994, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

D. $[44.1, 44.19]$

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

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.

$$-\sqrt{\frac{196}{169}} + 16i^2$$

The solution is Rational, which is option C.

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. Irrational

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

C. Rational

* This is the correct option!

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 and choose the interval the simplification is contained within.

$$3 - 20 \div 10 * 4 - (16 * 7)$$

The solution is -117.000, which is option B.

A. $[110.5, 119.5]$

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

B. $[-121, -116]$

* -117.000, which is the correct option.

C. $[-110.5, -105.5]$

-109.500, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

D. $[-147, -144]$

-147.000, 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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9. Choose the **smallest** set of Real numbers that the number below belongs to.

$$-\sqrt{\frac{1120}{10}}$$

The solution is Irrational, which is option A.

A. Irrational

* This is the correct option!

B. Rational

These are numbers that can be written as fraction of Integers (e.g., -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. 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 $-\sqrt{112}$.

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

$$\frac{9 + 55i}{-6 + 8i}$$

The solution is $3.86 - 4.02i$, which is option A.

A. $a \in [3.5, 4.5]$ and $b \in [-5, -3.5]$

   * $3.86 - 4.02i$, which is the correct option.

B. $a \in [-5.5, -3.5]$ and $b \in [-3, -1]$

   $-4.94 - 2.58i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

C. $a \in [385, 386.5]$ and $b \in [-5, -3.5]$

   $386.00 - 4.02i$, 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 $b \in [6, 8]$

   $-1.50 + 6.88i$, which corresponds to just dividing the first term by the first term and the second by the second.

E. $a \in [3.5, 4.5]$ and $b \in [-402.5, -401]$

   $3.86 - 402.00i$, 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 $2 - 3i$.
