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.

$$16 - 9^2 + 4 \div 17 * 14 \div 3$$

The solution is -63.902, which is option C.

A. $[-65.1, -64.36]$

-64.994, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

B. $[97.97, 98.99]$

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

C. $[-64.37, -63.54]$

* -63.902, this is the correct option

D. $[96, 97.36]$

97.006, which corresponds to two Order of Operations errors.

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.

$$\sqrt{\frac{3600}{100}}$$

The solution is Whole, which is option B.

A. Irrational

These cannot be written as a fraction of Integers.

B. Whole

* 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. Integer

These are the negative and positive counting numbers (..., -3, -2, -1, 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 60.

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.

$$\sqrt{\frac{64}{225}} + \sqrt{63}i$$

The solution is Nonreal Complex, which is option B.

A. Rational

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

B. Nonreal Complex

* 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. Irrational

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

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

$$2 - 10 \div 18 * 14 - (1 * 15)$$

The solution is -20.778, which is option D.

A. $[-105.67, -98.67]$

-101.667, which corresponds to not distributing a negative correctly.

B. $[-13.04, -8.04]$

-13.040, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

C. $[9.96, 23.96]$

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

D. $[-21.78, -15.78]$

* -20.778, 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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5. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

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

The solution is $-58 - 11i$, which is option A.

A. $a \in [-61, -51]$ and $b \in [-14, -4]$

* $-58 - 11i$, which is the correct option.

B. $a \in [-3, -1]$ and $b \in [49, 62]$

$-2 + 59i$, which corresponds to adding a minus sign in the first term.

C. $a \in [-61, -51]$ and $b \in [10, 14]$

$-58 + 11i$, which corresponds to adding a minus sign in both terms.

D. $a \in [-3, -1]$ and $b \in [-61, -58]$

$-2 - 59i$, which corresponds to adding a minus sign in the second term.

E. $a \in [-32, -25]$ and $b \in [27, 34]$

$-30+28i$, 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.

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

$$\sqrt{\frac{20736}{144}}$$

The solution is Whole, which is option C.

A. Irrational

These cannot be written as a fraction of Integers.

B. Rational

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

C. Whole

* This is the correct option!

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 144.

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

$$\frac{45 + 88i}{-1 + 4i}$$

The solution is $18.06 - 15.76i$, which is option A.

A. $a \in [17, 18.5]$ and $b \in [-16.5, -14.5]$

* $18.06 - 15.76i$, which is the correct option.

B. $a \in [-24.5, -23]$ and $b \in [4.5, 6]$

$-23.35 + 5.41i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

C. $a \in [306, 308]$ and $b \in [-16.5, -14.5]$

$307.00 - 15.76i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

D. $a \in [-45.5, -44]$ and $b \in [21.5, 22.5]$

$-45.00 + 22.00i$, which corresponds to just dividing the first term by the first term and the second by the second.

E. $a \in [17, 18.5]$ and $b \in [-269, -267.5]$

$18.06 - 268.00i$, 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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8. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\frac{-9}{17} + \sqrt{198}i$$

The solution is Nonreal Complex, which is option B.

A. Irrational

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

B. Nonreal Complex

* This is the correct option!

C. Rational

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

D. Pure Imaginary

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

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

$$(-2 - 7i)(4 - 8i)$$

The solution is $-64 - 12i$, which is option A.

A. $a \in [-72, -63]$ and $b \in [-14, -11]$

* $-64 - 12i$, which is the correct option.

B. $a \in [-12, -1]$ and $b \in [47, 57]$

$-8 + 56i$, 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. $a \in [45, 52]$ and $b \in [-45, -43]$

$48 - 44i$, which corresponds to adding a minus sign in the second term.

D. $a \in [45, 52]$ and $b \in [39, 47]$

$48 + 44i$, which corresponds to adding a minus sign in the first term.

E. $a \in [-72, -63]$ and $b \in [10, 14]$

$-64 + 12i$, 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.

$$\frac{-36 - 55i}{-3 + 6i}$$

The solution is $-4.93 + 8.47i$, which is option C.

A. $a \in [-5.5, -4.5]$ and $b \in [380.5, 382]$

$-4.93 + 381.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

B. $a \in [9, 10.5]$ and $b \in [-1.5, 0]$

$9.73 - 1.13i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

C. $a \in [-5.5, -4.5]$ and $b \in [8, 10]$

* $-4.93 + 8.47i$, which is the correct option.

D. $a \in [11.5, 14]$ and $b \in [-9.5, -8]$

$12.00 - 9.17i$, which corresponds to just dividing the first term by the first term and the second by the second.

E. $a \in [-222.5, -221]$ and $b \in [8, 10]$

$-222.00 + 8.47i$, 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 $2 - 3i$.