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.

$$10 - 7 \div 1 * 5 - (11 * 17)$$

The solution is -212.000, which is option A.

A. $[-215, -203]$

* -212.000, which is the correct option.

B. $[184.6, 197.6]$

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

C. $[-178.4, -177.4]$

-178.400, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

D. $[-612, -610]$

-612.000, 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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2. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(-4 + 9i)(-6 - 10i)$$

The solution is $114 - 14i$, which is option B.

A. $a \in [24, 27]$ and $b \in [-93, -87]$

$24 - 90i$, 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. $a \in [113, 116]$ and $b \in [-18, -9]$

* $114 - 14i$, which is the correct option.

C. $a \in [-70, -65]$ and $b \in [93, 99]$

$-66 + 94i$, which corresponds to adding a minus sign in the first term.

D. $a \in [-70, -65]$ and $b \in [-95, -92]$

$-66 - 94i$, which corresponds to adding a minus sign in the second term.

E. $a \in [113, 116]$ and $b \in [11, 20]$

$114 + 14i$, 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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3. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{18 - 33i}{-8 - i}$$

The solution is $-1.71 + 4.34i$, which is option C.

A. $a \in [-1.9, -1.15]$ and $b \in [281.75, 282.6]$

$-1.71 + 282.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

B. $a \in [-3.95, -2.35]$ and $b \in [3.75, 3.85]$

$-2.72 + 3.78i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

C. $a \in [-1.9, -1.15]$ and $b \in [3.85, 4.4]$

* $-1.71 + 4.34i$, which is the correct option.

D. $a \in [-2.65, -2.2]$ and $b \in [32.6, 33.65]$

$-2.25 + 33.00i$, which corresponds to just dividing the first term by the first term and the second by the second.

E. $a \in [-111.15, -110]$ and $b \in [3.85, 4.4]$

$-111.00 + 4.34i$, 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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4. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\frac{\sqrt{70}}{15} + \sqrt{-4}i$$

The solution is Irrational, which is option A.

A. Irrational

* This is the correct option!

B. Pure Imaginary

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

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. Rational

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

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

$$(4 + 9i)(-8 + 5i)$$

The solution is $-77 - 52i$, which is option D.

A. $a \in [11, 21]$ and $b \in [91, 94]$

$13 + 92i$, which corresponds to adding a minus sign in the first term.

B. $a \in [-37, -30]$ and $b \in [45, 46]$

$-32 + 45i$, 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.

C. $a \in [-78, -75]$ and $b \in [52, 58]$

$-77 + 52i$, which corresponds to adding a minus sign in both terms.

D. $a \in [-78, -75]$ and $b \in [-56, -51]$

* $-77 - 52i$, which is the correct option.

E. $a \in [11, 21]$ and $b \in [-93, -87]$

$13 - 92i$, 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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6. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{-9 + 22i}{6 + 3i}$$

The solution is $0.27 + 3.53i$, which is option D.

A. $a \in [11, 12.5]$ and $b \in [2.5, 5]$

$12.00 + 3.53i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

B. $a \in [-3, -2]$ and $b \in [1, 3]$

$-2.67 + 2.33i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

C. $a \in [-0.5, 0.5]$ and $b \in [158, 159.5]$

$0.27 + 159.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

D. $a \in [-0.5, 0.5]$ and $b \in [2.5, 5]$

* $0.27 + 3.53i$, which is the correct option.

E. $a \in [-2, -1]$ and $b \in [5.5, 7.5]$

$-1.50 + 7.33i$, which corresponds to just dividing the first term by the first term and the second by the second.

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

$$4 - 7 \div 11 * 3 - (17 * 20)$$

The solution is -337.909, which is option A.

A. $[-339.21, -337.19]$

* -337.909, which is the correct option.

B. $[-337.32, -335.8]$

-336.212, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

C. $[343.13, 343.92]$

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

D. $[-300.51, -297.85]$

-298.182, 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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8. Choose the **smallest** set of Real numbers that the number below belongs to.

$$-\sqrt{\frac{-1859}{13}}$$

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

A. Rational

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

B. Integer

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

C. Irrational

These cannot be written as a fraction of Integers.

D. Not a Real number

* This is the correct option!

E. Whole

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

General Comment: First, you **NEED** to simplify the expression. This question simplifies to $-\sqrt{143}i$.

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

$$-\sqrt{\frac{-1176}{14}}$$

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

A. Not a Real number

* This is the correct option!

B. Irrational

These cannot be written as a fraction of Integers.

C. Rational

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

D. Integer

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

E. Whole

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

General Comment: First, you **NEED** to simplify the expression. This question simplifies to $-\sqrt{84}i$.

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

$$\sqrt{\frac{-880}{5}} + \sqrt{126}$$

The solution is Nonreal Complex, which is option B.

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. 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. 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.
