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 Complex numbers that the number below belongs to.

$$\frac{2}{-17} + 4i^2$$

The solution is Rational, which is option C.

A. Pure Imaginary

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

B. Nonreal Complex

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

C. Rational

* This is the correct option!

D. Irrational

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

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

$$\frac{-18 - 44i}{5 + 3i}$$

The solution is $-6.53 - 4.88i$, which is option E.

A. $a \in [0.5, 2.5]$ and $b \in [-9, -8]$

$1.24 - 8.06i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

B. $a \in [-7, -6.5]$ and $b \in [-166.5, -165.5]$

$-6.53 - 166.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

C. $a \in [-4, -3]$ and $b \in [-15.5, -13.5]$

$-3.60 - 14.67i$, which corresponds to just dividing the first term by the first term and the second by the second.

D. $a \in [-222.5, -221]$ and $b \in [-5, -4.5]$

$-222.00 - 4.88i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

E. $a \in [-7, -6.5]$ and $b \in [-5, -4.5]$

* $-6.53 - 4.88i$, 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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3. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(8 - 7i)(6 + 5i)$$

The solution is $83 - 2i$, which is option B.

A. $a \in [47, 52]$ and $b \in [-36, -33.4]$

$48 - 35i$, 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. $a \in [82, 86]$ and $b \in [-2.2, -1.4]$

* $83 - 2i$, which is the correct option.

C. $a \in [82, 86]$ and $b \in [0.2, 4.5]$

$83 + 2i$, which corresponds to adding a minus sign in both terms.

D. $a \in [12, 16]$ and $b \in [-84.2, -80.6]$

$13 - 82i$, which corresponds to adding a minus sign in the second term.

E. $a \in [12, 16]$ and $b \in [80.5, 84.8]$

$13 + 82i$, 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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4. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{-2618}{0}}i + \sqrt{198}i$$

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

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 the correct option!

C. Rational

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

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

$$(-7 + 3i)(-2 + 8i)$$

The solution is $-10 - 62i$, which is option B.

A. $a \in [11, 16]$ and $b \in [20, 29]$

$14 + 24i$, 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. $a \in [-14, -8]$ and $b \in [-68, -60]$

* $-10 - 62i$, which is the correct option.

C. $a \in [36, 41]$ and $b \in [-52, -44]$

$38 - 50i$, which corresponds to adding a minus sign in the first term.

D. $a \in [-14, -8]$ and $b \in [62, 65]$

$-10 + 62i$, which corresponds to adding a minus sign in both terms.

E. $a \in [36, 41]$ and $b \in [50, 52]$

$38 + 50i$, 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.

$$\frac{72 + 11i}{-4 - 3i}$$

The solution is $-12.84 + 6.88i$, which is option A.

A. $a \in [-14, -11.5]$ and $b \in [6.5, 8]$

* $-12.84 + 6.88i$, which is the correct option.

B. $a \in [-14, -11.5]$ and $b \in [171, 172.5]$

$-12.84 + 172.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

C. $a \in [-10.5, -9]$ and $b \in [-12, -10]$

$-10.20 - 10.40i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

D. $a \in [-18.5, -17]$ and $b \in [-4.5, -2.5]$

$-18.00 - 3.67i$, which corresponds to just dividing the first term by the first term and the second by the second.

E. $a \in [-322, -320.5]$ and $b \in [6.5, 8]$

$-321.00 + 6.88i$, 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. Simplify the expression below and choose the interval the simplification is contained within.

$$4 - 8^2 + 13 \div 15 * 3 \div 11$$

The solution is -59.764, which is option B.

A. $[67.88, 68.05]$

68.026, which corresponds to two Order of Operations errors.

B. $[-59.91, -59.61]$

* -59.764, this is the correct option

C. $[-60.43, -59.89]$

-59.974, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

D. $[68.2, 68.52]$

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

$$\sqrt{\frac{400}{441}}$$

The solution is Rational, which is option D.

A. Not a Real number

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

B. Irrational

These cannot be written as a fraction of Integers.

C. Whole

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

D. Rational

* 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 $\frac{20}{21}$.

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

$$7 - 10 \div 19 * 11 - (4 * 9)$$

The solution is -34.789, which is option D.

A. $[-26, -20.6]$

-25.105, which corresponds to not distributing a negative correctly.

B. $[41.2, 43.1]$

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

C. $[-31.2, -28.4]$

-29.048, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

D. $[-39.6, -33.1]$

* -34.789, 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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10. Choose the **smallest** set of Real numbers that the number below belongs to.

$$-\sqrt{\frac{1001}{7}}$$

The solution is Irrational, which is option B.

A. Whole

These are the counting numbers with 0 (0, 1, 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. Rational

These are numbers that can be written as fraction of Integers (e.g., -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 $-\sqrt{143}$.

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.
