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.

$$\frac{0}{-2\pi} + \sqrt{4}i$$

The solution is Pure Imaginary, which is option E.

A. Rational

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

B. Nonreal Complex

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

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

$$4 - 15 \div 6 * 14 - (3 * 19)$$

The solution is -88.000, which is option B.

A. $[-53.18, -50.18]$

-53.179, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

B. $[-92, -83]$

* -88.000, which is the correct option.

C. $[56.82, 66.82]$

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

D. $[-653, -641]$

-646.000, 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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3. Simplify the expression below and choose the interval the simplification is contained within.

$$11 - 4^2 + 5 \div 3 * 16 \div 18$$

The solution is -3.519, which is option D.

A. $[-7, -4.2]$

-4.994, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

B. $[27.7, 29.2]$

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

C. $[24, 27.1]$

27.006, which corresponds to two Order of Operations errors.

D. $[-3.9, -1.8]$

* -3.519, 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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4. Choose the **smallest** set of Real numbers that the number below belongs to.

$$-\sqrt{\frac{14}{0}}$$

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. Irrational

These cannot be written as a fraction of Integers.

C. Integer

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

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 $-\sqrt{\frac{14}{0}}$.

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

$$\frac{36 - 22i}{8 - i}$$

The solution is $4.77 - 2.15i$, which is option C.

A. $a \in [309.95, 310.2]$ and $b \in [-2.5, -1]$

$310.00 - 2.15i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

B. $a \in [4.55, 5.35]$ and $b \in [-140.5, -138.5]$

$4.77 - 140.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

C. $a \in [4.55, 5.35]$ and $b \in [-2.5, -1]$

* $4.77 - 2.15i$, which is the correct option.

D. $a \in [4.15, 4.65]$ and $b \in [21.5, 22.5]$

$4.50 + 22.00i$, which corresponds to just dividing the first term by the first term and the second by the second.

E. $a \in [3.65, 4.25]$ and $b \in [-3.5, -3]$

$4.09 - 3.26i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

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

$$\frac{-21}{0} + \sqrt{99}i$$

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

A. Nonreal Complex

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

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. 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.

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

$$(9 - 7i)(-5 + 4i)$$

The solution is $-17 + 71i$, which is option C.

A. $a \in [-20, -13]$ and $b \in [-73, -67]$

$-17 - 71i$, which corresponds to adding a minus sign in both terms.

B. $a \in [-56, -44]$ and $b \in [-32, -24]$

$-45 - 28i$, 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.

C. $a \in [-20, -13]$ and $b \in [71, 74]$

* $-17 + 71i$, which is the correct option.

D. $a \in [-74, -72]$ and $b \in [1, 6]$

$-73 + i$, which corresponds to adding a minus sign in the first term.

E. $a \in [-74, -72]$ and $b \in [-2, 0]$

$-73 - i$, 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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8. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

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

The solution is $-1.82 - 19.71i$, which is option D.

A. $a \in [-11.5, -9.5]$ and $b \in [-17, -16]$

$-10.88 - 16.53i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

B. $a \in [-31.5, -29.5]$ and $b \in [-21, -19]$

$-31.00 - 19.71i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

C. $a \in [-8.5, -6]$ and $b \in [76.5, 78]$

$-6.75 + 77.00i$, which corresponds to just dividing the first term by the first term and the second by the second.

D. $a \in [-3, -1.5]$ and $b \in [-21, -19]$

* $-1.82 - 19.71i$, which is the correct option.

E. $a \in [-3, -1.5]$ and $b \in [-336, -333]$

$-1.82 - 335.00i$, 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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9. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(8 - 2i)(6 + 3i)$$

The solution is $54 + 12i$, which is option E.

A. $a \in [53, 55]$ and $b \in [-12, -7]$

$54 - 12i$, which corresponds to adding a minus sign in both terms.

B. $a \in [38, 43]$ and $b \in [33, 38]$

$42 + 36i$, which corresponds to adding a minus sign in the first term.

C. $a \in [38, 43]$ and $b \in [-40, -30]$

$42 - 36i$, which corresponds to adding a minus sign in the second term.

D. $a \in [46, 52]$ and $b \in [-7, -4]$

$48 - 6i$, 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.

E. $a \in [53, 55]$ and $b \in [5, 14]$

* $54 + 12i$, which is the correct option.

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

$$-\sqrt{\frac{8100}{36}}$$

The solution is Integer, which is option C.

A. Irrational

These cannot be written as a fraction of Integers.

B. Not a Real number

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

C. Integer

* This is the correct option!

D. Whole

These are the counting numbers with 0 (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 -90.

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.
