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.

$$\frac{0}{16\pi} + \sqrt{9}i$$

The solution is Pure Imaginary, which is option D.

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 not a number. The only non-Complex number we know is dividing by 0 as this is not a number!

C. Irrational

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

D. Pure Imaginary

* This is the correct option!

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

$$\frac{54 + 55i}{-4 + i}$$

The solution is $-9.47 - 16.12i$, which is option C.

A. $a \in [-161.5, -159.5]$ and $b \in [-17, -15]$

$-161.00 - 16.12i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

B. $a \in [-17, -14.5]$ and $b \in [-10.5, -8.5]$

$-15.94 - 9.76i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

C. $a \in [-11, -8.5]$ and $b \in [-17, -15]$

* $-9.47 - 16.12i$, which is the correct option.

D. $a \in [-11, -8.5]$ and $b \in [-276, -272.5]$

$-9.47 - 274.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

E. $a \in [-14.5, -12.5]$ and $b \in [54.5, 55.5]$

$-13.50 + 55.00i$, 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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3. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(-5 + 3i)(-2 + 8i)$$

The solution is $-14 - 46i$, which is option C.

A. $a \in [34, 37]$ and $b \in [33, 37]$

$34 + 34i$, which corresponds to adding a minus sign in the second term.

B. $a \in [34, 37]$ and $b \in [-37, -33]$

$34 - 34i$, which corresponds to adding a minus sign in the first term.

C. $a \in [-16, -10]$ and $b \in [-50, -44]$

* $-14 - 46i$, which is the correct option.

D. $a \in [5, 16]$ and $b \in [14, 30]$

$10 + 24i$, 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.

E. $a \in [-16, -10]$ and $b \in [46, 54]$

$-14 + 46i$, 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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4. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{-63 + 11i}{-5 - 6i}$$

The solution is $4.08 - 7.10i$, which is option D.

A. $a \in [248, 249.5]$ and $b \in [-8, -6]$

$249.00 - 7.10i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

B. $a \in [4, 4.5]$ and $b \in [-433.5, -432]$

$4.08 - 433.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

C. $a \in [12, 14]$ and $b \in [-2, -1]$

$12.60 - 1.83i$, which corresponds to just dividing the first term by the first term and the second by the second.

D. $a \in [4, 4.5]$ and $b \in [-8, -6]$

* $4.08 - 7.10i$, which is the correct option.

E. $a \in [6, 7]$ and $b \in [3.5, 5.5]$

$6.25 + 5.30i$, 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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5. Choose the **smallest** set of Real numbers that the number below belongs to.

$$\sqrt{\frac{360000}{625}}$$

The solution is Whole, which is option C.

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. Whole

* This is the correct option!

D. Integer

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

E. Not a Real number

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

General Comment: First, you **NEED** to simplify the expression. This question simplifies to 600.

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

$$\sqrt{\frac{-1386}{9}}$$

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

A. Not a Real number

* This is the correct option!

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. 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 $\sqrt{154}i$.

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

$$16 - 3 \div 1 * 15 - (2 * 8)$$

The solution is -45.000, which is option B.

A. $[25.8, 32.8]$

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

B. $[-48, -42]$

* -45.000, which is the correct option.

C. $[-2.2, 0.8]$

-0.200, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

D. $[-253, -243]$

-248.000, 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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8. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{770}{11}} + \sqrt{143}i$$

The solution is Nonreal Complex, 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. Nonreal Complex

* This is the correct option!

D. Rational

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

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

$$(7 + 2i)(-5 - 9i)$$

The solution is $-17 - 73i$, which is option C.

A. $a \in [-37, -31]$ and $b \in [-24, -13]$

$-35 - 18i$, 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. $a \in [-53, -52]$ and $b \in [53, 56]$

$-53 + 53i$, which corresponds to adding a minus sign in the second term.

C. $a \in [-18, -13]$ and $b \in [-78, -68]$

* $-17 - 73i$, which is the correct option.

D. $a \in [-18, -13]$ and $b \in [70, 75]$

$-17 + 73i$, which corresponds to adding a minus sign in both terms.

E. $a \in [-53, -52]$ and $b \in [-54, -52]$

$-53 - 53i$, 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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10. Simplify the expression below and choose the interval the simplification is contained within.

$$14 - 3^2 + 9 \div 12 * 11 \div 17$$

The solution is 5.485, which is option D.

A. $[23.28, 23.96]$

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

B. $[22.06, 23.09]$

23.004, which corresponds to two Order of Operations errors.

C. $[4.84, 5.01]$

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

D. $[5.06, 5.61]$

* 5.485, 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.
