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.

$$\sqrt{\frac{-315}{5}} + \sqrt{0}i$$

The solution is Pure Imaginary, which is option E.

A. Nonreal Complex

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

B. Irrational

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

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. Rational

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

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

$$\sqrt{\frac{625}{441}} + 36i^2$$

The solution is Rational, which is option A.

A. Rational

* This is the correct option!

B. Nonreal Complex

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

C. Pure Imaginary

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

D. 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!

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

$$19 - 7^2 + 9 \div 12 * 11 \div 18$$

The solution is -29.542, which is option D.

A. $[-30.09, -29.92]$

-29.996, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

B. $[67.82, 68.26]$

68.004, which corresponds to two Order of Operations errors.

C. $[68.41, 68.66]$

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

D. $[-29.59, -28.91]$

* -29.542, 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. Simplify the expression below and choose the interval the simplification is contained within.

$$13 - 1 \div 6 * 19 - (8 * 12)$$

The solution is -86.167, which is option C.

A. $[21.8, 22.31]$

22.000, which corresponds to not distributing a negative correctly.

B. $[-83.04, -81.13]$

-83.009, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

C. $[-86.82, -85.92]$

* -86.167, which is the correct option.

D. $[108.47, 109.39]$

108.991, which corresponds to not distributing addition and subtraction 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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5. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(-6 + 5i)(-10 - 4i)$$

The solution is $80 - 26i$, which is option A.

A. $a \in [74, 87]$ and $b \in [-26, -22]$

* $80 - 26i$, which is the correct option.

B. $a \in [59, 65]$ and $b \in [-25, -13]$

$60 - 20i$, 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. $a \in [74, 87]$ and $b \in [25, 28]$

$80 + 26i$, which corresponds to adding a minus sign in both terms.

D. $a \in [37, 45]$ and $b \in [-79, -72]$

$40 - 74i$, which corresponds to adding a minus sign in the second term.

E. $a \in [37, 45]$ and $b \in [72, 78]$

$40 + 74i$, 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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6. Choose the **smallest** set of Real numbers that the number below belongs to.

$$\sqrt{\frac{11664}{36}}$$

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 108.

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.

$$\frac{36 + 33i}{-7 + 8i}$$

The solution is $0.11 - 4.59i$, which is option C.

A. $a \in [-5.3, -4.85]$ and $b \in [3, 5.5]$

$-5.14 + 4.12i$, which corresponds to just dividing the first term by the first term and the second by the second.

B. $a \in [-0.4, 0.8]$ and $b \in [-519.5, -518.5]$

$0.11 - 519.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

C. $a \in [-0.4, 0.8]$ and $b \in [-6, -4]$

* $0.11 - 4.59i$, which is the correct option.

D. $a \in [-4.85, -4.05]$ and $b \in [-0.5, 1.5]$

$-4.57 + 0.50i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

E. $a \in [11.85, 12.7]$ and $b \in [-6, -4]$

$12.00 - 4.59i$, 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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8. Choose the **smallest** set of Real numbers that the number below belongs to.

$$\sqrt{\frac{-1989}{9}}$$

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

A. Rational

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

B. Not a Real number

* This is the correct option!

C. Integer

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

D. Irrational

These cannot be written as a fraction of Integers.

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 $\sqrt{221}i$.

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

$$\frac{54 - 44i}{-2 - 8i}$$

The solution is $3.59 + 7.65i$, which is option D.

A. $a \in [243.5, 244.5]$ and $b \in [6, 9]$

$244.00 + 7.65i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

B. $a \in [-28, -26.5]$ and $b \in [5, 7]$

$-27.00 + 5.50i$, which corresponds to just dividing the first term by the first term and the second by the second.

C. $a \in [2.5, 4.5]$ and $b \in [519.5, 520.5]$

$3.59 + 520.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

D. $a \in [2.5, 4.5]$ and $b \in [6, 9]$

* $3.59 + 7.65i$, which is the correct option.

E. $a \in [-7, -6.5]$ and $b \in [-5.5, -4.5]$

$-6.76 - 5.06i$, 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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10. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(5 - 3i)(-10 + 6i)$$

The solution is $-32 + 60i$, which is option E.

A. $a \in [-73, -67]$ and $b \in [-2, 1]$

$-68 + 0i$, which corresponds to adding a minus sign in the second term.

B. $a \in [-55, -49]$ and $b \in [-21, -14]$

$-50-18i$, 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.

C. $a \in [-73, -67]$ and $b \in [-2, 1]$

$-68 + 0i$, which corresponds to adding a minus sign in the first term.

D. $a \in [-35, -29]$ and $b \in [-62, -59]$

$-32 - 60i$, which corresponds to adding a minus sign in both terms.

E. $a \in [-35, -29]$ and $b \in [58, 63]$

* $-32 + 60i$, 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.
