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.

$$14 - 2^2 + 18 \div 19 * 10 \div 16$$

The solution is 10.592, which is option D.

A. $[16.2, 18.38]$

18.006, which corresponds to two Order of Operations errors.

B. $[18.18, 19.28]$

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

C. $[9.91, 10.54]$

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

D. $[10.22, 10.67]$

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

$$\sqrt{\frac{-2475}{0}}i + \sqrt{55}i$$

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

A. Not a Complex Number

* This is the correct option!

B. Irrational

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

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

$$\frac{54 - 33i}{4 - 7i}$$

The solution is $6.88 + 3.78i$, which is option E.

A. $a \in [6.5, 8.5]$ and $b \in [245, 247]$

$6.88 + 246.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

B. $a \in [13, 14]$ and $b \in [4, 5.5]$

$13.50 + 4.71i$, which corresponds to just dividing the first term by the first term and the second by the second.

C. $a \in [445.5, 448.5]$ and $b \in [3, 4]$

$447.00 + 3.78i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

D. $a \in [-1.5, 0]$ and $b \in [-9, -7]$

$-0.23 - 7.85i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

E. $a \in [6.5, 8.5]$ and $b \in [3, 4]$

* $6.88 + 3.78i$, 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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4. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{-756}{9}}i + \sqrt{187}i$$

The solution is Nonreal Complex, which is option E.

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. Pure Imaginary

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

C. Rational

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

D. Irrational

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

E. Nonreal Complex

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

$$\sqrt{\frac{660}{12}}$$

The solution is Irrational, which is option A.

A. Irrational

* This is the correct option!

B. Not a Real number

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

C. Rational

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

D. Whole

These are the counting numbers with 0 (0, 1, 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 $\sqrt{55}$.

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

$$(6 + 4i)(-8 - 2i)$$

The solution is $-40 - 44i$, which is option B.

A. $a \in [-65, -54]$ and $b \in [19, 25]$

$-56 + 20i$, which corresponds to adding a minus sign in the first term.

B. $a \in [-43, -33]$ and $b \in [-48, -40]$

* $-40 - 44i$, which is the correct option.

C. $a \in [-53, -47]$ and $b \in [-12, -6]$

$-48 - 8i$, 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.

D. $a \in [-43, -33]$ and $b \in [37, 46]$

$-40 + 44i$, which corresponds to adding a minus sign in both terms.

E. $a \in [-65, -54]$ and $b \in [-20, -16]$

$-56 - 20i$, 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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7. Simplify the expression below and choose the interval the simplification is contained within.

$$2 - 3 \div 4 * 9 - (5 * 18)$$

The solution is -94.750, which is option B.

A. $[89.92, 94.92]$

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

B. $[-97.75, -91.75]$

* -94.750, which is the correct option.

C. $[-90.08, -86.08]$

-88.083, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

D. $[-175.5, -170.5]$

-175.500, 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.

$$\sqrt{\frac{-882}{7}}$$

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

A. Integer

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

B. Whole

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

C. Rational

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

D. Irrational

These cannot be written as a fraction of Integers.

E. Not a Real number

* This is the correct option!

General Comment: First, you **NEED** to simplify the expression. This question simplifies to $\sqrt{126}i$.

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.

$$\frac{-45 - 77i}{-3 - 8i}$$

The solution is $10.29 - 1.77i$, which is option B.

A. $a \in [10, 11]$ and $b \in [-129.5, -128]$

$10.29 - 129.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

B. $a \in [10, 11]$ and $b \in [-3, 0]$

* $10.29 - 1.77i$, which is the correct option.

C. $a \in [-7.5, -5.5]$ and $b \in [7.5, 9]$

$-6.59 + 8.10i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

D. $a \in [13.5, 17.5]$ and $b \in [8.5, 11]$

$15.00 + 9.62i$, which corresponds to just dividing the first term by the first term and the second by the second.

E. $a \in [749, 751.5]$ and $b \in [-3, 0]$

$751.00 - 1.77i$, 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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10. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(5 + 4i)(9 + 10i)$$

The solution is $5 + 86i$, which is option A.

A. $a \in [-5, 10]$ and $b \in [81, 91]$

* $5 + 86i$, which is the correct option.

B. $a \in [80, 86]$ and $b \in [-16, -10]$

$85 - 14i$, which corresponds to adding a minus sign in the second term.

C. $a \in [41, 50]$ and $b \in [39, 43]$

$45 + 40i$, 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.

D. $a \in [80, 86]$ and $b \in [14, 15]$

$85 + 14i$, which corresponds to adding a minus sign in the first term.

E. $a \in [-5, 10]$ and $b \in [-92, -82]$

$5 - 86i$, 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.
