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.

$$\sqrt{\frac{0}{6}} + \sqrt{10}i$$

The solution is Pure Imaginary, which is option D.

A. Rational

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

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. Pure Imaginary

* This is the correct option!

E. Nonreal Complex

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

$$(6 - 8i)(7 - 3i)$$

The solution is $18 - 74i$, which is option D.

A. $a \in [62, 72]$ and $b \in [35, 42]$

$66 + 38i$, which corresponds to adding a minus sign in the first term.

B. $a \in [13, 23]$ and $b \in [69, 76]$

$18 + 74i$, which corresponds to adding a minus sign in both terms.

C. $a \in [62, 72]$ and $b \in [-38, -34]$

$66 - 38i$, which corresponds to adding a minus sign in the second term.

D. $a \in [13, 23]$ and $b \in [-75, -71]$

* $18 - 74i$, which is the correct option.

E. $a \in [42, 45]$ and $b \in [23, 26]$

$42 + 24i$, 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.

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

$$\frac{36 + 77i}{-8 + 2i}$$

The solution is $-1.97 - 10.12i$, which is option A.

A. $a \in [-2.5, -1]$ and $b \in [-10.5, -9]$

* $-1.97 - 10.12i$, which is the correct option.

B. $a \in [-5, -4]$ and $b \in [38, 39]$

$-4.50 + 38.50i$, which corresponds to just dividing the first term by the first term and the second by the second.

C. $a \in [-2.5, -1]$ and $b \in [-689.5, -687.5]$

$-1.97 - 688.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

D. $a \in [-7.5, -5]$ and $b \in [-8.5, -7.5]$

$-6.50 - 8.00i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

E. $a \in [-135, -133.5]$ and $b \in [-10.5, -9]$

$-134.00 - 10.12i$, 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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4. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{36 + 33i}{2 + 8i}$$

The solution is $4.94 - 3.26i$, which is option E.

A. $a \in [4.5, 6]$ and $b \in [-222.4, -221.9]$

$4.94 - 222.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

B. $a \in [17, 18.5]$ and $b \in [3.8, 5.1]$

$18.00 + 4.12i$, which corresponds to just dividing the first term by the first term and the second by the second.

C. $a \in [-4, -1.5]$ and $b \in [4.65, 5.45]$

$-2.82 + 5.21i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

D. $a \in [335, 336.5]$ and $b \in [-4, -3.15]$

$336.00 - 3.26i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

E. $a \in [4.5, 6]$ and $b \in [-4, -3.15]$

* $4.94 - 3.26i$, 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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5. Simplify the expression below and choose the interval the simplification is contained within.

$$20 - 15 \div 17 * 18 - (12 * 13)$$

The solution is -151.882, which is option B.

A. $[-109.47, -95.47]$

-102.471, which corresponds to not distributing a negative correctly.

B. $[-154.88, -149.88]$

* -151.882, which is the correct option.

C. $[-137.05, -127.05]$

-136.049, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

D. $[171.95, 180.95]$

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

$$\sqrt{\frac{144}{529}}$$

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. Integer

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

D. Rational

* 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 $\frac{12}{23}$.

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

$$-\sqrt{\frac{57600}{400}}$$

The solution is Integer, which is option E.

A. Not a Real number

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

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. Integer

* This is the correct option!

General Comment: First, you **NEED** to simplify the expression. This question simplifies to -240.

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

$$\sqrt{\frac{0}{289}} + \sqrt{8}i$$

The solution is Pure Imaginary, which is option A.

A. Pure Imaginary

* This is the correct option!

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. Nonreal Complex

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

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

$$(-3 - 6i)(-7 - 5i)$$

The solution is $-9 + 57i$, which is option B.

A. $a \in [-9, -1]$ and $b \in [-64, -52]$

$-9 - 57i$, which corresponds to adding a minus sign in both terms.

B. $a \in [-9, -1]$ and $b \in [54, 60]$

* $-9 + 57i$, which is the correct option.

C. $a \in [46, 52]$ and $b \in [22, 28]$

$51 + 27i$, which corresponds to adding a minus sign in the second term.

D. $a \in [46, 52]$ and $b \in [-27, -23]$

$51 - 27i$, which corresponds to adding a minus sign in the first term.

E. $a \in [17, 28]$ and $b \in [28, 31]$

$21 + 30i$, 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.

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.

$$5 - 10^2 + 4 \div 20 * 14 \div 8$$

The solution is -94.650, which is option A.

A. $[-94.89, -94.41]$

* -94.650, this is the correct option

B. $[105.16, 105.51]$

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

C. $[-95.32, -94.66]$

-94.998, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

D. $[104.7, 105.1]$

105.002, which corresponds to two Order of Operations errors.

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.
