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 Real numbers that the number below belongs to.

$$-\sqrt{\frac{49}{64}}$$

The solution is Rational, which is option A.

A. Rational

* 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. Not a Real number

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

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 $-\frac{7}{8}$.

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

$$(-2 + 4i)(-5 - 7i)$$

The solution is $38 - 6i$, which is option C.

A. $a \in [-23, -12]$ and $b \in [34, 39]$

$-18 + 34i$, which corresponds to adding a minus sign in the first term.

B. $a \in [3, 17]$ and $b \in [-33, -21]$

$10 - 28i$, 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. $a \in [30, 42]$ and $b \in [-7, 3]$

* $38 - 6i$, which is the correct option.

D. $a \in [-23, -12]$ and $b \in [-37, -33]$

$-18 - 34i$, which corresponds to adding a minus sign in the second term.

E. $a \in [30, 42]$ and $b \in [5, 7]$

$38 + 6i$, 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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3. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{-9 - 55i}{4 - 2i}$$

The solution is $3.70 - 11.90i$, which is option E.

A. $a \in [-7.5, -6]$ and $b \in [-11.5, -9.5]$

$-7.30 - 10.10i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

B. $a \in [3, 4]$ and $b \in [-239, -237]$

$3.70 - 238.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

C. $a \in [-3, -1]$ and $b \in [26.5, 28]$

$-2.25 + 27.50i$, which corresponds to just dividing the first term by the first term and the second by the second.

D. $a \in [73.5, 74.5]$ and $b \in [-12.5, -11]$

$74.00 - 11.90i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

E. $a \in [3, 4]$ and $b \in [-12.5, -11]$

* $3.70 - 11.90i$, 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. Simplify the expression below and choose the interval the simplification is contained within.

$$1 - 7^2 + 13 \div 4 * 3 \div 18$$

The solution is -47.458, which is option A.

A. $[-47.66, -47.17]$

* -47.458, this is the correct option

B. $[-48.06, -47.92]$

-47.940, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

C. $[50.53, 51.09]$

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

D. $[49.85, 50.46]$

50.060, 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.

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5. 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 E.

A. Irrational

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

B. Rational

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

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

$$\frac{27 + 22i}{-8 + 7i}$$

The solution is $-0.55 - 3.23i$, which is option C.

A. $a \in [-3.75, -3.31]$ and $b \in [2, 4]$

$-3.38 + 3.14i$, which corresponds to just dividing the first term by the first term and the second by the second.

B. $a \in [-62.08, -61.8]$ and $b \in [-4, -2]$

$-62.00 - 3.23i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

C. $a \in [-0.76, -0.45]$ and $b \in [-4, -2]$

* $-0.55 - 3.23i$, which is the correct option.

D. $a \in [-0.76, -0.45]$ and $b \in [-366, -364.5]$

$-0.55 - 365.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

E. $a \in [-3.33, -3.24]$ and $b \in [-0.5, 0.5]$

$-3.27 + 0.12i$, 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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7. Choose the **smallest** set of Real numbers that the number below belongs to.

$$\sqrt{\frac{-720}{8}}$$

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

A. Whole

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

B. Rational

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

C. Irrational

These cannot be written as a fraction of Integers.

D. Not a Real number

* This is the correct option!

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 $\sqrt{90}i$.

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

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

The solution is $-59 - 53i$, which is option D.

A. $a \in [-37, -27]$ and $b \in [-76, -72]$

$-31 - 73i$, which corresponds to adding a minus sign in the first term.

B. $a \in [-48, -44]$ and $b \in [14, 23]$

$-45+14i$, 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. $a \in [-62, -58]$ and $b \in [51, 59]$

$-59 + 53i$, which corresponds to adding a minus sign in both terms.

D. $a \in [-62, -58]$ and $b \in [-55, -50]$

* $-59 - 53i$, which is the correct option.

E. $a \in [-37, -27]$ and $b \in [73, 75]$

$-31 + 73i$, 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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9. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{-2028}{13}} + \sqrt{0}i$$

The solution is Pure Imaginary, 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. Pure Imaginary

* This is the correct option!

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

$$20 - 4^2 + 1 \div 16 * 11 \div 5$$

The solution is 4.138, which is option C.

A. $[35.77, 36.02]$

36.001, which corresponds to two Order of Operations errors.

B. $[36.1, 36.28]$

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

C. $[4.12, 4.15]$

* 4.138, this is the correct option

D. $[3.99, 4.07]$

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

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.
