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.

$$-\sqrt{\frac{3276}{14}}$$

The solution is Irrational, which is option E.

A. Whole

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

B. Integer

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

C. Not a Real number

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

D. Rational

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

E. Irrational

* This is the correct option!

General Comment: First, you **NEED** to simplify the expression. This question simplifies to $-\sqrt{234}$.

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

$$-\sqrt{\frac{140625}{225}}$$

The solution is Integer, which is option E.

A. Whole

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

B. Not a Real number

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

C. Irrational

These cannot be written as a fraction of Integers.

D. Rational

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

E. Integer

* This is the correct option!

General Comment: First, you **NEED** to simplify the expression. This question simplifies to -375.

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

$$10 - 9^2 + 8 \div 13 * 14 \div 4$$

The solution is -68.846, which is option B.

A. $[91.5, 94.1]$

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

B. $[-70.3, -67]$

* -68.846, this is the correct option

C. $[89.1, 92.6]$

91.011, which corresponds to two Order of Operations errors.

D. $[-72.7, -69.9]$

-70.989, 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.

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

$$\sqrt{\frac{-1008}{12}} + \sqrt{63}$$

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

$$\frac{-27 - 11i}{-8 + 4i}$$

The solution is $2.15 + 2.45i$, which is option B.

A. $a \in [1.8, 2.25]$ and $b \in [194, 196.5]$

$2.15 + 196.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

B. $a \in [1.8, 2.25]$ and $b \in [1.5, 3]$

* $2.15 + 2.45i$, which is the correct option.

C. $a \in [3.35, 3.45]$ and $b \in [-4, -1.5]$

$3.38 - 2.75i$, which corresponds to just dividing the first term by the first term and the second by the second.

D. $a \in [171.65, 172.3]$ and $b \in [1.5, 3]$

$172.00 + 2.45i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

E. $a \in [2.8, 3.3]$ and $b \in [-1, 0]$

$3.25 - 0.25i$, 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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6. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(-7 + 9i)(10 + 4i)$$

The solution is $-106 + 62i$, which is option E.

A. $a \in [-106, -98]$ and $b \in [-62, -60]$

$-106 - 62i$, which corresponds to adding a minus sign in both terms.

B. $a \in [-35, -24]$ and $b \in [117, 121]$

$-34 + 118i$, which corresponds to adding a minus sign in the second term.

C. $a \in [-35, -24]$ and $b \in [-121, -117]$

$-34 - 118i$, which corresponds to adding a minus sign in the first term.

D. $a \in [-73, -60]$ and $b \in [35, 42]$

$-70 + 36i$, 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. $a \in [-106, -98]$ and $b \in [62, 66]$

* $-106 + 62i$, 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.

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

$$\frac{-27 - 11i}{5 + 6i}$$

The solution is $-3.30 + 1.75i$, which is option E.

A. $a \in [-202.5, -200.5]$ and $b \in [1.5, 2.5]$

$-201.00 + 1.75i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

B. $a \in [-6, -4]$ and $b \in [-3, -1.5]$

$-5.40 - 1.83i$, which corresponds to just dividing the first term by the first term and the second by the second.

C. $a \in [-3.5, -2]$ and $b \in [106, 107.5]$

$-3.30 + 107.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

D. $a \in [-1.5, 0]$ and $b \in [-5, -3]$

$-1.13 - 3.56i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

E. $a \in [-3.5, -2]$ and $b \in [1.5, 2.5]$

* $-3.30 + 1.75i$, 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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8. Simplify the expression below and choose the interval the simplification is contained within.

$$18 - 19^2 + 7 \div 11 * 4 \div 5$$

The solution is -342.491, which is option D.

A. $[-343.57, -342.68]$

-342.968, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

B. $[378.53, 379.29]$

379.032, which corresponds to two Order of Operations errors.

C. $[379.25, 380.16]$

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

D. $[-342.59, -342.13]$

* -342.491, 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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9. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{0}{576}} + \sqrt{4}i$$

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. Nonreal Complex

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

D. Pure Imaginary

* This is the correct option!

E. 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!

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

$$(7 - 4i)(-5 + 3i)$$

The solution is $-23 + 41i$, which is option A.

A. $a \in [-25, -19]$ and $b \in [40.51, 41.33]$

   * $-23 + 41i$, which is the correct option.

B. $a \in [-25, -19]$ and $b \in [-41.91, -40.51]$

   $-23 - 41i$, which corresponds to adding a minus sign in both terms.

C. $a \in [-36, -32]$ and $b \in [-12.77, -11.81]$

   $-35 - 12i$, 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. $a \in [-49, -45]$ and $b \in [-1.59, -0.39]$

   $-47 - i$, which corresponds to adding a minus sign in the second term.

E. $a \in [-49, -45]$ and $b \in [0.87, 1.51]$

   $-47 + i$, 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.
