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.

$$-\sqrt{\frac{160000}{256}}$$

The solution is Integer, which is option D.

A. Rational

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

B. Whole

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

C. Irrational

These cannot be written as a fraction of Integers.

D. Integer

* This is the correct option!

E. Not a Real number

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

General Comment: First, you **NEED** to simplify the expression. This question simplifies to -400.

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 Complex numbers that the number below belongs to.

$$\frac{\sqrt{70}}{9} + \sqrt{-3}i$$

The solution is Irrational, which is option D.

A. Nonreal Complex

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

B. 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!

C. Rational

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

D. Irrational

* This is the correct option!

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

$$-\sqrt{\frac{765}{9}}$$

The solution is Irrational, which is option C.

A. Rational

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

B. Whole

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

C. Irrational

* This is the correct option!

D. Not a Real number

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

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 $-\sqrt{85}$.

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

$$16 - 10^2 + 18 \div 1 * 7 \div 12$$

The solution is -73.500, which is option A.

A. $[-76.5, -70.5]$

* -73.500, this is the correct option

B. $[-84.79, -82.79]$

-83.786, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

C. $[121.5, 130.5]$

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

D. $[114.21, 123.21]$

116.214, 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.

$$-\sqrt{\frac{1260}{15}} + 2i^2$$

The solution is Irrational, which is option B.

A. Rational

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

B. Irrational

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

$$\frac{18 - 77i}{8 - i}$$

The solution is $3.40 - 9.20i$, which is option C.

A. $a \in [220.5, 221.5]$ and $b \in [-9.65, -8.95]$

$221.00 - 9.20i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

B. $a \in [0.5, 1.5]$ and $b \in [-10, -9.4]$

$1.03 - 9.75i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

C. $a \in [3, 4.5]$ and $b \in [-9.65, -8.95]$

* $3.40 - 9.20i$, which is the correct option.

D. $a \in [1.5, 3]$ and $b \in [76.8, 77.05]$

$2.25 + 77.00i$, which corresponds to just dividing the first term by the first term and the second by the second.

E. $a \in [3, 4.5]$ and $b \in [-598.05, -597.7]$

$3.40 - 598.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

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

$$(-2 + 9i)(8 - 3i)$$

The solution is $11 + 78i$, which is option C.

A. $a \in [-44, -41]$ and $b \in [66, 69]$

$-43 + 66i$, which corresponds to adding a minus sign in the second term.

B. $a \in [7, 17]$ and $b \in [-86, -72]$

$11 - 78i$, which corresponds to adding a minus sign in both terms.

C. $a \in [7, 17]$ and $b \in [76, 82]$

* $11 + 78i$, which is the correct option.

D. $a \in [-44, -41]$ and $b \in [-66, -59]$

$-43 - 66i$, which corresponds to adding a minus sign in the first term.

E. $a \in [-20, -10]$ and $b \in [-29, -26]$

$-16 - 27i$, 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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8. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{-45 - 11i}{4 - 8i}$$

The solution is $-1.15 - 5.05i$, which is option D.

A. $a \in [-11.5, -10.5]$ and $b \in [0, 2]$

$-11.25 + 1.38i$, which corresponds to just dividing the first term by the first term and the second by the second.

B. $a \in [-1.5, -0.5]$ and $b \in [-405, -403]$

$-1.15 - 404.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

C. $a \in [-92.5, -91]$ and $b \in [-6, -4]$

$-92.00 - 5.05i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

D. $a \in [-1.5, -0.5]$ and $b \in [-6, -4]$

* $-1.15 - 5.05i$, which is the correct option.

E. $a \in [-3.5, -2.5]$ and $b \in [3.5, 5.5]$

$-3.35 + 3.95i$, 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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9. Simplify the expression below and choose the interval the simplification is contained within.

$$20 - 9^2 + 7 \div 1 * 10 \div 14$$

The solution is -56.000, which is option C.

A. $[-64.95, -58.95]$

-60.950, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

B. $[105, 109]$

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

C. $[-60, -50]$

* -56.000, this is the correct option

D. $[100.05, 102.05]$

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

$$(8 - 6i)(-2 + 3i)$$

The solution is $2 + 36i$, which is option B.

A. $a \in [-37, -29]$ and $b \in [10, 14]$

$-34 + 12i$, which corresponds to adding a minus sign in the first term.

B. $a \in [2, 6]$ and $b \in [32, 38]$

* $2 + 36i$, which is the correct option.

C. $a \in [-20, -14]$ and $b \in [-23, -16]$

$-16 - 18i$, 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.

D. $a \in [2, 6]$ and $b \in [-36, -33]$

$2 - 36i$, which corresponds to adding a minus sign in both terms.

E. $a \in [-37, -29]$ and $b \in [-17, -4]$

$-34 - 12i$, 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.
