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.

---

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

$$(-9 - 7i)(8 + 10i)$$

The solution is $-2 - 146i$

A. $a \in [-147, -138]$ and $b \in [-35, -33]$

$-142 - 34i$, which corresponds to adding a minus sign in the first term.

B. $a \in [-147, -138]$ and $b \in [32, 41]$

$-142 + 34i$, which corresponds to adding a minus sign in the second term.

C. $a \in [-4, 6]$ and $b \in [-149, -144]$

* $-2 - 146i$, which is the correct option.

D. $a \in [-4, 6]$ and $b \in [143, 150]$

$-2 + 146i$, which corresponds to adding a minus sign in both terms.

E. $a \in [-74, -67]$ and $b \in [-71, -66]$

$-72 - 70i$, 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 Comments: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

---

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

$$\frac{27 - 22i}{-6 + 5i}$$

The solution is $-4.46 - 0.05i$

A. $a \in [-4.54, -4.48]$ and $b \in [-5.92, -4.35]$

$-4.50 - 4.40i$, which corresponds to just dividing the first term by the first term and the second by the second.

B. $a \in [-272.01, -271.98]$ and $b \in [-0.78, 0.77]$

$-272.00 - 0.05i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

C. $a \in [-4.47, -4.44]$ and $b \in [-3.03, -2.73]$

$-4.46 - 3.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

D. $a \in [-4.47, -4.44]$ and $b \in [-0.78, 0.77]$

* $-4.46 - 0.05i$, which is the correct option.

E. $a \in [-0.86, -0.83]$ and $b \in [2.8, 4.87]$

$-0.85 + 4.38i$, 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 $2 - 3i$.

---

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

$$-\sqrt{\frac{20449}{121}}$$

The solution is Integer

A. Not a Real number

These are Nonreal Complex numbers OR things that are not numbers (dividing by 0).

B. Irrational

These cannot be written as a fraction of Integers.

C. Whole

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

D. Integer

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

E. Rational

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

General Comments: First, you **NEED** to simplify the expression. This question simplifies to -143.

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.

---

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

$$\sqrt{\frac{880}{8}} + 4i^2$$

The solution is Irrational

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. 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!

E. Pure Imaginary

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

General Comments: 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.

---

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

$$3 - 15^2 + 18 \div 10 * 19 \div 14$$

The solution is -219.557

A. $[229.74, 231.65]$

230.443000, which corresponds to an Order of Operations error: multiplying by negative before squaring. For example: $(-3)^2 \neq -3^2$

B. $[227.53, 228.31]$

228.007000, which corresponds to two Order of Operations errors.

C. $[-220.44, -219.19]$

* -219.557000, this is the correct option

D. $[-222.27, -220.7]$

-221.993000, 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 Comments: 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.
