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. **General Comment:** None

---

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

$$\frac{45 - 77i}{8 - i}$$

The solution is $6.72 - 8.78i$, which is option B.

A. $a \in [3, 4.5]$ and $b \in [-11, -9]$ $4.35 - 10.17i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

B. $a \in [6, 7.5]$ and $b \in [-9.5, -8]$ * $6.72 - 8.78i$, which is the correct option.

C. $a \in [5, 6.5]$ and $b \in [76.5, 78]$ $5.62 + 77.00i$, which corresponds to just dividing the first term by the first term and the second by the second.

D. $a \in [6, 7.5]$ and $b \in [-572, -570]$ $6.72 - 571.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

E. $a \in [435.5, 437.5]$ and $b \in [-9.5, -8]$ $437.00 - 8.78i$, 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 $2 - 3i$.

---

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

$$(-3 - 10i)(8 - 2i)$$

The solution is $-44 - 74i$, which is option B.

A. $a \in [-26, -20]$ and $b \in [17, 25]$ $-24 + 20i$, 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.

B. $a \in [-49, -39]$ and $b \in [-74, -70]$ * $-44 - 74i$, which is the correct option.

C. $a \in [-4, -2]$ and $b \in [-86, -82]$ $-4 - 86i$, which corresponds to adding a minus sign in the second term.

D. $a \in [-49, -39]$ and $b \in [66, 76]$ $-44 + 74i$, which corresponds to adding a minus sign in both terms.

E. $a \in [-4, -2]$ and $b \in [83, 87]$ $-4 + 86i$, 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.

---

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

$$7 - 15 \div 9 * 13 - (17 * 4)$$

The solution is -82.667, which is option C.

A. $[-65.13, -58.13]$ -61.128, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

B. $[74.87, 76.87]$ 74.872, which corresponds to not distributing addition and subtraction correctly.

C. $[-91.67, -77.67]$ * -82.667, which is the correct option.

D. $[-130.67, -120.67]$ -126.667, which corresponds to not distributing a negative 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.

---

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

$$\frac{12}{8} + 81i^2$$

The solution is Rational, which is option E.

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

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

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 * 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.

---

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

$$-\sqrt{\frac{44100}{225}}$$

The solution is Integer, which is option A.

A. Integer * This is the correct option!

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

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

D. Not a Real number These are Nonreal Complex numbers **OR** things that are not numbers (e.g., dividing by 0).

E. Irrational These cannot be written as a fraction of Integers.

General Comment: First, you **NEED** to simplify the expression. This question simplifies to -210.

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.
