

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

$$\sqrt{\frac{-1404}{0}} + \sqrt{126}$$

The solution is Not a Complex Number, which is option E.

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. Pure Imaginary

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

D. Nonreal Complex

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

E. Not a Complex Number

* 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.

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

$$\frac{63 - 33i}{-5 - i}$$

The solution is $-10.85 + 8.77i$, which is option C.

A. $a \in [-13.45, -13.3]$ and $b \in [3.5, 5]$

$-13.38 + 3.92i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

B. $a \in [-13.15, -11.9]$ and $b \in [32.5, 33.5]$

$-12.60 + 33.00i$, which corresponds to just dividing the first term by the first term and the second by the second.

C. $a \in [-11.45, -10.5]$ and $b \in [8.5, 10.5]$

* $-10.85 + 8.77i$, which is the correct option.

D. $a \in [-11.45, -10.5]$ and $b \in [227.5, 229.5]$

$-10.85 + 228.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

E. $a \in [-282.1, -281.3]$ and $b \in [8.5, 10.5]$

$-282.00 + 8.77i$, 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.

$$(-5 - 2i)(-6 - 8i)$$

The solution is $14 + 52i$, which is option C.

A. $a \in [44, 52]$ and $b \in [-32, -21]$

$46 - 28i$, which corresponds to adding a minus sign in the second term.

B. $a \in [44, 52]$ and $b \in [28, 30]$

$46 + 28i$, which corresponds to adding a minus sign in the first term.

C. $a \in [13, 20]$ and $b \in [48, 57]$

* $14 + 52i$, which is the correct option.

D. $a \in [13, 20]$ and $b \in [-52, -50]$

$14 - 52i$, which corresponds to adding a minus sign in both terms.

E. $a \in [27, 33]$ and $b \in [16, 18]$

$30 + 16i$, 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.

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

$$\frac{9 + 55i}{6 + 2i}$$

The solution is $4.10 + 7.80i$, which is option B.

A. $a \in [163.5, 164.5]$ and $b \in [6.5, 8]$

$164.00 + 7.80i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

B. $a \in [3.5, 4.5]$ and $b \in [6.5, 8]$

* $4.10 + 7.80i$, which is the correct option.

C. $a \in [1, 2.5]$ and $b \in [26, 28.5]$

$1.50 + 27.50i$, which corresponds to just dividing the first term by the first term and the second by the second.

D. $a \in [-2.5, 0]$ and $b \in [8.5, 9]$

$-1.40 + 8.70i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

E. $a \in [3.5, 4.5]$ and $b \in [311.5, 312.5]$

$4.10 + 312.00i$, 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 $2 - 3i$.

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

$$18 - 20 \div 1 * 17 - (3 * 4)$$

The solution is -334.000 , which is option B.

A. $[26.82, 31.82]$

28.824 , which corresponds to not distributing addition and subtraction correctly.

B. $[-339, -333]$

-334.000 , which is the correct option.

C. $[-1302, -1298]$

-1300.000 , which corresponds to not distributing a negative correctly.

D. $[2.82, 5.82]$

4.824 , 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.

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

$$\sqrt{\frac{540}{12}}$$

The solution is Irrational, which is option B.

A. Whole

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

B. Irrational

* This is the correct option!

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. 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 $\sqrt{45}$.

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.

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

$$\sqrt{\frac{-693}{7}} + \sqrt{0}i$$

The solution is Pure Imaginary, which is option A.

A. Pure Imaginary

* This is the correct option!

B. Irrational

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

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. Rational

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

E. Nonreal Complex

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

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

$$(-7 - 3i)(4 - 2i)$$

The solution is $-34 + 2i$, which is option D.

A. $a \in [-32, -26]$ and $b \in [4, 8.1]$

$-28 + 6i$, 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. $a \in [-36, -29]$ and $b \in [-3.7, -1.2]$

$-34 - 2i$, which corresponds to adding a minus sign in both terms.

C. $a \in [-27, -20]$ and $b \in [-26.7, -24.5]$

$-22 - 26i$, which corresponds to adding a minus sign in the second term.

D. $a \in [-36, -29]$ and $b \in [-1.3, 3.1]$

* $-34 + 2i$, which is the correct option.

E. $a \in [-27, -20]$ and $b \in [23.8, 27]$

$-22 + 26i$, 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.

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

$$\sqrt{\frac{196}{169}}$$

The solution is Rational, which is option D.

A. Irrational

These cannot be written as a fraction of Integers.

B. Integer

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

C. Whole

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

D. Rational

* 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 $\frac{14}{13}$.

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.

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

$$1 - 17 \div 4 * 16 - (10 * 12)$$

The solution is -187.000 , which is option D.

A. $[-121.27, -118.27]$

-119.266 , which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

B. $[114.73, 123.73]$

120.734 , which corresponds to not distributing addition and subtraction correctly.

C. $[-926, -920]$

-924.000 , which corresponds to not distributing a negative correctly.

D. $[-188, -182]$

* -187.000, which 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.
