

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.

$$\frac{-15}{0} + \sqrt{154}i$$

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. Pure Imaginary

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

C. Irrational

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

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.

$$\frac{-45 - 11i}{6 - 3i}$$

The solution is $-5.27 - 4.47i$, which is option E.

A. $a \in [-7.55, -7.05]$ and $b \in [2, 4.5]$

$-7.50 + 3.67i$, which corresponds to just dividing the first term by the first term and the second by the second.

B. $a \in [-237.2, -236.95]$ and $b \in [-5, -3.5]$

$-237.00 - 4.47i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

C. $a \in [-6.1, -4.8]$ and $b \in [-202, -200.5]$

$-5.27 - 201.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

D. $a \in [-6.75, -5.6]$ and $b \in [1, 2]$

$-6.73 + 1.53i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

E. $a \in [-6.1, -4.8]$ and $b \in [-5, -3.5]$

* $-5.27 - 4.47i$, 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 $2 - 3i$.

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

$$(-3 - 2i)(10 + 4i)$$

The solution is $-22 - 32i$, which is option D.

A. $a \in [-25, -19]$ and $b \in [29, 38]$

$-22 + 32i$, which corresponds to adding a minus sign in both terms.

B. $a \in [-40, -36]$ and $b \in [-9, -7]$

$-38 - 8i$, which corresponds to adding a minus sign in the second term.

C. $a \in [-33, -25]$ and $b \in [-9, -7]$

$-30 - 8i$, 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. $a \in [-25, -19]$ and $b \in [-37, -26]$

* $-22 - 32i$, which is the correct option.

E. $a \in [-40, -36]$ and $b \in [7, 16]$

$-38 + 8i$, 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 into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{-45 + 88i}{6 + 7i}$$

The solution is $4.07 + 9.92i$, which is option D.

A. $a \in [-11.5, -9.5]$ and $b \in [1.5, 4]$

$-10.42 + 2.51i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

B. $a \in [345, 346.5]$ and $b \in [8.5, 10.5]$

$346.00 + 9.92i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

C. $a \in [3.5, 5.5]$ and $b \in [842.5, 844]$

$4.07 + 843.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

D. $a \in [3.5, 5.5]$ and $b \in [8.5, 10.5]$

* $4.07 + 9.92i$, which is the correct option.

E. $a \in [-9, -7]$ and $b \in [11.5, 13]$

$-7.50 + 12.57i$, which corresponds to just dividing the first term by the first term and the second by the second.

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.

$$17 - 18 \div 4 * 11 - (14 * 2)$$

The solution is -60.500 , which is option A.

A. $[-60.5, -55.5]$

* -60.500 , which is the correct option.

B. $[-96, -92]$

-93.000 , which corresponds to not distributing a negative correctly.

C. $[41.59, 45.59]$

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

D. $[-11.41, -7.41]$

-11.409 , 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.

$$\sqrt{\frac{20736}{144}}$$

The solution is Whole, which is option B.

A. Integer

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

B. Whole

* This is the correct option!

C. Irrational

These cannot be written as a fraction of Integers.

D. Not a Real number

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

E. Rational

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

General Comment: First, you **NEED** to simplify the expression. This question simplifies to 144.

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.

$$\sqrt{\frac{-990}{10}}i + \sqrt{165}i$$

The solution is Nonreal Complex, which is option B.

A. Rational

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

B. Nonreal Complex

* This is the correct option!

C. Irrational

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

D. Pure Imaginary

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

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.

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

$$(-2 - 4i)(-10 + 8i)$$

The solution is $52 + 24i$, which is option E.

A. $a \in [-18, -6]$ and $b \in [53, 60]$

$-12 + 56i$, which corresponds to adding a minus sign in the second term.

B. $a \in [46, 58]$ and $b \in [-24, -23]$

$52 - 24i$, which corresponds to adding a minus sign in both terms.

C. $a \in [-18, -6]$ and $b \in [-59, -53]$

$-12 - 56i$, which corresponds to adding a minus sign in the first term.

D. $a \in [15, 24]$ and $b \in [-36, -29]$

$20 - 32i$, 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. $a \in [46, 58]$ and $b \in [17, 29]$

* $52 + 24i$, 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.

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

$$-\sqrt{\frac{330625}{625}}$$

The solution is Integer, which is option E.

- A. Whole

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

- B. Rational

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

- C. Not a Real number

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

- D. Irrational

These cannot be written as a fraction of Integers.

- E. Integer

* This is the correct option!

General Comment: First, you **NEED** to simplify the expression. This question simplifies to -575 .

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.

$$18 - 14 \div 15 * 19 - (12 * 6)$$

The solution is -71.733 , which is option B.

- A. $[89.23, 90.02]$

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

- B. $[-72.93, -70.46]$

* -71.733 , which is the correct option.

- C. $[-71.48, -69.28]$

-70.400 , which corresponds to not distributing a negative correctly.

D. $[-54.18, -52.78]$

-54.049, 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.

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