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

$$\frac{18 + 44i}{-8 - 3i}$$

The solution is $-3.78 - 4.08i$, which is option A.

A. $a \in [-5, -3]$ and $b \in [-5, -3]$

* $-3.78 - 4.08i$, which is the correct option.

B. $a \in [-5, -3]$ and $b \in [-299.5, -297]$

$-3.78 - 298.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

C. $a \in [-278, -275]$ and $b \in [-5, -3]$

$-276.00 - 4.08i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

D. $a \in [-1.5, 0]$ and $b \in [-7.5, -5]$

$-0.16 - 5.56i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

E. $a \in [-3.5, -1]$ and $b \in [-15, -14]$

$-2.25 - 14.67i$, 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 $2 - 3i$.

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

$$15 - 6^2 + 20 \div 9 * 5 \div 13$$

The solution is -20.145, which is option B.

A. $[51.62, 52.12]$

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

B. $[-20.47, -19.44]$

* -20.145, this is the correct option

C. $[50.8, 51.11]$

51.034, which corresponds to two Order of Operations errors.

D. $[-21.33, -20.36]$

-20.966, 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.

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

$$(-5 + 2i)(-9 + 6i)$$

The solution is $33 - 48i$, which is option A.

A. $a \in [31, 34]$ and $b \in [-52, -42]$

* $33 - 48i$, which is the correct option.

B. $a \in [56, 61]$ and $b \in [-13, -9]$

$57 - 12i$, which corresponds to adding a minus sign in the first term.

C. $a \in [31, 34]$ and $b \in [46, 53]$

$33 + 48i$, which corresponds to adding a minus sign in both terms.

D. $a \in [45, 49]$ and $b \in [12, 18]$

$45 + 12i$, 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. $a \in [56, 61]$ and $b \in [12, 18]$

$57 + 12i$, 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.

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

$$\frac{\sqrt{130}}{10} + \sqrt{-7}i$$

The solution is Irrational, which is option A.

A. Irrational

* This is the correct option!

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

$$\sqrt{\frac{127449}{441}}$$

The solution is Whole, which is option B.

A. Integer

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

B. Whole

* This is the correct option!

C. Irrational

These cannot be written as a fraction of Integers.

D. Rational

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

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 357.

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

$$\frac{18 + 55i}{6 + 7i}$$

The solution is $5.80 + 2.40i$, which is option C.

A. $a \in [2.5, 3.5]$ and $b \in [7.5, 8.5]$

$3.00 + 7.86i$, which corresponds to just dividing the first term by the first term and the second by the second.

B. $a \in [492.5, 494.5]$ and $b \in [2, 3]$

$493.00 + 2.40i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

C. $a \in [4, 6.5]$ and $b \in [2, 3]$

* $5.80 + 2.40i$, which is the correct option.

D. $a \in [-4.5, -3]$ and $b \in [5, 6.5]$

$-3.26 + 5.36i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

E. $a \in [4, 6.5]$ and $b \in [203, 205]$

$5.80 + 204.00i$, 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. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{0}{49}} + \sqrt{6}i$$

The solution is Pure Imaginary, which is option C.

A. 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!

B. Rational

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

C. Pure Imaginary

* This is the correct option!

D. Nonreal Complex

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

E. Irrational

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

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

$$\sqrt{\frac{78400}{400}}$$

The solution is Whole, which is option E.

A. Integer

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

B. Irrational

These cannot be written as a fraction of Integers.

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. Whole

* This is the correct option!

General Comment: First, you **NEED** to simplify the expression. This question simplifies to 280.

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

$$12 - 9 \div 6 * 4 - (10 * 16)$$

The solution is -154.000, which is option C.

A. $[-69, -59]$

-64.000, which corresponds to not distributing a negative correctly.

B. $[170.62, 176.62]$

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

C. $[-158, -152]$

* -154.000, which is the correct option.

D. $[-153.38, -146.38]$

-148.375, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

E. None of the above

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

$$(5 - 8i)(-10 - 2i)$$

The solution is $-66 + 70i$, which is option B.

A. $a \in [-53, -49]$ and $b \in [13, 23]$

$-50 + 16i$, 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.

B. $a \in [-73, -61]$ and $b \in [66, 74]$

* $-66 + 70i$, which is the correct option.

C. $a \in [-36, -31]$ and $b \in [90, 96]$

$-34 + 90i$, which corresponds to adding a minus sign in the second term.

D. $a \in [-73, -61]$ and $b \in [-72, -69]$

$-66 - 70i$, which corresponds to adding a minus sign in both terms.

E. $a \in [-36, -31]$ and $b \in [-92, -89]$

$-34 - 90i$, 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.
