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

$$\sqrt{\frac{169}{400}}$$

The solution is Rational, which is option A.

A. Rational

* This is the correct option!

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. Whole

These are the counting numbers with 0 (0, 1, 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 $\frac{13}{20}$.

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

$$(10 + 5i)(6 + 4i)$$

The solution is $40 + 70i$, which is option E.

A. $a \in [79, 83]$ and $b \in [-14, -6]$

$80 - 10i$, which corresponds to adding a minus sign in the second term.

B. $a \in [35, 42]$ and $b \in [-72, -66]$

$40 - 70i$, which corresponds to adding a minus sign in both terms.

C. $a \in [53, 66]$ and $b \in [17, 25]$

$60 + 20i$, 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.

D. $a \in [79, 83]$ and $b \in [8, 14]$

$80 + 10i$, which corresponds to adding a minus sign in the first term.

E. $a \in [35, 42]$ and $b \in [67, 76]$

* $40 + 70i$, 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.

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

$$\frac{-18 - 55i}{-6 + 4i}$$

The solution is $-2.15 + 7.73i$, which is option C.

A. $a \in [5, 8]$ and $b \in [4, 5.5]$

$6.31 + 4.96i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

B. $a \in [-2.5, -2]$ and $b \in [401.5, 403.5]$

$-2.15 + 402.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

C. $a \in [-2.5, -2]$ and $b \in [6, 8]$

* $-2.15 + 7.73i$, which is the correct option.

D. $a \in [1.5, 4.5]$ and $b \in [-14, -12.5]$

$3.00 - 13.75i$, which corresponds to just dividing the first term by the first term and the second by the second.

E. $a \in [-112.5, -111.5]$ and $b \in [6, 8]$

$-112.00 + 7.73i$, 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 $2 - 3i$.

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

$$-\sqrt{\frac{2925}{15}} + 8i^2$$

The solution is Irrational, which is option B.

A. Pure Imaginary

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

B. Irrational

* This is the correct option!

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. Nonreal Complex

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

E. Rational

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

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

$$\frac{18 + 77i}{1 - 6i}$$

The solution is $-12.00 + 5.00i$, which is option C.

A. $a \in [11.5, 13.5]$ and $b \in [-1.5, 0]$

$12.97 - 0.84i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

B. $a \in [-13, -11]$ and $b \in [184, 185.5]$

$-12.00 + 185.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

C. $a \in [-13, -11]$ and $b \in [4, 5.5]$

* $-12.00 + 5.00i$, which is the correct option.

D. $a \in [-445, -442.5]$ and $b \in [4, 5.5]$

$-444.00 + 5.00i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

E. $a \in [17, 18.5]$ and $b \in [-13.5, -11.5]$

$18.00 - 12.83i$, 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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6. Simplify the expression below and choose the interval the simplification is contained within.

$$20 - 5 \div 14 * 13 - (15 * 16)$$

The solution is -224.643, which is option B.

A. $[255.97, 262.97]$

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

B. $[-229.64, -221.64]$

* -224.643, which is the correct option.

C. $[1.71, 9.71]$

5.714, which corresponds to not distributing a negative correctly.

D. $[-222.03, -214.03]$

-220.027, 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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7. Choose the **smallest** set of Real numbers that the number below belongs to.

$$\sqrt{\frac{289}{100}}$$

The solution is Rational, which is option D.

A. Irrational

These cannot be written as a fraction of Integers.

B. Whole

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

C. Integer

These are the negative and positive counting numbers (..., -3, -2, -1, 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 $\frac{17}{10}$.

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

$$\frac{4}{-19} + 81i^2$$

The solution is Rational, which is option B.

A. Pure Imaginary

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

B. Rational

* This is the correct option!

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

$$14 - 7^2 + 3 \div 16 * 12 \div 15$$

The solution is -34.850, which is option B.

A. $[62.94, 63.1]$

63.001, which corresponds to two Order of Operations errors.

B. $[-34.94, -34.81]$

* -34.850, this is the correct option

C. $[-35.04, -34.93]$

-34.999, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

D. $[63.02, 63.36]$

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

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

$$(-3 - 7i)(4 - 8i)$$

The solution is $-68 - 4i$, which is option E.

A. $a \in [44, 47]$ and $b \in [50, 55]$

$44 + 52i$, which corresponds to adding a minus sign in the first term.

B. $a \in [-17, -11]$ and $b \in [54, 57]$

$-12+56i$, 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.

C. $a \in [44, 47]$ and $b \in [-55, -51]$

$44 - 52i$, which corresponds to adding a minus sign in the second term.

D. $a \in [-71, -66]$ and $b \in [4, 5]$

$-68 + 4i$, which corresponds to adding a minus sign in both terms.

E. $a \in [-71, -66]$ and $b \in [-5, 2]$

* $-68 - 4i$, 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.
