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 and choose the interval the simplification is contained within.

$$12 - 3^2 + 10 \div 8 * 14 \div 18$$

The solution is 3.972, which is option D.

A. $[19.97, 21.49]$

21.005, which corresponds to two Order of Operations errors.

B. $[2.65, 3.16]$

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

C. $[21.43, 22.28]$

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

D. $[3.82, 5.19]$

* 3.972, this 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.

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

$$\sqrt{\frac{193600}{400}}$$

The solution is Whole, which is option A.

A. Whole

* This is the correct option!

B. Not a Real number

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

C. Integer

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

D. Irrational

These cannot be written as a fraction of Integers.

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 440.

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

$$(-6 - 7i)(8 + 9i)$$

The solution is $15 - 110i$, which is option A.

A. $a \in [13, 20]$ and $b \in [-113, -107]$

* $15 - 110i$, which is the correct option.

B. $a \in [-50, -43]$ and $b \in [-65, -57]$

$-48 - 63i$, 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. $a \in [13, 20]$ and $b \in [106, 113]$

$15 + 110i$, which corresponds to adding a minus sign in both terms.

D. $a \in [-117, -108]$ and $b \in [-2, 0]$

$-111 - 2i$, which corresponds to adding a minus sign in the second term.

E. $a \in [-117, -108]$ and $b \in [1, 11]$

$-111 + 2i$, 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.

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

$$-\sqrt{\frac{1872}{9}} + 8i^2$$

The solution is Irrational, which is option A.

A. Irrational

* This is the correct option!

B. Nonreal Complex

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

C. Pure Imaginary

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

D. Rational

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

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.

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

$$\sqrt{\frac{43264}{256}}$$

The solution is Whole, which is option B.

A. Not a Real number

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

B. Whole

* This is the correct option!

C. Integer

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

D. Rational

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

E. Irrational

These cannot be written as a fraction of Integers.

General Comment: First, you **NEED** to simplify the expression. This question simplifies to 208.

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.

$$\frac{9 + 66i}{4 + 2i}$$

The solution is $8.40 + 12.30i$, which is option B.

A. $a \in [-6, -4.5]$ and $b \in [13, 14.5]$

$-4.80 + 14.10i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

B. $a \in [8, 10.5]$ and $b \in [12, 13]$

* $8.40 + 12.30i$, which is the correct option.

C. $a \in [167.5, 168.5]$ and $b \in [12, 13]$

$168.00 + 12.30i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

D. $a \in [8, 10.5]$ and $b \in [245.5, 247]$

$8.40 + 246.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

E. $a \in [1, 2.5]$ and $b \in [32, 33.5]$

$2.25 + 33.00i$, 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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7. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{-63 - 88i}{-3 + 5i}$$

The solution is $-7.38 + 17.03i$, which is option A.

A. $a \in [-8, -6]$ and $b \in [16.5, 17.5]$

* $-7.38 + 17.03i$, which is the correct option.

B. $a \in [16.5, 19]$ and $b \in [-2, 0.5]$

$18.50 - 1.50i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

C. $a \in [-251.5, -250]$ and $b \in [16.5, 17.5]$

$-251.00 + 17.03i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

D. $a \in [20, 21.5]$ and $b \in [-18.5, -17]$

$21.00 - 17.60i$, which corresponds to just dividing the first term by the first term and the second by the second.

E. $a \in [-8, -6]$ and $b \in [578.5, 579.5]$

$-7.38 + 579.00i$, 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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8. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(6 - 5i)(-2 + 4i)$$

The solution is $8 + 34i$, which is option A.

A. $a \in [7, 13]$ and $b \in [32, 37]$

* $8 + 34i$, which is the correct option.

B. $a \in [-33, -29]$ and $b \in [8, 16]$

$-32 + 14i$, which corresponds to adding a minus sign in the first term.

C. $a \in [-33, -29]$ and $b \in [-17, -13]$

$-32 - 14i$, which corresponds to adding a minus sign in the second term.

D. $a \in [7, 13]$ and $b \in [-38, -32]$

$8 - 34i$, which corresponds to adding a minus sign in both terms.

E. $a \in [-14, -7]$ and $b \in [-26, -17]$

$-12 - 20i$, 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.

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

$$-\sqrt{\frac{1404}{12}} + 2i^2$$

The solution is Irrational, which is option D.

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. Nonreal Complex

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

D. Irrational

* This is the correct option!

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.

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

$$20 - 15 \div 3 * 14 - (2 * 11)$$

The solution is -72.000, which is option B.

A. $[-576, -570]$

-572.000, which corresponds to not distributing a negative correctly.

B. $[-76, -68]$

* -72.000, which is the correct option.

C. $[-4.36, 2.64]$

-2.357, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

D. $[40.64, 42.64]$

41.643, which corresponds to not distributing addition and subtraction 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.
