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.

$$-\sqrt{\frac{250000}{625}}$$

The solution is Integer, which is option E.

A. Rational

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

B. Not a Real number

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

C. Whole

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

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 -500.

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 and choose the interval the simplification is contained within.

$$14 - 5 \div 15 * 20 - (19 * 9)$$

The solution is -163.667, which is option B.

A. $[-159.02, -153.02]$

-157.017, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

B. $[-167.67, -159.67]$

* -163.667, which is the correct option.

C. $[-105, -104]$

-105.000, which corresponds to not distributing a negative correctly.

D. $[184.98, 185.98]$

184.983, 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.

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

$$\sqrt{\frac{32400}{81}}$$

The solution is Whole, which is option A.

A. Whole

* This is the correct option!

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. Integer

These are the negative and positive counting numbers (..., -3, -2, -1, 0, 1, 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 180.

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

$$\frac{-63 + 11i}{3 - 5i}$$

The solution is $-7.18 - 8.29i$, which is option D.

A. $a \in [-22, -20.5]$ and $b \in [-2.5, -0.5]$

$-21.00 - 2.20i$, which corresponds to just dividing the first term by the first term and the second by the second.

B. $a \in [-5, -3]$ and $b \in [9.5, 11]$

$-3.94 + 10.24i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

C. $a \in [-7.5, -7]$ and $b \in [-282.5, -281]$

$-7.18 - 282.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

D. $a \in [-7.5, -7]$ and $b \in [-10, -7]$

* $-7.18 - 8.29i$, which is the correct option.

E. $a \in [-245.5, -243]$ and $b \in [-10, -7]$

$-244.00 - 8.29i$, 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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5. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{27 + 44i}{6 - 2i}$$

The solution is $1.85 + 7.95i$, which is option E.

A. $a \in [73, 74.5]$ and $b \in [7, 8.5]$

$74.00 + 7.95i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

B. $a \in [5.5, 7]$ and $b \in [3.5, 6.5]$

$6.25 + 5.25i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

C. $a \in [0.5, 2.5]$ and $b \in [317.5, 319.5]$

$1.85 + 318.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

D. $a \in [3, 5]$ and $b \in [-22.5, -20.5]$

$4.50 - 22.00i$, which corresponds to just dividing the first term by the first term and the second by the second.

E. $a \in [0.5, 2.5]$ and $b \in [7, 8.5]$

* $1.85 + 7.95i$, 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 $2 - 3i$.

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

$$8 - 1^2 + 12 \div 15 * 18 \div 14$$

The solution is 8.029, which is option A.

A. $[7.42, 8.89]$

* 8.029, this is the correct option

B. $[8.79, 9.57]$

9.003, which corresponds to two Order of Operations errors.

C. $[6.4, 7.59]$

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

D. $[9.85, 10.53]$

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

$$\frac{\sqrt{221}}{10} + \sqrt{-5}i$$

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

$$(5 - 9i)(-7 + 10i)$$

The solution is $55 + 113i$, which is option D.

A. $a \in [54, 61]$ and $b \in [-119, -111]$

$55 - 113i$, which corresponds to adding a minus sign in both terms.

B. $a \in [-128, -122]$ and $b \in [11, 19]$

$-125 + 13i$, which corresponds to adding a minus sign in the second term.

C. $a \in [-128, -122]$ and $b \in [-13, -7]$

$-125 - 13i$, which corresponds to adding a minus sign in the first term.

D. $a \in [54, 61]$ and $b \in [106, 114]$

* $55 + 113i$, which is the correct option.

E. $a \in [-38, -33]$ and $b \in [-93, -85]$

$-35 - 90i$, 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.

$$\sqrt{\frac{-720}{0}}i + \sqrt{208}i$$

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

A. Rational

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

B. Nonreal Complex

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

C. Irrational

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

D. Not a Complex Number

* This is the correct option!

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

$$(-2 - 9i)(-4 + 8i)$$

The solution is $80 + 20i$, which is option A.

A. $a \in [76, 85]$ and $b \in [10, 22]$

* $80 + 20i$, which is the correct option.

B. $a \in [-64, -61]$ and $b \in [48, 56]$

$-64 + 52i$, which corresponds to adding a minus sign in the second term.

C. $a \in [76, 85]$ and $b \in [-23, -13]$

$80 - 20i$, which corresponds to adding a minus sign in both terms.

D. $a \in [3, 14]$ and $b \in [-76, -70]$

$8 - 72i$, 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. $a \in [-64, -61]$ and $b \in [-52, -47]$

$-64 - 52i$, 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.
