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.

$$-\sqrt{\frac{82944}{144}}$$

The solution is Integer, which is option B.

A. Irrational

These cannot be written as a fraction of Integers.

B. Integer

* This is the correct option!

C. Whole

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

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 -288.

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

$$-\sqrt{\frac{15}{0}}$$

The solution is Not a Real number, which is option B.

A. Integer

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

B. Not a Real number

* This is the correct option!

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. 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 $-\sqrt{\frac{15}{0}}$.

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 and choose the interval the simplification is contained within.

$$6 - 9^2 + 18 \div 15 * 3 \div 13$$

The solution is -74.723, which is option A.

A. $[-74.84, -74.52]$

* -74.723, this is the correct option

B. $[-75.27, -74.92]$

-74.969, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

C. $[86.83, 87.11]$

87.031, which corresponds to two Order of Operations errors.

D. $[87.21, 87.35]$

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

$$\sqrt{\frac{441}{7}} + \sqrt{132}i$$

The solution is Nonreal Complex, 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. Pure Imaginary

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

C. Nonreal Complex

* This is the correct option!

D. Rational

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

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

$$\frac{72 - 77i}{6 + 5i}$$

The solution is $0.77 - 13.48i$, which is option D.

A. $a \in [13.15, 13.5]$ and $b \in [-2, -1.5]$

$13.39 - 1.67i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

B. $a \in [46.45, 47.25]$ and $b \in [-14.5, -12.5]$

$47.00 - 13.48i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

C. $a \in [0.55, 1.05]$ and $b \in [-822.5, -821]$

$0.77 - 822.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

D. $a \in [0.55, 1.05]$ and $b \in [-14.5, -12.5]$

* $0.77 - 13.48i$, which is the correct option.

E. $a \in [11.4, 12.45]$ and $b \in [-17, -14.5]$

$12.00 - 15.40i$, 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 into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(7 + 10i)(-4 - 2i)$$

The solution is $-8 - 54i$, which is option B.

A. $a \in [-12, -3]$ and $b \in [49, 59]$

$-8 + 54i$, which corresponds to adding a minus sign in both terms.

B. $a \in [-12, -3]$ and $b \in [-60, -51]$

* $-8 - 54i$, which is the correct option.

C. $a \in [-48, -43]$ and $b \in [26, 27]$

$-48 + 26i$, which corresponds to adding a minus sign in the first term.

D. $a \in [-32, -25]$ and $b \in [-20, -19]$

$-28 - 20i$, 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.

E. $a \in [-48, -43]$ and $b \in [-31, -23]$

$-48 - 26i$, 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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7. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{72 - 11i}{-4 + 5i}$$

The solution is $-8.37 - 7.71i$, which is option E.

A. $a \in [-343.5, -341.5]$ and $b \in [-8, -7.5]$

$-343.00 - 7.71i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

B. $a \in [-18.5, -16.5]$ and $b \in [-2.5, -2]$

$-18.00 - 2.20i$, which corresponds to just dividing the first term by the first term and the second by the second.

C. $a \in [-7, -5]$ and $b \in [8.5, 11]$

$-5.68 + 9.85i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

D. $a \in [-9, -7]$ and $b \in [-316.5, -315.5]$

$-8.37 - 316.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

E. $a \in [-9, -7]$ and $b \in [-8, -7.5]$

* $-8.37 - 7.71i$, 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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8. Simplify the expression below and choose the interval the simplification is contained within.

$$7 - 18 \div 4 * 11 - (12 * 15)$$

The solution is -222.500, which is option D.

A. $[-177.41, -171.41]$

-173.409, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

B. $[184.59, 193.59]$

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

C. $[-821.5, -808.5]$

-817.500, which corresponds to not distributing a negative correctly.

D. $[-223.5, -221.5]$

* -222.500, which 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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9. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\frac{0}{9\pi} + \sqrt{10}i$$

The solution is Pure Imaginary, which is option E.

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. Irrational

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

C. Nonreal Complex

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

D. Rational

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

E. Pure Imaginary

* 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.

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

$$(4 - 9i)(8 - 3i)$$

The solution is $5 - 84i$, which is option C.

A. $a \in [4, 8]$ and $b \in [80, 85]$

$5 + 84i$, which corresponds to adding a minus sign in both terms.

B. $a \in [25, 37]$ and $b \in [25, 31]$

$32 + 27i$, 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. $a \in [4, 8]$ and $b \in [-88, -81]$

* $5 - 84i$, which is the correct option.

D. $a \in [56, 63]$ and $b \in [56, 67]$

$59 + 60i$, which corresponds to adding a minus sign in the first term.

E. $a \in [56, 63]$ and $b \in [-64, -53]$

$59 - 60i$, 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.
