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.

$$17 - 16 \div 15 * 9 - (6 * 20)$$

The solution is -112.600, which is option D.

A. $[-110.12, -97.12]$

-103.119, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

B. $[27, 31]$

28.000, which corresponds to not distributing a negative correctly.

C. $[136.88, 141.88]$

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

D. $[-117.6, -110.6]$

* -112.600, 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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2. Choose the **smallest** set of Real numbers that the number below belongs to.

$$\sqrt{\frac{74529}{441}}$$

The solution is Whole, which is option E.

A. Not a Real number

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

B. Irrational

These cannot be written as a fraction of Integers.

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. Whole

* This is the correct option!

General Comment: First, you **NEED** to simplify the expression. This question simplifies to 273.

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.

$$(3 + 8i)(2 + 5i)$$

The solution is $-34 + 31i$, which is option A.

A. $a \in [-38, -29]$ and $b \in [29.6, 33.4]$

* $-34 + 31i$, which is the correct option.

B. $a \in [46, 47]$ and $b \in [-1.1, 0.5]$

$46 - i$, which corresponds to adding a minus sign in the first term.

C. $a \in [5, 8]$ and $b \in [38, 41]$

$6 + 40i$, 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. $a \in [-38, -29]$ and $b \in [-32.6, -30.4]$

$-34 - 31i$, which corresponds to adding a minus sign in both terms.

E. $a \in [46, 47]$ and $b \in [-0.1, 6.2]$

$46 + i$, 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 Real numbers that the number below belongs to.

$$-\sqrt{\frac{484}{81}}$$

The solution is Rational, which is option B.

A. Integer

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

B. Rational

* 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. 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 $-\frac{22}{9}$.

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

$$3 - 11 \div 16 * 15 - (10 * 19)$$

The solution is -197.312, which is option D.

A. $[190.95, 194.95]$

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

B. $[-190.05, -181.05]$

-187.046, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

C. $[-330.94, -325.94]$

-328.938, which corresponds to not distributing a negative correctly.

D. $[-200.31, -190.31]$

* -197.312, 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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6. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\frac{0}{-8\pi} + \sqrt{6}i$$

The solution is Pure Imaginary, which is option A.

A. Pure Imaginary

* This is the correct option!

B. Rational

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

C. Nonreal Complex

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

D. Irrational

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

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

$$(6 + 10i)(-9 + 2i)$$

The solution is $-74 - 78i$, which is option E.

A. $a \in [-80, -72]$ and $b \in [78, 82]$

$-74 + 78i$, which corresponds to adding a minus sign in both terms.

B. $a \in [-58, -50]$ and $b \in [20, 25]$

$-54 + 20i$, 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.

C. $a \in [-36, -31]$ and $b \in [102, 105]$

$-34 + 102i$, which corresponds to adding a minus sign in the first term.

D. $a \in [-36, -31]$ and $b \in [-103, -98]$

$-34 - 102i$, which corresponds to adding a minus sign in the second term.

E. $a \in [-80, -72]$ and $b \in [-82, -77]$

* $-74 - 78i$, 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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8. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{-9 - 44i}{-2 - 7i}$$

The solution is $6.15 + 0.47i$, which is option B.

A. $a \in [5.5, 6.5]$ and $b \in [24, 26]$

$6.15 + 25.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

B. $a \in [5.5, 6.5]$ and $b \in [0, 2]$

* $6.15 + 0.47i$, which is the correct option.

C. $a \in [-6, -4.5]$ and $b \in [2, 4]$

$-5.47 + 2.85i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

D. $a \in [4, 5.5]$ and $b \in [5.5, 7.5]$

$4.50 + 6.29i$, which corresponds to just dividing the first term by the first term and the second by the second.

E. $a \in [325.5, 326.5]$ and $b \in [0, 2]$

$326.00 + 0.47i$, 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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9. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{0}{36}} + \sqrt{5}i$$

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

$$\frac{45 + 11i}{-3 - 4i}$$

The solution is $-7.16 + 5.88i$, which is option A.

A. $a \in [-7.5, -6.5]$ and $b \in [4.5, 6]$

* $-7.16 + 5.88i$, which is the correct option.

B. $a \in [-180, -178]$ and $b \in [4.5, 6]$

$-179.00 + 5.88i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

C. $a \in [-4, -2.5]$ and $b \in [-10.5, -8]$

$-3.64 - 8.52i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

D. $a \in [-7.5, -6.5]$ and $b \in [145, 148]$

$-7.16 + 147.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

E. $a \in [-16, -14.5]$ and $b \in [-3.5, -2]$

$-15.00 - 2.75i$, 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 $2 - 3i$.