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.

$$6 - 18^2 + 10 \div 13 * 7 \div 20$$

The solution is -317.731, which is option D.

A. $[330.25, 330.46]$

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

B. $[329.72, 330.11]$

330.005, which corresponds to two Order of Operations errors.

C. $[-318.08, -317.95]$

-317.995, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

D. $[-317.81, -317.64]$

* -317.731, 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. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(-6 + 7i)(-2 + 10i)$$

The solution is $-58 - 74i$, which is option A.

A. $a \in [-61, -54]$ and $b \in [-75.5, -71.7]$

* $-58 - 74i$, which is the correct option.

B. $a \in [-61, -54]$ and $b \in [71.7, 76.6]$

$-58 + 74i$, which corresponds to adding a minus sign in both terms.

C. $a \in [79, 83]$ and $b \in [45.2, 48.6]$

$82 + 46i$, which corresponds to adding a minus sign in the second term.

D. $a \in [79, 83]$ and $b \in [-47.3, -44.2]$

$82 - 46i$, which corresponds to adding a minus sign in the first term.

E. $a \in [12, 14]$ and $b \in [68.7, 73.3]$

$12 + 70i$, 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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3. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{640}{8}} + \sqrt{77}i$$

The solution is Nonreal Complex, which is option D.

A. Irrational

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

B. Pure Imaginary

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

C. Rational

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

D. Nonreal Complex

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

$$-\sqrt{\frac{5929}{49}}$$

The solution is Integer, 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. Rational

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

D. Whole

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

E. Integer

* This is the correct option!

General Comment: First, you **NEED** to simplify the expression. This question simplifies to -77.

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

$$\frac{27 - 77i}{2 + 8i}$$

The solution is $-8.26 - 5.44i$, which is option E.

A. $a \in [-563, -561.5]$ and $b \in [-6, -4]$

$-562.00 - 5.44i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

B. $a \in [9, 10.5]$ and $b \in [-0.5, 1]$

$9.85 + 0.91i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

C. $a \in [-9.5, -7.5]$ and $b \in [-370.5, -369.5]$

$-8.26 - 370.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

D. $a \in [12, 14]$ and $b \in [-10, -9]$

$13.50 - 9.62i$, which corresponds to just dividing the first term by the first term and the second by the second.

E. $a \in [-9.5, -7.5]$ and $b \in [-6, -4]$

* $-8.26 - 5.44i$, 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.

$$13 - 2^2 + 7 \div 17 * 16 \div 6$$

The solution is 10.098, which is option D.

A. $[7.73, 9.14]$

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

B. $[16.66, 17.49]$

17.004, which corresponds to two Order of Operations errors.

C. $[17.06, 18.61]$

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

D. $[9.09, 10.8]$

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

$$\sqrt{\frac{-1260}{0}}i + \sqrt{234}i$$

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

A. Pure Imaginary

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

B. Not a Complex Number

* 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. Irrational

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

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

$$-\sqrt{\frac{924}{11}}$$

The solution is Irrational, which is option D.

A. Not a Real number

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

B. Integer

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

C. Rational

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

D. Irrational

* This is the correct option!

E. Whole

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

General Comment: First, you **NEED** to simplify the expression. This question simplifies to $-\sqrt{84}$.

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

$$(2 + 3i)(7 - 10i)$$

The solution is $44 + i$, which is option E.

A. $a \in [6, 18]$ and $b \in [-34, -25]$

$14 - 30i$, 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.

B. $a \in [40, 50]$ and $b \in [-5, 0]$

$44 - i$, which corresponds to adding a minus sign in both terms.

C. $a \in [-17, -14]$ and $b \in [37, 42]$

$-16 + 41i$, which corresponds to adding a minus sign in the second term.

D. $a \in [-17, -14]$ and $b \in [-45, -38]$

$-16 - 41i$, which corresponds to adding a minus sign in the first term.

E. $a \in [40, 50]$ and $b \in [1, 3]$

* $44 + i$, 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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10. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{-54 + 44i}{-8 - 7i}$$

The solution is $1.10 - 6.46i$, which is option E.

A. $a \in [6.7, 7]$ and $b \in [-6.34, -6.04]$

$6.75 - 6.29i$, which corresponds to just dividing the first term by the first term and the second by the second.

B. $a \in [0.25, 1.35]$ and $b \in [-730.31, -729.96]$

$1.10 - 730.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

C. $a \in [123.15, 124.35]$ and $b \in [-6.62, -6.4]$

$124.00 - 6.46i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

D. $a \in [6.35, 6.7]$ and $b \in [0.12, 0.48]$

$6.55 + 0.23i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

E. $a \in [0.25, 1.35]$ and $b \in [-6.62, -6.4]$

* $1.10 - 6.46i$, 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 $2 - 3i$.
