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.

$$\sqrt{\frac{3600}{100}}$$

The solution is Whole, 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. Irrational

These cannot be written as a fraction of Integers.

D. Integer

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

E. Whole

* This is the correct option!

General Comment: First, you **NEED** to simplify the expression. This question simplifies to 60.

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

$$(-6 - 8i)(-4 + 7i)$$

The solution is $80 - 10i$, which is option C.

A. $a \in [-33, -24]$ and $b \in [74, 75]$

$-32 + 74i$, which corresponds to adding a minus sign in the second term.

B. $a \in [18, 26]$ and $b \in [-57, -55]$

$24 - 56i$, 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. $a \in [80, 82]$ and $b \in [-10, -7]$

* $80 - 10i$, which is the correct option.

D. $a \in [-33, -24]$ and $b \in [-79, -73]$

$-32 - 74i$, which corresponds to adding a minus sign in the first term.

E. $a \in [80, 82]$ and $b \in [8, 11]$

$80 + 10i$, which corresponds to adding a minus sign in both terms.

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

$$\frac{63 - 66i}{-5 - 3i}$$

The solution is $-3.44 + 15.26i$, which is option D.

A. $a \in [-14, -12]$ and $b \in [21, 22.5]$

$-12.60 + 22.00i$, which corresponds to just dividing the first term by the first term and the second by the second.

B. $a \in [-5.5, -2.5]$ and $b \in [517.5, 520]$

$-3.44 + 519.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

C. $a \in [-16.5, -14]$ and $b \in [3, 5]$

$-15.09 + 4.15i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

D. $a \in [-5.5, -2.5]$ and $b \in [14, 16.5]$

* $-3.44 + 15.26i$, which is the correct option.

E. $a \in [-117.5, -116]$ and $b \in [14, 16.5]$

$-117.00 + 15.26i$, 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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4. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{3120}{15}} + \sqrt{154}i$$

The solution is Nonreal Complex, 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. Rational

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

D. Pure Imaginary

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

E. Nonreal Complex

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

$$\frac{45 + 22i}{-1 + 3i}$$

The solution is $2.10 - 15.70i$, which is option A.

A. $a \in [1.5, 3.5]$ and $b \in [-16, -14.5]$

* $2.10 - 15.70i$, which is the correct option.

B. $a \in [-12, -10]$ and $b \in [10.5, 12]$

$-11.10 + 11.30i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

C. $a \in [-45.5, -44]$ and $b \in [6.5, 8]$

$-45.00 + 7.33i$, which corresponds to just dividing the first term by the first term and the second by the second.

D. $a \in [1.5, 3.5]$ and $b \in [-157.5, -156.5]$

$2.10 - 157.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

E. $a \in [20, 21.5]$ and $b \in [-16, -14.5]$

$21.00 - 15.70i$, 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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6. Simplify the expression below and choose the interval the simplification is contained within.

$$6 - 7 \div 5 * 14 - (1 * 19)$$

The solution is -32.600, which is option D.

A. $[-13.1, -9.1]$

-13.100, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

B. $[24.9, 25.9]$

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

C. $[-277.4, -274.4]$

-277.400, which corresponds to not distributing a negative correctly.

D. $[-33.6, -27.6]$

* -32.600, 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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7. Choose the **smallest** set of Real numbers that the number below belongs to.

$$-\sqrt{\frac{41616}{289}}$$

The solution is Integer, which is option E.

A. Whole

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

B. Irrational

These cannot be written as a fraction of Integers.

C. Not a Real number

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

D. Rational

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

E. Integer

* This is the correct option!

General Comment: First, you **NEED** to simplify the expression. This question simplifies to -204.

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

$$\frac{\sqrt{182}}{19} + \sqrt{-4}i$$

The solution is Irrational, 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. 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. Pure Imaginary

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

E. Irrational

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

$$9 - 10^2 + 6 \div 5 * 7 \div 2$$

The solution is -86.800, which is option A.

A. $[-87.8, -84.8]$

* -86.800, this is the correct option

B. $[-93.91, -88.91]$

-90.914, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

C. $[108.09, 112.09]$

109.086, which corresponds to two Order of Operations errors.

D. $[113.2, 122.2]$

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

$$(-4 + 3i)(-5 - 9i)$$

The solution is $47 + 21i$, which is option A.

A. $a \in [47, 48]$ and $b \in [18, 28]$

* $47 + 21i$, which is the correct option.

B. $a \in [-17, -3]$ and $b \in [-58, -49]$

$-7 - 51i$, which corresponds to adding a minus sign in the second term.

C. $a \in [47, 48]$ and $b \in [-23, -15]$

$47 - 21i$, which corresponds to adding a minus sign in both terms.

D. $a \in [17, 27]$ and $b \in [-28, -26]$

$20 - 27i$, 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.

E. $a \in [-17, -3]$ and $b \in [47, 54]$

$-7 + 51i$, 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.
