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

$$(2 - 4i)(7 - 8i)$$

The solution is $-18 - 44i$, which is option E.

A. $a \in [45, 47]$ and $b \in [8, 20]$

$46 + 12i$, which corresponds to adding a minus sign in the first term.

B. $a \in [45, 47]$ and $b \in [-14, -5]$

$46 - 12i$, which corresponds to adding a minus sign in the second term.

C. $a \in [-21, -9]$ and $b \in [43, 50]$

$-18 + 44i$, which corresponds to adding a minus sign in both terms.

D. $a \in [12, 15]$ and $b \in [32, 37]$

$14 + 32i$, 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. $a \in [-21, -9]$ and $b \in [-48, -39]$

* $-18 - 44i$, 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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2. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{-616}{8}} + \sqrt{0}i$$

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. Rational

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

C. Irrational

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

D. Nonreal Complex

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

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

$$11 - 2 \div 10 * 7 - (5 * 13)$$

The solution is -55.400, which is option D.

A. $[-54.1, -53.3]$

-54.029, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

B. $[74.4, 76.3]$

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

C. $[59.4, 61.1]$

59.800, which corresponds to not distributing a negative correctly.

D. $[-57.9, -54.9]$

* -55.400, 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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4. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$-\sqrt{\frac{1638}{14}} + 5i^2$$

The solution is Irrational, which is option E.

A. Rational

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

B. 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!

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

$$-\sqrt{\frac{529}{625}}$$

The solution is Rational, 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. Whole

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

D. Integer

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

E. Rational

* This is the correct option!

General Comment: First, you **NEED** to simplify the expression. This question simplifies to $-\frac{23}{25}$.

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

$$\sqrt{\frac{100}{81}}$$

The solution is Rational, which is option C.

A. Not a Real number

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

B. Whole

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

C. Rational

* This is the correct option!

D. Irrational

These cannot be written as a fraction of Integers.

E. Integer

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

General Comment: First, you **NEED** to simplify the expression. This question simplifies to $\frac{10}{9}$.

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

$$\frac{27 - 22i}{5 + i}$$

The solution is $4.35 - 5.27i$, which is option D.

A. $a \in [3.95, 4.5]$ and $b \in [-138, -135.5]$

$4.35 - 137.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

B. $a \in [112.05, 113.3]$ and $b \in [-6.5, -4.5]$

$113.00 - 5.27i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

C. $a \in [6, 6.65]$ and $b \in [-4, -2]$

$6.04 - 3.19i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

D. $a \in [3.95, 4.5]$ and $b \in [-6.5, -4.5]$

* $4.35 - 5.27i$, which is the correct option.

E. $a \in [5.15, 5.9]$ and $b \in [-23, -20.5]$

$5.40 - 22.00i$, 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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8. Simplify the expression below and choose the interval the simplification is contained within.

$$12 - 18 \div 6 * 20 - (5 * 16)$$

The solution is -128.000, which is option D.

A. $[-68.15, -66.15]$

-68.150, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

B. $[88.85, 96.85]$

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

C. $[-849, -836]$

-848.000, which corresponds to not distributing a negative correctly.

D. $[-131, -125]$

* -128.000, 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. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{45 + 44i}{-2 + 3i}$$

The solution is $3.23 - 17.15i$, which is option B.

A. $a \in [-23, -20.5]$ and $b \in [14.5, 16]$

$-22.50 + 14.67i$, which corresponds to just dividing the first term by the first term and the second by the second.

B. $a \in [3, 4]$ and $b \in [-18, -16.5]$

* $3.23 - 17.15i$, which is the correct option.

C. $a \in [3, 4]$ and $b \in [-223.5, -222]$

$3.23 - 223.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

D. $a \in [41, 43.5]$ and $b \in [-18, -16.5]$

$42.00 - 17.15i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

E. $a \in [-18, -15.5]$ and $b \in [2.5, 4]$

$-17.08 + 3.62i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

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

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

The solution is $25 - 125i$, which is option D.

A. $a \in [-46, -44]$ and $b \in [-75, -68]$

$-45 - 70i$, 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.

B. $a \in [19, 28]$ and $b \in [123, 130]$

$25 + 125i$, which corresponds to adding a minus sign in both terms.

C. $a \in [-117, -109]$ and $b \in [52, 60]$

$-115 + 55i$, which corresponds to adding a minus sign in the first term.

D. $a \in [19, 28]$ and $b \in [-126, -122]$

* $25 - 125i$, which is the correct option.

E. $a \in [-117, -109]$ and $b \in [-56, -46]$

$-115 - 55i$, 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.
