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.

$$\sqrt{\frac{78400}{400}}$$

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. Integer

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

C. Irrational

These cannot be written as a fraction of Integers.

D. Not a Real number

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

E. Whole

* This is the correct option!

General Comment: First, you **NEED** to simplify the expression. This question simplifies to 280.

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.

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

The solution is $-76 - i$, which is option E.

A. $a \in [-74, -69]$ and $b \in [5.7, 6.6]$

$-70 + 6i$, 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. $a \in [-80, -75]$ and $b \in [0.8, 1.2]$

$-76 + i$, which corresponds to adding a minus sign in both terms.

C. $a \in [-67, -60]$ and $b \in [39.9, 41.6]$

$-64 + 41i$, which corresponds to adding a minus sign in the second term.

D. $a \in [-67, -60]$ and $b \in [-41.8, -39.7]$

$-64 - 41i$, which corresponds to adding a minus sign in the first term.

E. $a \in [-80, -75]$ and $b \in [-1.1, 0.5]$

* $-76 - i$, 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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3. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{-54 + 11i}{-7 - 3i}$$

The solution is $5.95 - 4.12i$, which is option C.

A. $a \in [344.6, 345.3]$ and $b \in [-4.27, -4.02]$

$345.00 - 4.12i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

B. $a \in [7.55, 8.5]$ and $b \in [-3.81, -3.6]$

$7.71 - 3.67i$, which corresponds to just dividing the first term by the first term and the second by the second.

C. $a \in [5.45, 6.45]$ and $b \in [-4.27, -4.02]$

* $5.95 - 4.12i$, which is the correct option.

D. $a \in [5.45, 6.45]$ and $b \in [-239.1, -238.97]$

$5.95 - 239.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

E. $a \in [6.65, 7.15]$ and $b \in [1.43, 1.6]$

$7.09 + 1.47i$, 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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4. Simplify the expression below and choose the interval the simplification is contained within.

$$12 - 3 \div 8 * 20 - (4 * 13)$$

The solution is -47.500, which is option A.

A. $[-48.5, -45.5]$

* -47.500, which is the correct option.

B. $[3.5, 8.5]$

6.500, which corresponds to not distributing a negative correctly.

C. $[-41.02, -35.02]$

-40.019, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

D. $[60.98, 64.98]$

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

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

$$-\sqrt{\frac{400}{289}} + 25i^2$$

The solution is Rational, which is option E.

A. Irrational

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

B. Nonreal Complex

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

C. 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!

D. Pure Imaginary

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

E. Rational

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

$$\frac{18 - 77i}{-5 - i}$$

The solution is $-0.50 + 15.50i$, which is option E.

A. $a \in [-6.5, -5.5]$ and $b \in [13.5, 15]$

$-6.42 + 14.12i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

B. $a \in [-5.5, -2]$ and $b \in [76, 78.5]$

$-3.60 + 77.00i$, which corresponds to just dividing the first term by the first term and the second by the second.

C. $a \in [-1.5, 0.5]$ and $b \in [402, 403.5]$

$-0.50 + 403.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

D. $a \in [-13.5, -12.5]$ and $b \in [15, 17]$

$-13.00 + 15.50i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

E. $a \in [-1.5, 0.5]$ and $b \in [15, 17]$

* $-0.50 + 15.50i$, 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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7. Choose the **smallest** set of Real numbers that the number below belongs to.

$$\sqrt{\frac{32400}{81}}$$

The solution is Whole, which is option A.

A. Whole

* This is the correct option!

B. Rational

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

C. Integer

These are the negative and positive counting numbers (..., -3, -2, -1, 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 180.

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

$$(-4 - 5i)(-7 - 6i)$$

The solution is $-2 + 59i$, which is option A.

A. $a \in [-2, -1]$ and $b \in [57, 62]$

* $-2 + 59i$, which is the correct option.

B. $a \in [-2, -1]$ and $b \in [-60, -57]$

$-2 - 59i$, which corresponds to adding a minus sign in both terms.

C. $a \in [57, 63]$ and $b \in [-12, -1]$

$58 - 11i$, which corresponds to adding a minus sign in the first term.

D. $a \in [57, 63]$ and $b \in [8, 16]$

$58 + 11i$, which corresponds to adding a minus sign in the second term.

E. $a \in [25, 34]$ and $b \in [29, 35]$

$28 + 30i$, 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.

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

$$\sqrt{\frac{121}{0}} + \sqrt{117}i$$

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

A. Pure Imaginary

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

B. Nonreal Complex

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

C. Rational

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

D. Irrational

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

E. Not a Complex Number

* 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 and choose the interval the simplification is contained within.

$$4 - 8^2 + 14 \div 13 * 19 \div 6$$

The solution is -56.590, which is option D.

A. $[71.41, 76.41]$

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

B. $[-61.99, -56.99]$

-59.991, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

C. $[64.01, 70.01]$

68.009, which corresponds to two Order of Operations errors.

D. $[-58.59, -53.59]$

* -56.590, 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.
