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.

---

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

$$\frac{36 + 66i}{-2 - i}$$

The solution is $-27.60 - 19.20i$, which is option B.

A. $a \in [-140, -137.5]$ and $b \in [-21, -19]$

$-138.00 - 19.20i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

B. $a \in [-28, -27]$ and $b \in [-21, -19]$

* $-27.60 - 19.20i$, which is the correct option.

C. $a \in [-28, -27]$ and $b \in [-97, -94.5]$

$-27.60 - 96.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

D. $a \in [-1.5, -0.5]$ and $b \in [-35, -33.5]$

$-1.20 - 33.60i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

E. $a \in [-18.5, -17.5]$ and $b \in [-67.5, -65]$

$-18.00 - 66.00i$, 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 $2 - 3i$.

---

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

$$(-10 - 2i)(-5 - 8i)$$

The solution is $34 + 90i$, which is option C.

A. $a \in [49, 52]$ and $b \in [15, 18]$

$50 + 16i$, 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. $a \in [31, 38]$ and $b \in [-98, -88]$

$34 - 90i$, which corresponds to adding a minus sign in both terms.

C. $a \in [31, 38]$ and $b \in [89, 94]$

* $34 + 90i$, which is the correct option.

D. $a \in [63, 71]$ and $b \in [69, 74]$

$66 + 70i$, which corresponds to adding a minus sign in the first term.

E. $a \in [63, 71]$ and $b \in [-71, -68]$

$66 - 70i$, 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.

---

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

$$4 - 5 \div 8 * 11 - (16 * 12)$$

The solution is -194.875, which is option A.

A. $[-197.88, -188.88]$

* -194.875, which is the correct option.

B. $[191.94, 199.94]$

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

C. $[-191.06, -183.06]$

-188.057, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

D. $[-228.5, -222.5]$

-226.500, which corresponds to not distributing a negative 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.

---

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

$$\frac{-20}{-9} + \sqrt{-16}i$$

The solution is Rational, which is option C.

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

* This is the correct option!

D. Nonreal Complex

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

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.

---

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

$$\frac{54 + 11i}{-2 - 3i}$$

The solution is $-10.85 + 10.77i$, which is option B.

A. $a \in [-6.5, -5]$ and $b \in [-14.5, -12]$

$-5.77 - 14.15i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

B. $a \in [-11, -10.5]$ and $b \in [10, 12.5]$

* $-10.85 + 10.77i$, which is the correct option.

C. $a \in [-142, -140]$ and $b \in [10, 12.5]$

$-141.00 + 10.77i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

D. $a \in [-11, -10.5]$ and $b \in [139.5, 140.5]$

$-10.85 + 140.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

E. $a \in [-28, -25.5]$ and $b \in [-4.5, -2.5]$

$-27.00 - 3.67i$, 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 $2 - 3i$.

---

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

$$\sqrt{\frac{1638}{0}} + \sqrt{176}i$$

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

A. Rational

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

B. Irrational

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

C. Not a Complex Number

* This is the correct option!

D. Pure Imaginary

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

E. Nonreal Complex

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

---

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

$$(10 - 5i)(-4 + 3i)$$

The solution is $-25 + 50i$, which is option B.

A. $a \in [-28, -22]$ and $b \in [-52, -49]$

$-25 - 50i$, which corresponds to adding a minus sign in both terms.

B. $a \in [-28, -22]$ and $b \in [49, 54]$

* $-25 + 50i$, which is the correct option.

C. $a \in [-55, -54]$ and $b \in [-12, -9]$

$-55 - 10i$, which corresponds to adding a minus sign in the second term.

D. $a \in [-55, -54]$ and $b \in [9, 11]$

$-55 + 10i$, which corresponds to adding a minus sign in the first term.

E. $a \in [-44, -36]$ and $b \in [-15, -13]$

$-40 - 15i$, 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.

---

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

$$\sqrt{\frac{7}{0}}$$

The solution is Not a Real number, which is option E.

A. Integer

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

B. Whole

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

C. Irrational

These cannot be written as a fraction of Integers.

D. Rational

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

E. Not a Real number

* This is the correct option!

General Comment: First, you **NEED** to simplify the expression. This question simplifies to $\sqrt{\frac{7}{0}}$.

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.

---

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

$$\sqrt{\frac{144400}{400}}$$

The solution is Whole, which is option E.

A. Integer

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

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. 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 380.

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.

---

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

$$16 - 18 \div 10 * 3 - (5 * 19)$$

The solution is -84.400, which is option B.

A. $[104.4, 109.4]$

106.400, which corresponds to not distributing a negative correctly.

B. $[-84.4, -81.4]$

* -84.400, which is the correct option.

C. $[-81.6, -77.6]$

-79.600, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

D. $[108.4, 112.4]$

110.400, 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.
