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

$$-\sqrt{\frac{1848}{12}}$$

The solution is Irrational, which is option A.

A. Irrational

* This is the correct option!

B. Integer

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

C. Not a Real number

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

D. Whole

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

E. Rational

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

General Comment: First, you **NEED** to simplify the expression. This question simplifies to $-\sqrt{154}$.

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.

---

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

$$(-8 - 9i)(-10 - 7i)$$

The solution is $17 + 146i$, which is option A.

A. $a \in [10, 22]$ and $b \in [143, 147]$

* $17 + 146i$, which is the correct option.

B. $a \in [10, 22]$ and $b \in [-149, -142]$

$17 - 146i$, which corresponds to adding a minus sign in both terms.

C. $a \in [143, 146]$ and $b \in [-34, -33]$

$143 - 34i$, which corresponds to adding a minus sign in the first term.

D. $a \in [79, 81]$ and $b \in [61, 66]$

$80 + 63i$, 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. $a \in [143, 146]$ and $b \in [26, 36]$

$143 + 34i$, 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. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{720}{9}} + 9i^2$$

The solution is Irrational, which is option B.

A. Rational

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

B. Irrational

* 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. 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!

E. Pure Imaginary

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

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.

---

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

$$\frac{27 + 44i}{8 - 7i}$$

The solution is $-0.81 + 4.79i$, which is option E.

A. $a \in [-92.5, -91.5]$ and $b \in [3.5, 5]$

$-92.00 + 4.79i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

B. $a \in [4, 5.5]$ and $b \in [0.5, 2]$

$4.64 + 1.44i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

C. $a \in [-1.5, 0.5]$ and $b \in [540.5, 541.5]$

$-0.81 + 541.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

D. $a \in [2.5, 4]$ and $b \in [-7, -6]$

$3.38 - 6.29i$, which corresponds to just dividing the first term by the first term and the second by the second.

E. $a \in [-1.5, 0.5]$ and $b \in [3.5, 5]$

* $-0.81 + 4.79i$, 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 $2 - 3i$.

---

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

$$13 - 12^2 + 20 \div 17 * 19 \div 8$$

The solution is -128.206, which is option C.

A. $[153.3, 158.4]$

157.008, which corresponds to two Order of Operations errors.

B. $[158.3, 161.4]$

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

C. $[-129.3, -128.1]$

* -128.206, this is the correct option

D. $[-133, -130.7]$

-130.992, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

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.

---

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

$$(10 + 8i)(-3 - 9i)$$

The solution is $42 - 114i$, which is option E.

A. $a \in [-105, -100]$ and $b \in [-66, -63]$

$-102 - 66i$, which corresponds to adding a minus sign in the first term.

B. $a \in [-105, -100]$ and $b \in [63, 70]$

$-102 + 66i$, which corresponds to adding a minus sign in the second term.

C. $a \in [37, 44]$ and $b \in [114, 117]$

$42 + 114i$, which corresponds to adding a minus sign in both terms.

D. $a \in [-30, -26]$ and $b \in [-73, -67]$

$-30 - 72i$, 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. $a \in [37, 44]$ and $b \in [-119, -112]$

* $42 - 114i$, 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.

---

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

$$\sqrt{\frac{850}{10}} + 9i^2$$

The solution is Irrational, which is option C.

A. Nonreal Complex

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

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. Irrational

* This is the correct option!

D. Rational

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

E. Pure Imaginary

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

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.

---

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

$$-\sqrt{\frac{585}{5}}$$

The solution is Irrational, which is option D.

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. Whole

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

D. Irrational

* This is the correct option!

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 $-\sqrt{117}$.

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

$$6 - 12 \div 4 * 19 - (9 * 7)$$

The solution is -114.000, which is option B.

A. $[67.84, 73.84]$

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

B. $[-117, -111]$

* -114.000, which is the correct option.

C. $[-421, -417]$

-420.000, which corresponds to not distributing a negative correctly.

D. $[-59.16, -52.16]$

-57.158, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

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.

---

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

$$\frac{-72 + 77i}{2 - 3i}$$

The solution is $-28.85 - 4.77i$, which is option C.

A. $a \in [-38, -35.5]$ and $b \in [-27, -24.5]$

$-36.00 - 25.67i$, which corresponds to just dividing the first term by the first term and the second by the second.

B. $a \in [-30, -27]$ and $b \in [-62.5, -60.5]$

$-28.85 - 62.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

C. $a \in [-30, -27]$ and $b \in [-5, -3]$

* $-28.85 - 4.77i$, which is the correct option.

D. $a \in [6.5, 7]$ and $b \in [28, 29]$

$6.69 + 28.46i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

E. $a \in [-376, -374]$ and $b \in [-5, -3]$

$-375.00 - 4.77i$, 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 $2 - 3i$.