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.

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

The solution is $-10 - 76i$, which is option C.

A. $a \in [-15, -6]$ and $b \in [73, 82]$

$-10 + 76i$, which corresponds to adding a minus sign in both terms.

B. $a \in [-74, -72]$ and $b \in [-23, -16]$

$-74 - 20i$, which corresponds to adding a minus sign in the first term.

C. $a \in [-15, -6]$ and $b \in [-76, -75]$

* $-10 - 76i$, which is the correct option.

D. $a \in [-46, -35]$ and $b \in [-32, -30]$

$-42 - 32i$, 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. $a \in [-74, -72]$ and $b \in [19, 29]$

$-74 + 20i$, 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.

---

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

$$-\sqrt{\frac{-1008}{8}}$$

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

A. Rational

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

B. Irrational

These cannot be written as a fraction of Integers.

C. Not a Real number

* This is the correct option!

D. Integer

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

E. Whole

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

General Comment: First, you **NEED** to simplify the expression. This question simplifies to $-\sqrt{126}i$.

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.

---

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

$$12 - 9^2 + 1 \div 20 * 15 \div 2$$

The solution is -68.625, which is option C.

A. $[-69.18, -68.95]$

-68.998, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

B. $[92.75, 93.01]$

93.002, which corresponds to two Order of Operations errors.

C. $[-68.66, -68.37]$

* -68.625, this is the correct option

D. $[93.35, 94.09]$

93.375, 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.

---

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

$$\sqrt{\frac{0}{12}} + \sqrt{7}i$$

The solution is Pure Imaginary, which is option A.

A. Pure Imaginary

* This is the correct option!

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

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

D. Rational

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

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.

---

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

$$\frac{54 + 44i}{-5 - i}$$

The solution is $-12.08 - 6.38i$, which is option C.

A. $a \in [-13, -11.5]$ and $b \in [-167.5, -165.5]$

$-12.08 - 166.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

B. $a \in [-11.5, -9.5]$ and $b \in [-45, -43]$

$-10.80 - 44.00i$, which corresponds to just dividing the first term by the first term and the second by the second.

C. $a \in [-13, -11.5]$ and $b \in [-7, -6]$

* $-12.08 - 6.38i$, which is the correct option.

D. $a \in [-10, -7.5]$ and $b \in [-11.5, -9]$

$-8.69 - 10.54i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

E. $a \in [-315, -313.5]$ and $b \in [-7, -6]$

$-314.00 - 6.38i$, 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 $2 - 3i$.

---

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

$$\frac{63 - 66i}{-3 - 2i}$$

The solution is $-4.38 + 24.92i$, which is option E.

A. $a \in [-25.5, -24.5]$ and $b \in [4, 6.5]$

$-24.69 + 5.54i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

B. $a \in [-22.5, -20.5]$ and $b \in [32, 33.5]$

$-21.00 + 33.00i$, which corresponds to just dividing the first term by the first term and the second by the second.

C. $a \in [-58, -56]$ and $b \in [23.5, 25.5]$

$-57.00 + 24.92i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

D. $a \in [-5.5, -3.5]$ and $b \in [323.5, 324.5]$

$-4.38 + 324.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

E. $a \in [-5.5, -3.5]$ and $b \in [23.5, 25.5]$

* $-4.38 + 24.92i$, 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 $2 - 3i$.

---

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

$$-\sqrt{\frac{171396}{529}}$$

The solution is Integer, which is option B.

A. Whole

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

B. Integer

* This is the correct option!

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. Irrational

These cannot be written as a fraction of Integers.

General Comment: First, you **NEED** to simplify the expression. This question simplifies to -414.

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.

---

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

$$\frac{4}{8} + 4i^2$$

The solution is Rational, which is option C.

A. Pure Imaginary

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

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. Rational

* This is the correct option!

D. Irrational

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

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.

---

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

$$(9 + 2i)(-8 - 3i)$$

The solution is $-66 - 43i$, which is option A.

A. $a \in [-66, -58]$ and $b \in [-46, -41]$

* $-66 - 43i$, which is the correct option.

B. $a \in [-73, -71]$ and $b \in [-8, -4]$

$-72 - 6i$, 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.

C. $a \in [-83, -76]$ and $b \in [-14, -10]$

$-78 - 11i$, which corresponds to adding a minus sign in the first term.

D. $a \in [-83, -76]$ and $b \in [4, 16]$

$-78 + 11i$, which corresponds to adding a minus sign in the second term.

E. $a \in [-66, -58]$ and $b \in [39, 48]$

$-66 + 43i$, 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.

---

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

$$16 - 1^2 + 17 \div 18 * 14 \div 3$$

The solution is 19.407, which is option B.

A. $[15.12, 17.86]$

17.022, which corresponds to two Order of Operations errors.

B. $[18.1, 20.84]$

* 19.407, this is the correct option

C. $[13.85, 16.67]$

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

D. $[20.31, 21.99]$

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

$$(4 + 9i)(10 + 2i)$$

The solution is $22 + 98i$, which is option D.

A. $a \in [52, 61]$ and $b \in [80, 83]$

$58 + 82i$, which corresponds to adding a minus sign in the second term.

B. $a \in [52, 61]$ and $b \in [-84, -80]$

$58 - 82i$, which corresponds to adding a minus sign in the first term.

C. $a \in [35, 42]$ and $b \in [15, 20]$

$40 + 18i$, 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.

D. $a \in [18, 24]$ and $b \in [97, 100]$

* $22 + 98i$, which is the correct option.

E. $a \in [18, 24]$ and $b \in [-100, -94]$

$22 - 98i$, 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.

---

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

$$-\sqrt{\frac{202500}{625}}$$

The solution is Integer, which is option B.

A. Not a Real number

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

B. Integer

* This is the correct option!

C. Whole

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

D. Irrational

These cannot be written as a fraction of Integers.

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 -450.

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.

---

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

$$12 - 15^2 + 18 \div 4 * 11 \div 16$$

The solution is -209.906, which is option B.

A. $[-215.2, -211.5]$

-212.974, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

B. $[-211.2, -207.9]$

* -209.906, this is the correct option

C. $[235.8, 237.6]$

237.026, which corresponds to two Order of Operations errors.

D. $[237.9, 242.8]$

240.094, 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.

---

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

$$\frac{\sqrt{182}}{6} + \sqrt{-5}i$$

The solution is Irrational, which is option C.

A. Rational

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

B. Pure Imaginary

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

C. Irrational

* This is the correct option!

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. 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.

---

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

$$\frac{54+11i}{7+2i}$$

The solution is $7.55-0.58i$, which is option C.

A. $a \in [7.7, 7.84]$ and $b \in [4.5, 6.5]$

$7.71+5.50i$, which corresponds to just dividing the first term by the first term and the second by the second.

B. $a \in [6.7, 6.84]$ and $b \in [3, 5]$

$6.72+3.49i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

C. $a \in [7.41, 7.57]$ and $b \in [-1.5, 1]$

* $7.55-0.58i$, which is the correct option.

D. $a \in [399.9, 400.11]$ and $b \in [-1.5, 1]$

$400.00-0.58i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

E. $a \in [7.41, 7.57]$ and $b \in [-31.5, -30.5]$

$7.55-31.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

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 $2-3i$.

---

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

$$\frac{36-22i}{6+8i}$$

The solution is $0.40-4.20i$, which is option A.

A. $a \in [-0.5, 1.5]$ and $b \in [-5, -4]$

* $0.40-4.20i$, which is the correct option.

B. $a \in [5, 7]$ and $b \in [-3, -1.5]$

$6.00 - 2.75i$, which corresponds to just dividing the first term by the first term and the second by the second.

C. $a \in [39.5, 41]$ and $b \in [-5, -4]$

$40.00 - 4.20i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

D. $a \in [-0.5, 1.5]$ and $b \in [-420.5, -419]$

$0.40 - 420.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

E. $a \in [3, 4.5]$ and $b \in [1, 2.5]$

$3.92 + 1.56i$, 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 $2 - 3i$.

---

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

$$-\sqrt{\frac{-882}{7}}$$

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

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

* This is the correct option!

D. Rational

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

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 $-\sqrt{126}i$.

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.

---

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

$$\sqrt{\frac{0}{169}} + \sqrt{10}i$$

The solution is Pure Imaginary, which is option D.

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. 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 the correct option!

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.

---

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

$$(2 + 8i)(-4 - 5i)$$

The solution is $32 - 42i$, which is option B.

A. $a \in [-48, -46]$ and $b \in [21.2, 23]$

$-48 + 22i$, which corresponds to adding a minus sign in the first term.

B. $a \in [27, 40]$ and $b \in [-43.5, -41.7]$

* $32 - 42i$, which is the correct option.

C. $a \in [27, 40]$ and $b \in [38.7, 44.6]$

$32 + 42i$, which corresponds to adding a minus sign in both terms.

D. $a \in [-48, -46]$ and $b \in [-26.3, -20.6]$

$-48 - 22i$, which corresponds to adding a minus sign in the second term.

E. $a \in [-9, -5]$ and $b \in [-41.7, -37.8]$

$-8 - 40i$, 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.

---

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

$$18 - 20 \div 15 * 19 - (17 * 7)$$

The solution is -126.333, which is option D.

A. $[134.93, 137.93]$

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

B. $[-106.07, -98.07]$

-101.070, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

C. $[-172.33, -168.33]$

-170.333, which corresponds to not distributing a negative correctly.

D. $[-130.33, -121.33]$

* -126.333, 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.

---

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

$$(-7 - 2i)(9 + 10i)$$

The solution is $-43 - 88i$, which is option E.

A. $a \in [-86, -80]$ and $b \in [49, 54]$

$-83 + 52i$, which corresponds to adding a minus sign in the second term.

B. $a \in [-63, -62]$ and $b \in [-23, -18]$

$-63 - 20i$, 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. $a \in [-86, -80]$ and $b \in [-53, -49]$

$-83 - 52i$, which corresponds to adding a minus sign in the first term.

D. $a \in [-45, -41]$ and $b \in [86, 91]$

$-43 + 88i$, which corresponds to adding a minus sign in both terms.

E. $a \in [-45, -41]$ and $b \in [-92, -86]$

* $-43 - 88i$, 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.

---

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

$$\sqrt{\frac{58564}{484}}$$

The solution is Whole, 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. Irrational

These cannot be written as a fraction of Integers.

D. Whole

* 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 242.

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.

---

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

$$16 - 17 \div 9 * 19 - (15 * 18)$$

The solution is -289.889, which is option C.

A. $[280.9, 288.9]$

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

B. $[-255.1, -251.1]$

-254.099, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

C. $[-291.89, -288.89]$

* -289.889, which is the correct option.

D. $[-634, -623]$

-628.000, 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.

---

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

$$\sqrt{\frac{-910}{13}} + \sqrt{126}$$

The solution is Nonreal Complex, which is option A.

A. Nonreal Complex

* This is the correct option!

B. Pure Imaginary

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

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. Irrational

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

E. Rational

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

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.

---

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

$$\frac{-18 - 44i}{-6 - 3i}$$

The solution is $5.33 + 4.67i$, which is option A.

A. $a \in [4.5, 7]$ and $b \in [3.5, 6]$

* $5.33 + 4.67i$, which is the correct option.

B. $a \in [-1, 1]$ and $b \in [6.5, 9]$

$-0.53 + 7.07i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

C. $a \in [239.5, 241]$ and $b \in [3.5, 6]$

$240.00 + 4.67i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

D. $a \in [4.5, 7]$ and $b \in [209.5, 211]$

$5.33 + 210.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

E. $a \in [2, 3.5]$ and $b \in [14, 15.5]$

$3.00 + 14.67i$, 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 $2 - 3i$.

---

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

$$\frac{-27 - 88i}{2 + 5i}$$

The solution is $-17.03 - 1.41i$, which is option E.

A. $a \in [-495, -493]$ and $b \in [-2, -1]$

$-494.00 - 1.41i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

B. $a \in [12.5, 14]$ and $b \in [-11.5, -10.5]$

$13.31 - 10.72i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

C. $a \in [-17.5, -16]$ and $b \in [-42.5, -40]$

$-17.03 - 41.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

D. $a \in [-14, -12.5]$ and $b \in [-18.5, -16]$

$-13.50 - 17.60i$, which corresponds to just dividing the first term by the first term and the second by the second.

E. $a \in [-17.5, -16]$ and $b \in [-2, -1]$

* $-17.03 - 1.41i$, 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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27. Choose the **smallest** set of Real numbers that the number below belongs to.

$$\sqrt{\frac{945}{9}}$$

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)

B. Irrational

* This is the correct option!

C. Whole

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

D. Not a Real number

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

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 $\sqrt{105}$.

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

$$\sqrt{\frac{-1170}{13}} + \sqrt{0}i$$

The solution is Pure Imaginary, which is option A.

A. Pure Imaginary

* This is the correct option!

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. 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. 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.

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

$$(-4 + 10i)(5 - 9i)$$

The solution is $70 + 86i$, which is option B.

A. $a \in [-20, -19]$ and $b \in [-93, -88]$

$-20 - 90i$, 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. $a \in [65, 72]$ and $b \in [84, 92]$

* $70 + 86i$, which is the correct option.

C. $a \in [65, 72]$ and $b \in [-89, -81]$

$70 - 86i$, which corresponds to adding a minus sign in both terms.

D. $a \in [-118, -109]$ and $b \in [14, 21]$

$-110 + 14i$, which corresponds to adding a minus sign in the second term.

E. $a \in [-118, -109]$ and $b \in [-19, -7]$

$-110 - 14i$, 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.

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

$$10 - 5^2 + 12 \div 6 * 3 \div 7$$

The solution is -14.143, which is option A.

A. $[-14.21, -14.03]$

* -14.143, this is the correct option

B. $[34.97, 35.32]$

35.095, which corresponds to two Order of Operations errors.

C. $[-15.23, -14.82]$

-14.905, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

D. $[35.6, 36.47]$

35.857, 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.
