**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.

$$(6 + 5i)(-4 + 10i)$$

The solution is $-74 + 40i$, which is option B.

A. $a \in [22, 27]$ and $b \in [72, 87]$

$26 + 80i$, which corresponds to adding a minus sign in the first term.

B. $a \in [-79, -71]$ and $b \in [36, 43]$

* $-74 + 40i$, which is the correct option.

C. $a \in [-79, -71]$ and $b \in [-44, -37]$

$-74 - 40i$, which corresponds to adding a minus sign in both terms.

D. $a \in [-26, -23]$ and $b \in [48, 55]$

$-24+50i$, 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. $a \in [22, 27]$ and $b \in [-81, -76]$

$26 - 80i$, 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.

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

$$\frac{63 - 55i}{2 + 4i}$$

The solution is $-4.70 - 18.10i$, which is option A.

A. $a \in [-5, -3.5]$ and $b \in [-18.5, -17.5]$

* $-4.70 - 18.10i$, which is the correct option.

B. $a \in [31, 32]$ and $b \in [-14.5, -13.5]$

$31.50 - 13.75i$, which corresponds to just dividing the first term by the first term and the second by the second.

C. $a \in [-5, -3.5]$ and $b \in [-363.5, -361.5]$

$-4.70 - 362.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

D. $a \in [16.5, 19]$ and $b \in [6.5, 7.5]$

$17.30 + 7.10i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

E. $a \in [-95, -93.5]$ and $b \in [-18.5, -17.5]$

$-94.00 - 18.10i$, 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 $2 - 3i$.

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

$$\frac{-63 + 33i}{4 - 5i}$$

The solution is $-10.17 - 4.46i$, which is option C.

A. $a \in [-418.5, -416.5]$ and $b \in [-4.5, -2.5]$

$-417.00 - 4.46i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

B. $a \in [-3, -0.5]$ and $b \in [10, 12.5]$

$-2.12 + 10.90i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

C. $a \in [-10.5, -9.5]$ and $b \in [-4.5, -2.5]$

* $-10.17 - 4.46i$, which is the correct option.

D. $a \in [-10.5, -9.5]$ and $b \in [-184, -181.5]$

$-10.17 - 183.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

E. $a \in [-16, -15.5]$ and $b \in [-8, -6]$

$-15.75 - 6.60i$, 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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4. Simplify the expression below into the form $a + bi$. Then, choose the intervals that $a$ and $b$ belong to.

$$(-3 - 2i)(-4 + 9i)$$

The solution is $30 - 19i$, which is option A.

A. $a \in [28, 39]$ and $b \in [-20.3, -18.6]$

* $30 - 19i$, which is the correct option.

B. $a \in [-7, -4]$ and $b \in [-38.2, -34.6]$

$-6 - 35i$, which corresponds to adding a minus sign in the first term.

C. $a \in [28, 39]$ and $b \in [16, 20.5]$

$30 + 19i$, which corresponds to adding a minus sign in both terms.

D. $a \in [4, 15]$ and $b \in [-18.1, -15.7]$

$12 - 18i$, 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.

E. $a \in [-7, -4]$ and $b \in [32.5, 35.6]$

$-6 + 35i$, 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.

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