Conjugates

CN06-V1 · storyboard · CN06 Conjugates and the distance from 0. Read each picture with its sentences.

Picture 1

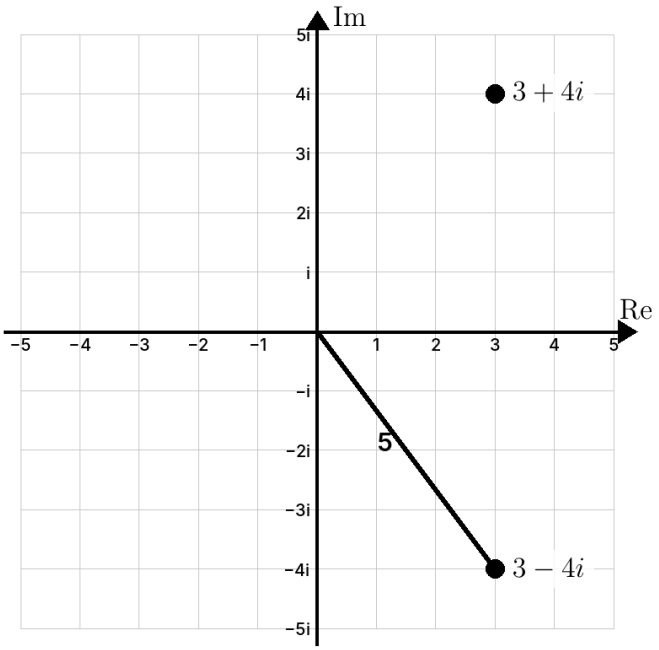
Multiply $(7 - 3i)(7 + 3i)$.

$$49 + 21i - 21i - 9i^2$$ the middle terms cancel

$$= \boxed{49 + 9 = 58}$$ always real

1. Multiply 7 minus 3 i, times its conjugate, 7 plus 3 i.
2. Four products.
3. The two middle terms, 21 i and negative 21 i, cancel.
4. And negative 9 i squared is plus 9.
5. So the product is 49 plus 9, which is 58: a real number.
6. In general, a plus b i, times a minus b i, is a squared plus b squared.

Picture 2



$$|3-4i| = \sqrt{9+16} = 5$$

7. On the complex plane, 3 minus 4 i is 3 right and 4 down, and its conjugate, 3 plus 4 i, is its reflection in the real axis.
8. The distance from 0 is the root of 9 plus 16, which is 5: the root of the number times its conjugate.

Picture 3

$(-3+8i)(-3+Ai)$ is real. Find A.

$$(9-8A)+(-3A-24)i$$ collect the parts

$$\boxed{-3A-24=0, \quad A=-8}$$ the imaginary part is 0

9. Negative 3 plus 8 i, times negative 3 plus A i, is a real number.
10. Find A.
11. Expand and collect the parts: 9 minus 8 A, plus, negative 3 A minus 24, times i.
12. The imaginary part must be 0: negative 3 A minus 24 equals 0, so A is negative 8.
13. The conjugate again.

Picture 4

Trap $\overline{3-2i}$

$\times \quad -3+2i$

$\checkmark \quad 3+2i$

14. Watch for the trap: the conjugate of 3 minus 2 i is not negative 3 plus 2 i.
15. Only the imaginary part changes sign: 3 plus 2 i.