

If $a + bi = (1 + 2i)(3 - 4i)$, where a and b are constants and $i = \sqrt{-1}$, what is the value of $a + b$?

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1. **13**

$$(1 + 2i)(3 - 4i)$$

FOIL: $(1)(3) + (1)(-4i) + (2i)(3) + (2i)(-4i)$

Simplify: $3 - 4i + 6i - 8i^2$

Substitute $i^2 = -1$: $3 - 4i + 6i - 8(-1)$

Combine like terms: $11 + 2i$

Therefore, $a = 11$ and $b = 2$, so $a + b = 13$.

If $a + bi = \frac{4+i}{2-i}$, where a and b are constants and $i = \sqrt{-1}$, what is the value of a ?

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2. **7/5 or 1.4**

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

Multiply conjugate:

$$\frac{(4+i)(2+i)}{(2-i)(2+i)}$$

FOIL:

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

$$\frac{8+4i+2i-1}{4+2i-2i+1}$$

Substitute $i^2 = -1$:

Combine like terms:

$$\frac{7+6i}{5}$$

Distribute division:

$$\frac{7}{5} + \frac{6}{5}i$$

For what value of b does $(b + i)^2 = 80 + 18i$?

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3. 9

$$(b + i)^2$$

FOIL:

$$(b + i)(b + i) = b^2 + bi + bi + i^2$$

Substitute $i^2 = -1$:

$$b^2 + bi + bi - 1$$

Combine like terms:

$$(b^2 - 1) + 2bi$$

Since this must equal $80 + 18i$, we can find b by solving either $b^2 - 1 = 80$ or $2b = 18$. The solution to both equations is $b = 9$.

The solutions of the equation $x^2 - 2x + 15 = 0$ are $x = a + i\sqrt{b}$ and $x = a - i\sqrt{b}$, where a and b are positive numbers. What is the value of $a + b$?

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4. 15 The equation we are given is a quadratic equation in which $a = 1$, $b = -2$, and $c = 15$. Therefore, we can use the quadratic formula:

Quadratic Formula:

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Substitute:

$$\frac{2 \pm \sqrt{(-2)^2 - 4(1)(15)}}{2(1)}$$

Simplify:

$$\frac{2 \pm \sqrt{-56}}{2}$$

Simplify:

$$\frac{2 \pm 2i\sqrt{14}}{2}$$

Distribute division:

$$1 \pm i\sqrt{14}$$

Therefore, $a = 1$ and $b = 14$, so $a + b = 15$.

Given that $i = \sqrt{-1}$, which of the following is equal

to $\frac{1}{(1+i)^2}$?

A) $\frac{1}{2} - \frac{1}{2}i$

B) $-\frac{1}{2}i$

C) $\frac{1}{2}i$

D) $\frac{1}{2} + \frac{1}{2}i$

5. B

$$\frac{1}{(1+i)^2}$$

FOIL:

$$\frac{1}{(1+i)(1+i)} = \frac{1}{1+i+i+i^2}$$

Substitute $i^2 = -1$:

$$\frac{1}{1+i+i+(-1)}$$

Simplify:

$$\frac{1}{2i}$$

Multiply by i/i :

$$\frac{i}{2i^2}$$

Substitute $i^2 = -1$:

$$\frac{i}{-2} = -\frac{1}{2}i$$

Which of the following expressions is equal to $(2 + 2i)^2$?

- A) 0
- B) $4i$
- C) $8i$
- D) $4 - 4i$

6. C

$$(2 + 2i)^2$$

FOIL:

$$(2 + 2i)(2 + 2i) = 4 + 4i + 4i + 4i^2$$

Substitute $i^2 = -1$:

$$4 + 8i - 4 = 8i$$

If $B(3 + i) = 3 - i$, what is the value of B ?

A) $\frac{3}{5} + \frac{4}{5}i$

B) $\frac{4}{5} + \frac{3}{5}i$

C) $\frac{3}{5} - \frac{4}{5}i$

D) $\frac{4}{5} - \frac{3}{5}i$

7. D

$$B(3 + i) = 3 - i$$

Divide by $3 + i$:

$$B = \frac{3 - i}{3 + i}$$

FOIL:

$$B = \frac{9 - 3i - 3i + i^2}{9 - 3i + 3i - i^2}$$

Substitute $i^2 = -1$:

$$B = \frac{9 - 3i - 3i + (-1)}{9 - 3i + 3i - (-1)}$$

Simplify:

$$B = \frac{8 - 6i}{10} = \frac{4 - 3i}{5}$$

Distribute division:

$$B = \frac{4}{5} - \frac{3}{5}i$$

$$x^2 + kx = -6$$

If one of the solutions to the equation above is $x = 1 - i\sqrt{5}$, what is the value of k ?

- A) -4
- B) -2
- C) 2
- D) 4

8. B

$$x^2 + kx = -6$$

Add 6:

$$x^2 + kx + 6 = 0$$

Substitute $x = 1 - i\sqrt{5}$: $(1 - i\sqrt{5})^2 + k(1 - i\sqrt{5}) + 6 = 0$

FOIL: $(1 - 2i\sqrt{5} + 5i^2) + k(1 - i\sqrt{5}) + 6 = 0$

Simplify: $(-4 - 2i\sqrt{5}) + k(1 - i\sqrt{5}) + 6 = 0$

Distribute: $-4 - 2i\sqrt{5} + k - ik\sqrt{5} + 6 = 0$

Collect terms: $(2 + k) - (2\sqrt{5} + k\sqrt{5})i = 0$

Therefore, both $2 + k = 0$ and $2\sqrt{5} + k\sqrt{5} = 0$. Solving either equation gives $k = -2$.

If $i^m = -i$, which of the following CANNOT be the value of m ?

- A) 15
- B) 18
- C) 19
- D) 27

9. B As we discussed in Lesson 10, the powers of i are “cyclical,” and $i^m = -i$ if and only if m is 3 more than a multiple of 4. The only number among the choices that is not 3 more than a multiple of 4 is (B) 18.