

Solutions for In-Class Problems 2 for Wednesday, January 24

These problems are from [Pre-Class Problems 2](#).

You can go to the solution for each problem by clicking on the problem letter or problem number.

1. Simplify each expression and write the result in the form $a + bi$.

a. $\frac{-48 + 6i}{12}$ b. $\frac{24 - \sqrt{-72}}{18}$

2. Simplify the power of i .

a. i^{38} b. i^{43}

3. Perform the indicated operations.

a. $(12 + 19i) - (8 - 10i)$ b. $(6 - 3i)(4 + 7i)$

c. $(5 - 9i)^2$ d. $\frac{11 - 5i}{2 + 3i}$ e. $\frac{3 + 8i}{3 - 8i}$

4. Solve the following equations by factoring.

a. $2x(3x + 5) = 11x + 12$ b. $72t^2 - 50 = 0$

5. Solve the following equations using square roots.

a. $3y^2 + 27 = 0$ b. $4(w - 3)^2 - 17 = 63$

SOLUTIONS:

1a. $\frac{-48 + 6i}{12}$

[Back to Problem 1.](#)

$$\frac{-48 + 6i}{12} = -\frac{48}{12} + \frac{6i}{12} = -4 + \frac{1}{2}i$$

Answer: $-4 + \frac{1}{2}i$

1b. $\frac{24 - \sqrt{-72}}{18}$

Back to [Problem 1](#).

$$\frac{24 - \sqrt{-72}}{18} = \frac{24 - i\sqrt{36 \cdot 2}}{18} = \frac{24 - 6i\sqrt{2}}{18} = \frac{24}{18} - \frac{6i\sqrt{2}}{18} =$$

$$\frac{4}{3} - \frac{\sqrt{2}}{3}i$$

Answer: $\frac{4}{3} - \frac{\sqrt{2}}{3}i$

2a. i^{38}

Back to [Problem 2](#).

$$i^{38} = i^{36+2} = i^{36}i^2 = i^2 = -1$$

NOTE: 36 is the largest multiple of 4 that is less than 38 and $38 = 36 + 2$.

NOTE: $i^{36} = (i^4)^9 = 1^9 = 1$

Answer: -1

2b. i^{43}

Back to [Problem 2](#).

$$i^{43} = i^{40+3} = i^{40}i^3 = i^3 = i^2i = -1i = -i$$

NOTE: 40 is the largest multiple of 4 that is less than 43 and $43 = 40 + 3$.

NOTE: $i^{40} = (i^4)^{10} = 1^{10} = 1$

Answer: $-i$

3a. $(12 + 19i) - (8 - 10i)$

Back to [Problem 3](#).

$$(12 + 19i) - (8 - 10i) = 12 + 19i - 8 + 10i = 4 + 29i$$

Answer: $4 + 29i$

3b. $(6 - 3i)(4 + 7i)$

Back to [Problem 3](#).

$$(6 - 3i)(4 + 7i) = 24 + 42i - 12i - 21i^2 = 24 + 42i - 12i + 21 = 45 + 30i$$

Answer: $45 + 30i$

3c. $(5 - 9i)^2$

Back to [Problem 3](#).

Use the special product formula: $(a - b)^2 = a^2 - 2ab + b^2$

$$(5 - 9i)^2 = 25 - 90i + 81i^2 = 25 - 90i - 81 = -56 - 90i$$

Answer: $-56 - 90i$

3d. $\frac{11 - 5i}{2 + 3i}$

Back to [Problem 3](#).

$$\begin{aligned}\frac{11 - 5i}{2 + 3i} &= \frac{11 - 5i}{2 + 3i} \cdot \frac{2 - 3i}{2 - 3i} = \frac{(11 - 5i)(2 - 3i)}{4 - 9i^2} = \frac{22 - 33i - 10i + 15i^2}{4 + 9} \\ &= \frac{22 - 33i - 10i - 15}{13} = \frac{7 - 43i}{13} = \frac{7}{13} - \frac{43}{13}i\end{aligned}$$

Answer: $\frac{7}{13} - \frac{43}{13}i$

3e. $\frac{3 + 8i}{3 - 8i}$

Back to [Problem 3](#).

$$\begin{aligned}\frac{3 + 8i}{3 - 8i} &= \frac{3 + 8i}{3 - 8i} \cdot \frac{3 + 8i}{3 + 8i} = \frac{(3 + 8i)^2}{9 - 64i^2} = \frac{9 + 48i + 64i^2}{9 + 64} \\ &= \frac{9 + 48i - 64}{73} = \frac{-55 + 48i}{73} = -\frac{55}{73} + \frac{48}{73}i\end{aligned}$$

Answer: $-\frac{55}{73} + \frac{48}{73}i$

4a. $2x(3x + 5) = 11x + 12$

Back to [Problem 4](#).

$$2x(3x + 5) = 11x + 12 \Rightarrow 6x^2 + 10x = 11x + 12 \Rightarrow$$

$$6x^2 - x - 12 = 0 \Rightarrow (2x - 3)(3x + 4) = 0$$

$$2x - 3 = 0 \Rightarrow x = \frac{3}{2}$$

$$3x + 4 = 0 \Rightarrow x = -\frac{4}{3}$$

Answer: $x = -\frac{4}{3}, x = \frac{3}{2}$ or $\left\{-\frac{4}{3}, \frac{3}{2}\right\}$

4b. $72t^2 - 50 = 0$

Back to [Problem 4](#).

$$72t^2 - 50 = 0 \Rightarrow 2(36t^2 - 25) = 0 \Rightarrow 2(6t + 5)(6t - 5) = 0$$

$$6t + 5 = 0 \Rightarrow t = -\frac{5}{6}$$

$$6t - 5 = 0 \Rightarrow t = \frac{5}{6}$$

NOTE: $36t^2 - 25$ is a difference of squares. Use the special factoring formula: $a^2 - b^2 = (a + b)(a - b)$.

Answer: $t = -\frac{5}{6}, t = \frac{5}{6}$ or $\left\{-\frac{5}{6}, \frac{5}{6}\right\}$

5a. $3y^2 + 27 = 0$

Back to [Problem 5](#).

$$3y^2 + 27 = 0 \Rightarrow 3y^2 = -27 \Rightarrow y^2 = -9 \Rightarrow y = \pm 3i$$

NOTE: $y^2 = -9 \Rightarrow \sqrt{y^2} = \sqrt{-9} \Rightarrow |y| = i\sqrt{9} \Rightarrow y = \pm 3i$

Answer: $y = \pm 3i$ or $\{\pm 3i\}$

5b. $4(w - 3)^2 - 17 = 63$

Back to [Problem 5](#).

$$4(w - 3)^2 - 17 = 63 \Rightarrow 4(w - 3)^2 = 80 \Rightarrow (w - 3)^2 = 20 \Rightarrow$$

$$w - 3 = \pm 2\sqrt{5} \Rightarrow w = 3 \pm 2\sqrt{5}$$

NOTE: $(w - 3)^2 = 20 \Rightarrow \sqrt{(w - 3)^2} = \sqrt{20} \Rightarrow |w - 3| = \sqrt{4 \cdot 5} \Rightarrow$
 $w - 3 = \pm 2\sqrt{5}$

Answer: $w = 3 \pm 2\sqrt{5}$ or $\{3 \pm 2\sqrt{5}\}$