

① Simplify:

A. $\sqrt{-9} = 3i$

$$\sqrt{-9} = \sqrt{9 \cdot -1}$$

$$\sqrt{-25} = 5i$$

Let $i^2 = -1$

$$\sqrt{-64} = 8i$$

$$= \sqrt{9 \cdot i^2}$$

$$= \sqrt{9} \cdot \sqrt{i^2}$$

$$= 3i$$

② Simplify:

A. $\sqrt{3} \cdot \sqrt{-48}$

$$= \sqrt{3} \cdot \sqrt{16 \cdot 3 \cdot -1}$$

$$= \sqrt{3} \cdot \sqrt{16} \cdot \sqrt{3} \cdot \sqrt{i^2}$$

$$= 4 \cdot 3 \cdot i$$

$$= 12i$$

B. $\sqrt{-20} \cdot \sqrt{-45}$

$$= \sqrt{4 \cdot 5 \cdot -1} \cdot \sqrt{9 \cdot 5 \cdot -1}$$

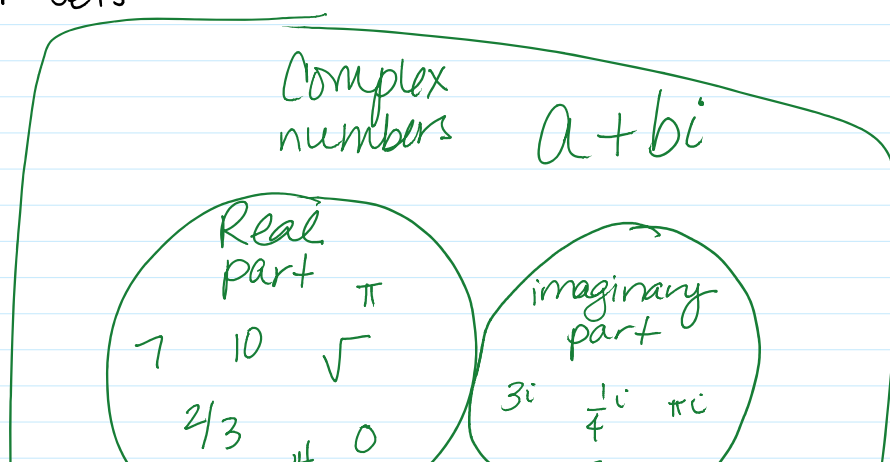
$$= \sqrt{4} \cdot \sqrt{5} \cdot \sqrt{i^2} \cdot \sqrt{9} \cdot \sqrt{5} \cdot \sqrt{i^2}$$

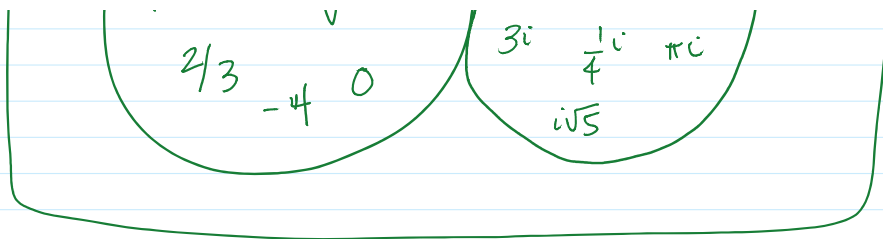
$$= 2 \cdot 5 \cdot 3 \cdot i \cdot i$$

$$= 30i^2$$

$$= -30$$

③ Number sets





Conjugate

$$7+2i, 7-2i$$

$$1+i\sqrt{3}, 1-i\sqrt{3}$$

$$2-17i, 2+17i$$

④ Operations of Complex numbers

A. Add: $(2+5i)+(-3+4i) = -1+9i$

Subtract: $(2+5i)-(-3+4i) = 5+i$

C. Solve for a and b.

$$(5+3i) - (2-bi) = 4a + 3bi$$

$$\begin{matrix} 3 & + & 9i & = & 4a & + & 3bi \\ \text{Real} & & \text{IMAG} & & \text{Real} & & \text{IMAG} \end{matrix}$$

$$\begin{aligned} 3 &= 4a \\ \frac{3}{4} &= a \end{aligned}$$

$$\begin{aligned} 9 &= 3b \\ b &= 3 \end{aligned}$$

Multiply: $(4-13i)(7+2i)$

$$= 28 + 8i - 91i - 26i^2$$

$$= 28 - 83i + 26$$

$$= 54 - 83i$$

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

$$= 25 - 16i^2$$

$$= 25 + 16$$

$$\star (2+3i)(2-3i)$$

..

$$\begin{aligned}
 &= 4 - 6i + 6i - 9i^2 \\
 &= 4 + 9 \\
 &= 13
 \end{aligned}$$

$$\begin{aligned}
 &= 41 \\
 &(1 - 7i)(1 + 7i) \\
 &= 1 - 49i^2 \\
 &= 1 + 49 = 50
 \end{aligned}$$

When you multiply 2 complex conjugates together, you get a REAL number.

E. Divide :

$$\frac{3 + 2i}{1 - 4i}$$

$$= \frac{3 + 12i + 2i + 8i^2}{1 + 16}$$

$$= \frac{3 + 14i - 8}{17}$$

$$= \frac{-5 + 14i}{17}$$

$$= \frac{-5}{17} + \frac{14i}{17}$$

Recall Exponents...

$$x^4 \cdot x^6 = x^{10}$$

$$\begin{aligned}
 i^1 &= i \\
 i^2 &= -1
 \end{aligned}$$

$$x^4 \cdot x^6 = x^{10}$$

$$(x^4)^6 = x^{24}$$

$$i^2 = -1$$

$$i^3 = i^2 \cdot i = -1 \cdot i = -i$$

$$i^4 = i^2 \cdot i^2 = -1 \cdot -1 = 1$$

$$i^5 = i^4 \cdot i = 1 \cdot i = i$$

$$i^6 = i^4 \cdot i^2 = 1 \cdot -1 = -1$$

$$i^7 = i^4 \cdot i^3 = -i$$

$$i^8 = i^4 \cdot i^4 = 1 \cdot 1 = 1$$

5) simplify

$$A. i^{53} = i^{52} \cdot i = i$$

$$B. i^9 = i^8 \cdot i = i$$

$$C. i^{18} = i^{16} \cdot i^2 = 1 \cdot -1 = -1$$

$$D. \frac{1}{i^3} \cdot \frac{i}{i} = \frac{i}{i^4} = \frac{i}{1} = i$$

$$\begin{aligned} i^{-1} &= \frac{1}{i} \cdot \frac{i^3}{i^3} \\ &= \frac{i^3}{1} = i^2 \cdot i = -i \end{aligned}$$

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