


Adding and Subtracting Complex Numbers
(a) $(7-3 i)+(4+5 i)=7+4-3 i+5 i$

$$
11+2 i \quad 11-2 i
$$

(b) $(2-i)-(8+3 i)=$

$$
2-i
$$

$$
-6-4 i \quad \rightarrow \quad-6+4 i
$$

Dividing Complex Numbers
Write the complex number in standard form.
(a) $\frac{2}{(3-i)} \cdot \frac{(3+i)}{(3+i)}$
(b) $\frac{(5+i)}{(2-3 i)} \cdot \frac{(2+3 i)}{(2+3 i)}$ foil 1

$$
\begin{aligned}
& \frac{6+2 i}{9+3 i-7 i}-i^{2} \quad \frac{10+15 i+2 i+3 i^{2}}{4-9 i^{2}} \\
& \frac{6+2 i}{9+1}=\frac{6+2 i}{10}=\frac{3}{5}+\frac{1}{5} i \frac{7+17 i}{\frac{7}{13}+\frac{17}{13} i}
\end{aligned}
$$

Solve $x^{2}+x+1=0$.

$$
\begin{aligned}
& b^{2}-4 a c \\
& 1^{2}-4(1) \\
& 1-4 \\
& -3
\end{aligned}
$$

$$
\begin{array}{ll}
x=\frac{-b \pm \sqrt{b^{2}-4 a s}}{2 a} \\
x=\frac{-1 \pm \sqrt{-3}}{2} & \sqrt{-3} \\
x=\frac{\sqrt{3} \cdot \sqrt{-1}}{2} i & \sqrt{3} i \\
x=-\frac{1}{2} \pm \frac{\sqrt{3}}{2} i &
\end{array}
$$

Multiplying Complex Numbers

$$
\begin{aligned}
&(2+3 i) \cdot(5-i)= \\
& i^{54}=(4)^{1} \cdot i^{2}
\end{aligned}
$$

$$
\begin{aligned}
& i^{3}=i^{2} \cdot i \\
& i^{3}=-1 \cdot i \\
& i^{4}=-i^{2} \cdot i^{2} \\
& i^{4}(-1)(-1) \\
& i^{4}=1
\end{aligned}
$$

Multiplying Complex Numbers

$$
\begin{aligned}
& (2+3 i) \cdot(5-i)= \\
& \text { Foil } \\
& \qquad \begin{array}{l}
10-2 i+15 i-3 \\
10+13 i+3 \\
13+13 i
\end{array}
\end{aligned}
$$

Complex Conjugates and Division
DEFINITION Complex Conjugate
The complex conjugate of the complex number $z=a+b i$ is

$$
\begin{array}{ccc}
\bar{z}=\overline{a+b i} & =\underline{a-b i} \\
13+13 i, & 13-13 i & 3+7 i+4 \\
-2+4 i, & -2-4 i & 7+7 i \\
3-7 i, & 3+7 i & 7-7 i
\end{array}
$$

