7.8 - Complex Numbers

The Number i i is the unique number for which $i = \sqrt{-1}$ and $i^2 = -1$.

We can now say $\sqrt{-a} = \sqrt{-1}\sqrt{a} = i\sqrt{a}$

Be careful! $i \neq \underline{}$

① Express in terms of i.
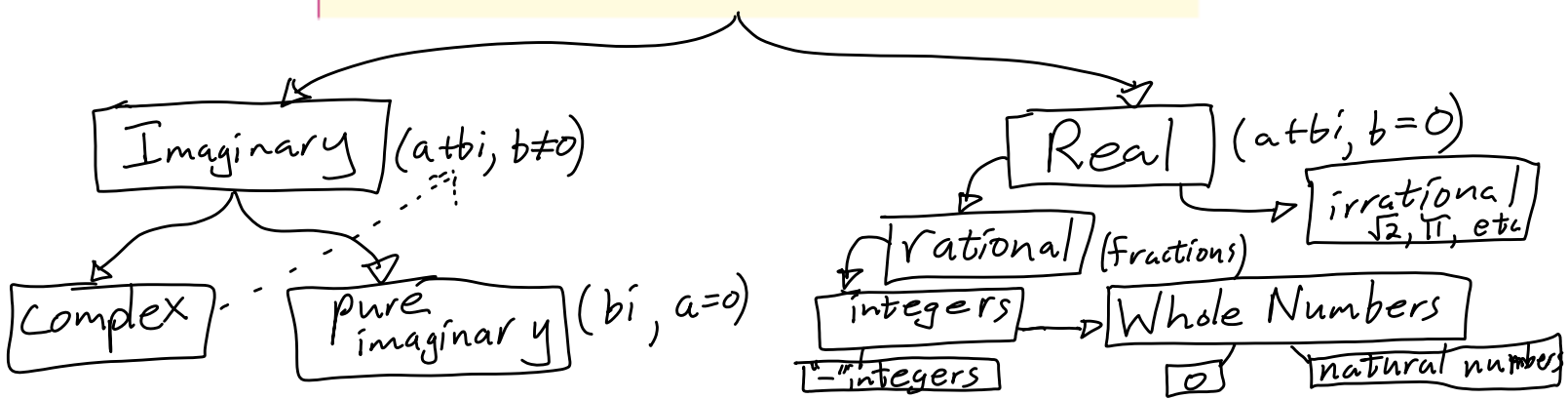
a) $\sqrt{-15}$ b) $\sqrt{-9}$ c) $-\sqrt{-50}$

Imaginary Numbers An *imaginary number* is a number that can be written in the form $a + bi$, where a and b are real numbers and $b \neq 0$.

These have <u>many</u> real world applications in engineering and physical sciences.

Complex Numbers A *complex number* is any number that can be written in the form $a + bi$, where a and b are real numbers. (Note that a and b both can be 0.)

Imaginary	$(a+bi, b\neq 0)$

Real	$(a+bi, b=0)$

Complex

pure imaginary $(bi, a=0)$

rational (fractions)

irrational $\sqrt{2}, \pi, etc$

integers

Whole Numbers

"-" integers

0

natural numbers

② Add or subtract

a) $(4-5i)+(2+3i)$ b) $(3-i)-(5-2i)$

observe: $\sqrt{-3}\cdot\sqrt{-2}$

careful! $\sqrt{-3}\cdot\sqrt{-2} \neq$

③ Multiply and simplify. If needed, write as $a+bi$.

a) $\sqrt{-9}\cdot\sqrt{-36}$ b) $\sqrt{-6}\cdot\sqrt{-10}$

c) $-2i\cdot7i$ d) $3i(4-7i)$

e) $(2-3i)(4+5i)$ f) $(3-5i)^2$

④ Find and multiply by the conjugate.

a) $-2 + 5i$

Conjugate: _____

b) $3 - 7i$

Conjugate: _____

c) $5i$

Conjugate: _____

When dividing by complex numbers, we multiply by the _____ _____ as a _____ similar to rationalizing the denominator.

⑤ Divide. Write answers as $a + bi$

a) $\dfrac{4}{2 - 3i}$

b) $\dfrac{2 + 7i}{5i}$

Powers of i

$i =$ $i^5 =$

$i^2 =$ $i^6 =$

$i^3 =$ $i^7 =$

$i^4 =$ $i^8 =$

Divide powers by ___

$\dfrac{\text{Remainder}}{} \bigg| \dfrac{\text{Result}}{}$

⑥ Simplify

a) i^{28} b) i^{46}

c) i^{33} d) i^{75}

On the Calc.