

# Complex Quick Reference and Implementation Hints

CS 102, U of C, Spring 2006

- Negation. The negation of  $a + bi$  is  $-a - bi$ .
- Conjugation. The conjugate of  $a + bi$ , denoted  $\overline{a + bi}$ , is  $a - bi$ .
- Reciprocation. The reciprocal of  $a + bi$  is

$$\frac{a}{a^2 + b^2} + \frac{-b}{a^2 + b^2}i$$

- The modulus of  $a + bi$  is  $\sqrt{a^2 + b^2}$ .
- Addition.

$$(a_1 + b_1i) + (a_2 + b_2i) = (a_1 + a_2) + (b_1 + b_2)i$$

- Subtraction. Use addition and negation.
- Multiplication.

$$(a_1 + b_1i)(a_2 + b_2i) = (a_1a_2 - b_1b_2) + (a_1b_2 + a_2b_1)i$$

- Division. Use multiplication and reciprocation.
- Exponentiation. Any complex number to the 0 is 1.  
For any positive power  $p$ ,

$$(a + bi)^p = (a + bi) * (a + bi)^{p-1}$$

For any negative power  $p$ , where  $p = -k$  for some positive  $k$ ,

$$(a + bi)^{-k} = \frac{1}{(a + bi)^k}$$