



**Grade 7/8 Math Circles**  
**November 21/22/23/24, 2022**  
**Complex Numbers - Problem Set**

1. Find an equivalent expression to the following using  $i$ :

(a)  $\sqrt{-81}$

(b)  $-\sqrt{-1}$

(c)  $-\sqrt{-12}$

(d)  $\sqrt{-\frac{10}{100}}$

2. Using the FOIL method, expand the following expressions:

(a)  $(a + 2)(a + 3)$

(b)  $(b + 1)(c - 1)$

(c)  $(2 + 3x)(1 - 2x)$

(d)  $(1 + 4i)(3 + 2i)$  (Simplify the expression using  $i^2 = -1$ .)

3. Find the real part and the imaginary part of the following complex numbers:

(a)  $7 + 7i$

(b) 900

(c)  $-100i + 12$

(d)  $i$

(e) 0

4. Find the following complex numbers:

(a)  $(11 - 23i) + (7i - 17)$

(b)  $(8 - 11i) + 100i$

(c)  $99 - (3 + 77i)$

(d)  $(9i + 11) - (-5 + 7i)$

(e)  $(-3 + 2i)(1 - 5i)$

(f)  $(7i + 2)(i - 1)$

(g)  $\frac{5 + i}{1 - i}$

(h)  $\frac{4 - 5i}{4 + 5i}$



5. Find the complex conjugates of following complex numbers:

- (a) 500
- (b)  $-777i$
- (c)  $1 + 7i$
- (d)  $i$
- (e) 0

6. Calculate the following powers of  $i$ :

- (a)  $i^{501}$
- (b)  $i^{44444444}$
- (c)  $i^6$
- (d)  $i^{10000003}$

7. Using the FOIL method, calculate the following:

- (a)  $(2 - 2i)^4$
- (b)  $(i + 1)^{10}$
- (c)  $(3 + 3i)^4$

8. Find the solutions of the following quadratic equations:

- (a)  $x^2 - 1 = 0$
- (b)  $x^2 - 10x + 20 = -5$
- (c)  $2x^2 - 5x + 2 = 0$
- (d)  $x^2 + 7x + 1 = 0$
- (e)  $x^2 + 4 = 0$

9. Verify that  $-\frac{1}{2} + \frac{\sqrt{3}}{2}i$  is a 3<sup>rd</sup> root of one.