

## Worksheet: Basics of Complex Numbers

This worksheet covers the basics of complex numbers, including addition, subtraction, multiplication, division, real and imaginary parts and the complex conjugate. Please read the study guide: [Basics of Complex Numbers](#) before doing these questions.

Basics of Complex  
Numbers study  
guide



Model answers for  
this sheet



When completing this worksheet, you should write each of your answers using the Cartesian form of a complex number  $z = a + bi$ .

1. Work out the real and imaginary parts of each of the following complex numbers.

- |                           |                     |                              |                                   |
|---------------------------|---------------------|------------------------------|-----------------------------------|
| i) $\sqrt{-9}$            | ii) $\sqrt{-36}$    | iii) $\sqrt{9} + \sqrt{-36}$ | iv) $\sqrt{-9} - \sqrt{36}$       |
| v) $\sqrt{9} + \sqrt{36}$ | vi) $\sqrt{-(9)^2}$ | vii) $\sqrt{(-9)^2}$         | viii) $3i + 6i^2$                 |
| ix) $3i - \sqrt{-9}$      | x) $9 + 6i - 3i^2$  | xi) $3i - \sqrt{36i^2}$      | xii) $\sqrt{9i^2} \sqrt{(-9i)^2}$ |

Find the complex conjugate of your answers.

2. You are given some quadratic equations below. Simplify (if you need to) and solve each of these using the quadratic formula (see study guide: [Solving Quadratic Equations using the Quadratic Formula](#)).

- |                         |                                   |
|-------------------------|-----------------------------------|
| i) $a^2 + 2a + 2 = 0$   | ii) $b^2 + 169 = 0$               |
| iii) $c^2 + 4c + 4 = 0$ | iv) $d^2 + 4d + 5 = 0$            |
| v) $(e)^2 - 3e - 3 = 0$ | vi) $-(f)^2 - 4i^2f - (2i)^2 = 0$ |

3. You are given three complex numbers  $z_1 = 4 - 3i$ ,  $z_2 = -2 + 2i$ , and  $z_3 = 1 + i$ . Work out the following:

i)  $z_1 + z_3$       ii)  $z_2 - z_1$       iii)  $z_3 z_2$       iv)  $\frac{z_1}{z_2}$

v)  $\bar{z}_1 + \bar{z}_3$       vi)  $\bar{z}_2 - \bar{z}_1$       vii)  $\bar{z}_3 \bar{z}_2$       viii)  $\frac{\bar{z}_1}{\bar{z}_2}$

What are the real and imaginary parts of each of your answers?

Work out the complex conjugates of i)-iv). What do you notice?

Using the same complex numbers as above (and some of your answers to the previous problems), work out the following:

ix)  $z_2 + z_3 - z_1$       x)  $z_2(z_1 + z_3)$       xi)  $\frac{z_1 z_3}{z_2}$       xii)  $\frac{z_1}{z_3 z_2}$

xiii)  $(\bar{z}_3 \bar{z}_2)(z_3 z_2)$       xiv)  $\frac{\bar{z}_1}{\bar{z}_2} + \frac{\bar{z}_2}{\bar{z}_1}$       xv)  $\frac{z_1 z_2}{z_2 z_3}$       xvi)  $\frac{(z_2 + z_3 - z_1)}{(z_3 + z_1 - z_2)}$

Write down the real and imaginary parts of each of your answers.



This worksheet is one of a series on mathematics produced by the **Learning Enhancement Team** with funding from the UEA Alumni Fund. Scan the QR-code with a smartphone app to go to our [website](#).



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