

Addition and Subtraction

Multiplication and Division

**Questions**

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**Answers**

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**Conjugate**

Change the sign of the imaginary part – for example the conjugate of -4+3i is -4-3i

**Solving simple equations using Complex Numbers**

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**Solve Quadratic Equations with Complex Roots**

When a quadratic equation cannot be solved by factorisation the following formula can be used

The equation *ax*2 + *bx* + *c* = 0 has the roots given by

**Note:** The whole of the top of the right hand side, including –b, is divided by 2a. It is also called the quadratic or –b formula. If *b*2 – 4*ac* < 0, then the number under the square root sign will be negative, and so the solutions will be complex numbers.

**Example**

Solve the equation *x*2 – 4*x* + 13

*ax*2 + *bx* + *c* = 0 => *a* = 1, *b* = 4, *c* = 13

=  = =

*x* = 2 ± 3*i*

Therefore, the roots are 2 + 3*i* and 2 – 3*i*

**Note:** Notice the roots occur in conjugate pairs. If one root of a quadratic equation is a complex number then the other root must also be complex and the conjugate of the first: i.e., if 3 – 4*i* is a root, then 3 + 4*i* is also a root,

if –2 –5*i* is a root, then –2 + 5*i* is also a root

if a + *bi* is a root, then *a* – *bi* is also a root

***Questions***

Solve for each of the following equations:

1. *x*2 – 6*x* + 13 = 0
2. *z*2 – 2*z* + 10 = 0
3. *x*2 + 16 = 0
4. *x*2 + 41 = 10*x*
5. 5 = 2*x* – *x*2

**Complex Numbers Worksheet**

1. **For** **the complex number ,** **identify the real number and** **the imaginary number**.
2. **Write the conjugate of each. Then plot all eight complex numbers in the same complex plane.**

A)  B)  C)  D) 

1. **Evaluate.** a)  b)  c) 
2. **Write the expression as a complex number in standard form.**

a)  b)  c) 

d)  e)  f)

g)  h)  i) 

j)  k) 

1. **Write the expression as a complex number in standard form.**

a)  b)  c)  d)  e) 

1. **Find the absolute value of the complex number.**

a)  b)  c)  d)  e) 

1. **Solve each equation.**

a)  b)  c)  d)  e)  f)  g)  h) 

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a)  b)  c)  d)  e) 

1. **Find the absolute value of the complex number.**

a)  b)  c)  d)  e) 

1. **Solve each equation.**

a)  b)  c)  d)  e)  f)  g)  h) 

**Answers**

1. Real number: ; Imaginary number: 4*i*
2. A)  B)  C)  D) 
3. a)  b)  c) 1
4. a) 8 b)  c)  d)  e)  f)  g)  h)  i)  j)  k) 
5. a)  b)  c)  d)  e) 
6. a)  b)  c)  d)  e) 
7. a)  b)  c)  d)  e)  f)  g)  h) 

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**Various Exercises**

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Q7 Express in the form a+bi (below)

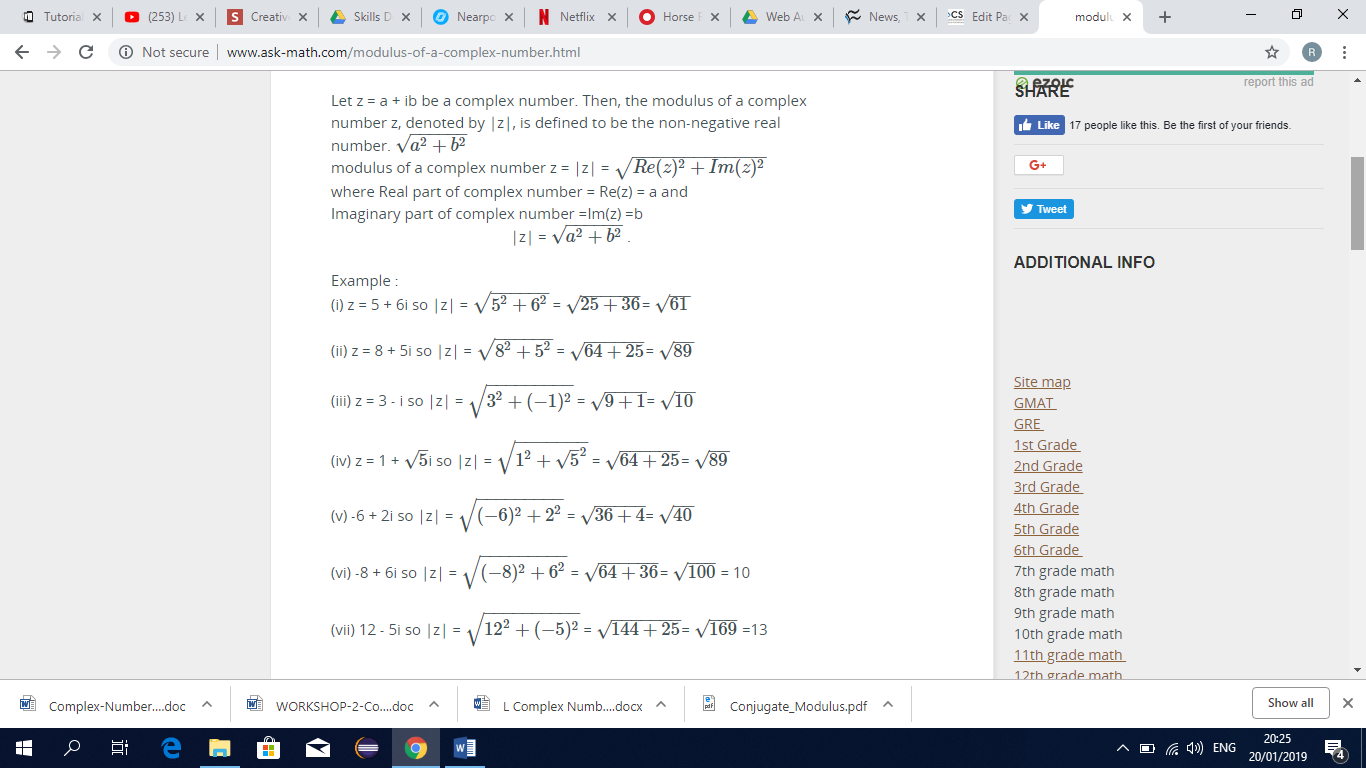
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**Modulus**



**Modulus and Argument of a Complex Number**

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**Complex Numbers in Polar Form**

Chart

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**Complex Numbers in General Polar Form**

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**Exercises**

Write each of the following in Polar and General Polar

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Solutions on next page

Diagram, engineering drawing

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Diagram, text, letter

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**Exercise**

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Diagram, letter

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**More Exercises**

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