Complex numbers:

Complex numbers have the form **a+ *i* b** where *a* and *b* are real numbers.

The *i* in the complex number refers to $i = \sqrt{-1}$ which allows for solving equations which have imaginary roots - that is the discriminate **(b2 – 4ac)** is less than zero. It's easy to see that squaring both sides of the ***i*** equation above yields

$i^2 = -1$.

This is the basis for all the imaginary complex numbers.

Basic Operations of Complex Numbers:

Now, these numbers can be added, subtracted, multiplied and divided in exactly the same manner as all the real numbers. Indeed, the rules are the same!

Example:

Suppose two complex numbers, say $5-2i$ and $3+4i$.

To add: $(5-2i)+(3+4i)=8+2i$ merely combine component parts. 5 + 3 and $-2i+4i$

Subtraction: $(5-2i)-(3+4i)=5-2i-3-4i=2-6i$

Multiplication :

$(5-2i)(3+4i) = 15 - 6i + 20i - 8i^2$ *but* $i^2 = -1$ *so* $-8i^2$ *becomes* $+8 \rightarrow 23 + 14i$

this is equal to -1

$= 23 + 14i$

Divide: **Simplify the following**:

$(5-2i) \div (3+4i) = \dfrac{5-2i}{3+4i}$

Multiply by the conjugate of the denominator (in the form of 1)

$\dfrac{5-2i}{3+4i} \cdot \dfrac{3-4i}{3-4i} = \dfrac{(5-2i)(3-4i)}{9-16i^2} = \dfrac{15-6i-20i+8i^2}{9+16}$

$= \dfrac{7-26i}{25} = \dfrac{7}{25} - \dfrac{26}{25}i$

Simplify, combine like terms and write in standard form.

1. $4 - 3i + 9i^2 - \left(\sqrt{16} + \sqrt{-16}\right)$

2. $(4-i) + (1+3i)$

3. $(4-i)(1+3i)$

4. $(5+7i) - (1-i)$

5. $6 + (4-3i)$

6. $(3+4i)(2-5i)$

7. $(2i)-(3+7i)$

8. $(7+i)(4-5i)$

9. $(7+i)\div(4-5i)$

10. $(4-5i)-(7+i)$

11. $(6+7i)+\sqrt{9i}-(4+3i)-2i+1$

12. $\dfrac{4-5i}{3+i}$

13. $(3-11i)-(3+11i)$

14. $(2+5i)(2-5i)$

15. $(3-4i)^2$