5. $8m^2+4m-16=-m^2$

$+m^2 \quad +m^2$

$9m^2+4m-16=0$

$a=9$, $b=4$, $c=-16$

$ax^2+bx+c=0$

$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$

$x=\frac{-4\pm\sqrt{(4)^2-4(9)(-16)}}{2(9)}$

$x=\frac{-4\pm\sqrt{16+576}}{18}$

$\sqrt{592}$

$592 = 2 \cdot 296$

$296 = 2 \cdot 148$

$148 = 2 \cdot 74$

$74 = 2 \cdot 37$

$\sqrt{592} = 2\cdot 2\sqrt{37} = 4\sqrt{37}$

$x=\frac{-4\pm\sqrt{592}}{18}$

$x=\frac{-4\pm 4\sqrt{37}}{18}$

$x=\frac{-4}{18}\pm\frac{4\sqrt{37}}{18}$

$x=\frac{-2}{9}\pm\frac{2\sqrt{37}}{9}$

$x=\frac{-2\pm 2\sqrt{37}}{9}$

7. $4b^2+8b+7=4$

$-4 \quad -4$

$4b^2+8b+3=0$

$a=4$, $b=8$, $c=3$

$x=\frac{-8\pm\sqrt{8^2-4(4)(3)}}{2(4)}$

$x=\frac{-8\pm\sqrt{64-48}}{8}$

$64 - 48 = 16$

$x=\frac{-8\pm\sqrt{16}}{8}$

$x=\frac{8\pm 4}{8}$

$\frac{8+4}{8}=\frac{12}{8}=\boxed{\frac{3}{2}}$

$\frac{8-4}{8}=\frac{4}{8}=\boxed{\frac{1}{2}}$

8-2 Complex Operations

Objective: Students will be able to:

Know the parts of a complex number

Know how to add, subtract, and multiply 2 complex numbers

Reduce different powers of i

imaginary

$$i = \sqrt{-1}$$

$$(i)^2 = (\sqrt{-1})^2$$

$$i^2 = -1$$

or

$$i^2 = -1$$

Definition

Complex numbers are numbers of the form $a+bi$, where a and b are real numbers. The real number a is called the real part and the number b is called the imaginary part.

Complex number

Standard form

$a + bi$

real

imaginary

Identify the real and imaginary parts of each complex number.

$4 + 5i$

R: 4
I: 5

$5 - i$

R: 5
I: -1

$3 + 0i$

R: 3
I: 0

$0 + 7i$

R: 0
I: 7

Write each of the following as a pure imaginary number.

$\sqrt{-16} = \sqrt{16 \cdot -1}$

$= \sqrt{16} \cdot \sqrt{-1}$

$= \boxed{4i}$

$\sqrt{-3} = \sqrt{3 \cdot -1}$

$= \sqrt{3} \cdot \sqrt{-1}$

$\boxed{\sqrt{3}\,i}$

$\sqrt{-18} = \sqrt{18 \cdot -1}$

$\sqrt{18} \cdot \sqrt{-1}$

$3\sqrt{2}\,i$

You Try

$\sqrt{-12}$

$\sqrt{12} \quad \sqrt{-1}$

$2\sqrt{3} \cdot i = \boxed{2\sqrt{3}i}$

$\sqrt{-5}$

$\sqrt{5} \cdot -1$

$\sqrt{5} \quad \sqrt{-1}$

$\boxed{\sqrt{5}\,i}$

$\sqrt{-36}$ $6i$

Write each in Standard Form. State the real and imaginary parts.

$a+bi$

$2-\sqrt{-25}$

$2-\sqrt{25}\,i$

$2-5i$

R: 2

I: -5

$3+\sqrt{-50}$

$3+\sqrt{50}\,i$

$5 \cdot 10$

$5\sqrt{2}$

$3+5\sqrt{2}\,i$

R: 3

$I: 5\sqrt{2}$

$\dfrac{4-\sqrt{-12}}{2}$

$\dfrac{4-2\sqrt{3}\,i}{2}$

$\dfrac{4}{2}-\dfrac{2\sqrt{3}\,i}{2}$

$2-\sqrt{3}\,i$

R: 2

$I: -\sqrt{3}$

You Try

$-2-\sqrt{-8}$

$2\sqrt{2}\,i$

$2 \cdot 4$

$2-2\sqrt{2}\,i$

$2 \cdot 2$

R: 2

$I: -2\sqrt{2}$

$\dfrac{6-\sqrt{-72}}{3}$

$6\sqrt{2}\,i$

$\dfrac{6-6\sqrt{2}\,i}{3}$ R: 2

$\dfrac{6}{3}-\dfrac{6\sqrt{2}}{3}\,i$ $-2\sqrt{2}$

$2-2\sqrt{2}\,i$

Add:

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

$4-3i-2+5i$

$2+2i$

$4+-2+-3i+5i$

$2+2i$

$\left(4+\sqrt{-25}\right)+\left(-6-\sqrt{-16}\right)$

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

$4+-6+5i+-4i$

$-2+i$

Subtract:

$(-3+7i)-(5-4i)$

$-3+7i-5++4i$

$-8+11i$

$\left(3+\sqrt{-12}\right)-\left(-2-\sqrt{-27}\right)$ $\sqrt{27}\sqrt{-1}$

$(3+\sqrt{12}\,i)-(-2-\sqrt{27}\,i)$

$2 \cdot 6$, $2 \cdot 3$, $3 \cdot 9$, $3 \cdot 3$

$(3+2\sqrt{3}\,i)-(-2-3\sqrt{3}\,i)$

$3++2+2\sqrt{3}i++3\sqrt{3}i$

$5+5\sqrt{3}\,i$

You Try

$$\left(4-\sqrt{-4}\right)+\left(-7+\sqrt{-9}\right)$$

$$(4-2i)-(-2+7i)$$

Multiply

$$4i(3-6i)$$

$12i-24i^2$

$12i-24(-1)$

$12i+24$

$24+12i$

$i^2=\sqrt{-1}^2$

$i=-1$

$a+bi$

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

17. $(2+i)(4+3i)$

$8+6i+4i+3i^2$

$+3(-1)$

$8+6i+4i-3$

$\boxed{5+10i}$

19. $(3+2i)^2 = (3+2i)(3+2i)$

Remember from before:

$$\sqrt[n]{a}\sqrt[n]{b} = \sqrt[n]{ab}$$

only works when $\sqrt[n]{a}$ and $\sqrt[n]{b}$ are real numbers

This means that

$$\sqrt{a}\sqrt{b} \neq \sqrt{ab} \text{ if } a < 0 \text{ or } b < 0$$

Multiply

$$\sqrt{-25}\sqrt{-4}$$

$$\left(2 + \sqrt{-16}\right)\left(1 - \sqrt{-4}\right)$$

You Try

$$\sqrt{-9}\sqrt{-36}$$

$$\left(2+\sqrt{-36}\right)\left(4-\sqrt{-25}\right)$$

Evaluate

i^1

i^2

i^3

i^4

i^5

i^6

i^7

i^8

Evaluate:

i^{34} i^{101}

You Try

i^{43} i^{98}

The rest is Honors

Multiply (What Happens?)

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

Complex Conjugate

If $a+bi$ is a complex number, then its conjugate is defined as $a-bi$

Divide:

$$\frac{3+4i}{2i}$$

$$\frac{-3+i}{5+3i}$$

You Try

$$\frac{-4+i}{3i}$$

$$\frac{4+3i}{1-3i}$$