

$$\lambda^2 - 25 = 0$$

$$\lambda^2 + 25 = 0$$

$$\lambda^2 = -25$$

$$\lambda = \sqrt{-25} = \sqrt{25 \times (-1)}$$

$$= \sqrt{25} \times \sqrt{-1}$$

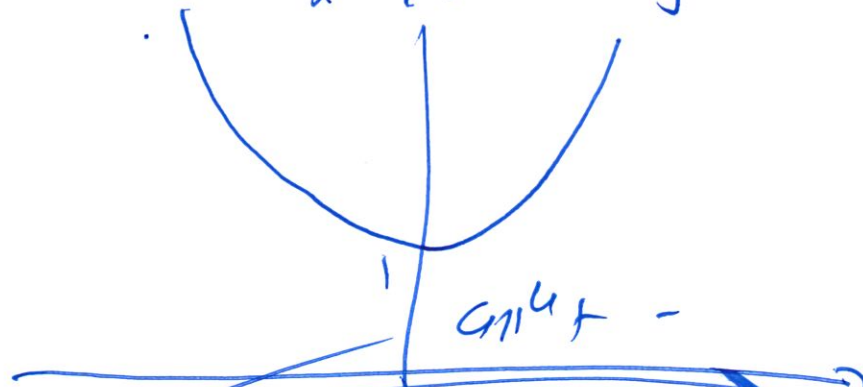
$$= \pm 5 \times \sqrt{-1}$$

$$= \pm 5j \text{ where } j = \sqrt{-1}$$

$$\lambda^2 + 1 = 0$$

$$\lambda^2 = -1$$

$$\lambda = \sqrt{-1} = \pm j$$



$$ax^3 + bx^2 + cx + d = 0$$

$$x^3 + ax + b = 0$$

depressed cubic.

Solve

$$z^2 - 2z + 5 = 0.$$

Soln:

$$\begin{aligned} z &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\ &= \frac{2 \pm \sqrt{(2)^2 - (4 \times 1 \times 5)}}{2} \\ &= \frac{2 \pm \sqrt{-16}}{2} \\ &= \frac{2 \pm 4j}{2} = 1 \pm 2j \end{aligned}$$

Complex Numbers.

$a + j(b)$ ← imaginary part. Im
↑
real part Re

$$\text{Re}(5 + j7) = 5$$

$$\text{Im}(5 + j7) = 7$$

+ & -

$$(a + jb) \pm (c + jd) = (a + c) \pm j(b + d)$$

$$\begin{aligned} (2 + j7) + (3 + j12) &= (2 + 3) + j(7 + 12) \\ &= 5 + j19 \end{aligned}$$

$$(2 + j7) - (3 + j12) = (2 - 3) + j(7 - 12) = -1 - j5$$

$$(3+j4) - (3-j4) = (3-3) + j(4+4) \\ = 0 + j8 = \underline{\underline{j8}}$$

Powers of j

$$\begin{array}{l} j = \sqrt{-1} \\ j^2 = -1 \\ j^3 = -j \\ j^4 = 1 \end{array}$$

Simplify $j^{203} = j^{200} j^3$
 $= (j^4)^{50} j^3 = 1^{50} j^3 = j^3 = -j$

Simplify $j^7 = j^4 j^3 = 1 \times j^3 = j^3 = -j$

$j^{1001} = j^{1000} j^1 = j$

X complex nos

$$(a+jb)(c+jd) = \underbrace{ac}_R + \underbrace{j(ad)}_O + \underbrace{j(bc)}_I + \underbrace{j^2 bd}_L \\ = ac + j(ad+bc) - bd.$$

$$\begin{aligned}
 (2+j3)(6+j7) &= \underbrace{(2 \times 6)}_F + \underbrace{j(2 \times 7)}_0 + \underbrace{j(3 \times 6)}_F \\
 &\quad - \underbrace{j^2(3 \times 7)}_L \\
 &= 12 + j14 + j18 - 21 \\
 &= -9 + j32.
 \end{aligned}$$

$$\begin{aligned}
 (2+j3)(2-j3) &= 4 - \underbrace{j^6 + j^6}_{=0} - \underbrace{j^2 9}_{=-9} \\
 &= 4 + 9 = 13
 \end{aligned}$$

Complex Conjugate

$$\begin{aligned}
 (3+j4)(3-j4) &= 9 - \underbrace{j^2 + j^2}_{=0} - j^2 16 \\
 &= 9 + 16 = 25.
 \end{aligned}$$

$$(5-j8)(5+j8) = 89$$

$$(1-j)(1+j) = 2$$

$$(7+j5)(7-j5) = 74$$

The complex conjugate of $a+jb$ is $a-jb$.

$$(a+jb)(a-jb) = a^2 + b^2.$$