Echelon Form and Complex Numbers

(1) Find the equation of the quadratic

$$y = ax^2 + bx + c \tag{1}$$

which passes through $(0, 0), (1, 2), (-1, 3)$.

(2) Find the determinant for the following Hermitian matrix. What do you notice?

$$\begin{bmatrix} 4 & 3-2i & -3i \\ 3+2i & 1 & -5+2i \\ 3i & -5-2i & 2 \end{bmatrix} \tag{2}$$

(3) Solve the following systems of linear equations.

$$\begin{array}{rcrcrcr} 3x & - & 4y & + & 7z & = & -23 \\ 5x & - & 10y & + & 11z & = & -47 \\ 5x & & & - & z & = & 7 \\ x & - & 3y & + & 2z & = & -12 \end{array} \tag{3}$$

$$\begin{array}{rcrcrcr} 2u & + & v & - & 2w & = & 4 \\ 2u & + & 4v & - & 3w & = & 9 \\ 4 & + & 5v & - & 5w & = & -11 \end{array} \tag{4}$$

(4) Represent the following complex numbers in polar form $r(\cos\theta + i\sin\theta)$.

1. $3 + 4i$
2. $-1.04 - 1.56i$

(5) Solve the following problems in electrical engineering.

1. The impedance Z (in Ω) in an alternating-current circuit is given by$Z = 3560/-32.4°$. Express this in rectangular form.
2. The current in a microprocessor circuit is represented by $3.75/15.0°\mu$A. Write this in rectangular form.
3. The voltage of a generator is represented by $2.84 - 1.06i$kV. Write this voltage in polar form.

(6) Solve the following problems in complex arithmetic.

1. $(8i - 5)(7 + 4i)$
2. $(\sqrt{-18}\sqrt{-4}) \cdot 3i$
3. $(1 + i)(1 - i)^2$
4. $\frac{0.25}{3-\sqrt{-1}}$
5. $\frac{6+5i}{3-4i}$
6. $\frac{(2-i^3)^4}{(i^8-i^6)^3} + i$