1.) Find **numerical values** for each of the following:

For parts (a) and (b) convert each complex number to polar form (express angle in degrees) :

a) (3 pts): $-50 + j200$

b) (3 pts): $-4 - j3$

For parts (c–e) convert each complex number to cartesian form:

c) (3pts): $2.5 \exp(-j\pi/9)$ (note angle is in radians)

d) (3 pts): $(100\angle 180^o) + (200\angle -145^o)$

e) (3 pts): $(2 + \frac{7}{j14}) \cdot 200 \exp(j35^o)$

f) (5 pts): Use phasors to find A and θ_A for

$$A\cos(120\pi t + \theta_A) = 50\cos(120\pi t + 140^o) - 250\sin(120\pi t - 55^o)$$

2.) (20 pts): A continuous time signal, $f(t) = 10\cos(240\pi t + 145^o)$ is sampled at $T_s = \Delta t = 0.022$ sec so that the sampled signal is $f[n] = 10\cos(\hat{\omega}_o n + \theta_o)$ where $\hat{\omega}_o$ is the *normalized radial frequency* for the **principal zone (principal alias)** description of the sampled signal. Find $\hat{\omega}_o$ and θ_o for the sampled signal. Identify whether the signal is oversampled or undersampled and justify why.

3.) (30 points): In each discrete time system below, the input signal is $x[n]$ and the output signal is $y[n]$. For each system determine if the system is linear or nonlinear and if the system is time-invariant or not time-invariant. Briefly justify your answers:

a.) $y[n] = 2e^{j\pi n/2} \cdot x[n]$

b.) $y[n] = 100x[n] - 40x[n-10]$

c.) $y[n] = 100\cos(2\pi x[n]/100)$

4.) (30 points): A LTI system starts at rest (no stored values) and has an impulse response

$$h[n] = 1.25\delta[n] - 0.5\delta[n-1] + \delta[n-3]$$

and an input signal

$$x[n] = 10\cos(0.25\pi n + 15^o)\,(u[n-1] - u[n-3])$$

Find a closed form (analytic expression) for the output of the system, $y[n]$.