1. Select all the correct facts about complex numbers from the list below. **4 / 4 points**

- [ ] The phase (angle) of a complex number $1 + j$ in radians is $\frac{\pi}{2}$.
- [x] The complex number $3 + 4j$ has modulus 5.

Correct
$\sqrt{3^2. + 4^2} = 5$

- [ ] The value of the expression $\exp(j\frac{\pi}{4})$ is j.
- [x] The conjugate of the complex number $re^{j\theta}$ is given by $re^{-j\theta}$.

Correct
Indeed: $r\cos(\theta) - jr\sin(\theta) = re^{-j\theta}$ which is the conjugate of $re^{j\theta}$.

- [ ] The conjugate of the complex number $re^{j\theta}$ is given by $\frac{1}{r}e^{j\theta}$.
- [x] The complex number j is one of the fourth roots of unity.

Correct
Correct. $j^4 = -1^2 = 1$

- [x] For any complex number z, the numbers $z + \overline{z}$ and $z \times \overline{z}$ are both real numbers.

Correct
Correct: Let $z = x + jy$. We have $z + \overline{z} = 2x$ and $z \times \overline{z} = x^2 + y^2$.

- [x] The value of $\frac{1}{1+j}$ is $\frac{1}{2}(1 - j)$.

Correct
Correct.

2. Let w_n denote the generator of the n^{th} roots of unity for $n \geq 1$. Select all the correct options from the list below. **4 / 4 points**

- [x] $w_n = \cos(\frac{2\pi}{n}) + j\sin(\frac{2\pi}{n})$

Correct
Correct

- [ ] The set of n^{th} roots of unity is $\{w_n, w_n^2, \cdots, w_n^{n-1}\}$.
- [x] $w_n^{n-1} = \overline{w_n} = \frac{1}{w_n}$.

Correct
Correct. Because $w_n^{n-1} = w_n^n \times w_n^{-1} = \frac{1}{w_n} = \overline{w_n}$

- [ ] If n is even and $n \geq 2$ then $w_n^{n/2} = 1$
- [x] If n is even and $n \geq 2$ then $w_n^2 = w_{n/2}$.

Correct
Correct: $w_n^2 = e^{j\frac{2\pi}{n}\times 2} = e^{j\frac{2\pi}{n/2}}$

- [x] For any $0 \leq k < n$ we have $w_n^k = \overline{\omega_n}^{n-k} = \frac{1}{\overline{\omega_n^k}}$.

Correct
Correct

- [x] $1 + w_n + w_n^2 + \cdots + w_n^{n-1} = 0$ for all $n \geq 2$

Correct
$1 + w_n + w_n^2 + \cdots + w_n^{n-1} = \frac{w_n^n - 1}{w_n - 1} = 0$ since $w_n^n = 1$.