1) - $f(x)$ is of degree 4 $\Rightarrow$ it has exactly 4 complex zeros.

- $f(x)$ has real coefficients $\Rightarrow$ if z is a zero, then $\bar{z}$ is also a zero.

- i is a zero $\Rightarrow$ $\bar{i} = -i$ is also a zero.

- $3+i$ is a zero $\Rightarrow$ $\overline{3+i} = 3-i$ is also a zero.

C

2) - $f(x)$ is of degree 3 $\Rightarrow$ it has exactly 3 complex zeros

- Since $3+i$ is a zero, $3-i$ is also a zero.

- $f(x) = (x+2)\left(x - \underbrace{(3+i)}_{a}\right)\left(x - \underbrace{(3-i)}_{b}\right)$

Trick: $(x-a)(x-b) = x^2 - (a+b)x + ab$

$$a+b = (3+i)+(3-i) = 6$$
$$ab = (3+i)(3-i) = 3^2 - i^2 = 10$$

- $f(x) = (x+2)(x^2 - 6x + 10)$

$= x^3 - 4x^2 - 2x + 20$

D

3) $f(x) = x^3 - 2x^2 - 11x + 52$

-4 is a zero of $f(x)$. $\Rightarrow$ $f(x)$ has a factor $x+4$.

Using long divison, we get

$$\begin{array}{r|rrrr} -4 & 1 & -2 & -11 & 52 \\ & & -4 & 24 & -52 \\ \hline & 1 & -6 & 13 & 0 \end{array}$$

$f(x) = (x+4)(x^2 - 6x + 13)$

Find the zeros of $x^2 - 6x + 13$.

$\Delta = 6^2 - 4.13 = 36 - 52 = -16$

$x^2 - 6x + 13$ has two distinct complex zeros

$$x = \frac{6 \pm i\sqrt{16}}{2} = \frac{6 \pm 4i}{2} = 3 \pm 2i$$

B

4) $2+2i$

- $x=2, \ y=2$

- $r=\sqrt{x^2+y^2}=\sqrt{2^2+2^2}=\sqrt{8}=2\sqrt{2}$

- $\cos\theta=\frac{x}{r}=\frac{2}{2\sqrt{2}}=\frac{1}{\sqrt{2}}$

  $\sin\theta=\frac{y}{r}=\frac{2}{2\sqrt{2}}=\frac{1}{\sqrt{2}}$

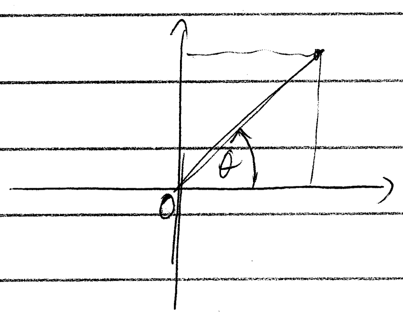
$\Rightarrow \theta=\frac{\pi}{4} \quad (=45^\circ)$

- $2+2i=2\sqrt{2}(\cos 45^\circ+i\sin 45^\circ)$

C

Remark: we can use $\tan\theta=\frac{y}{x}=\frac{2}{2}=1$

$\Rightarrow \theta=45^\circ+k.180^\circ$



Choose $k=1$ because the point is in the first quadrant.