

modulus & amplitude of

$$\frac{(3 - \sqrt{2}i)^2}{1 + 2i}$$

$$= \frac{3^2 + (\sqrt{2}i)^2 - 6\sqrt{2}i}{1 + 2i}$$

$$= \frac{9 + 2i^2 - 6\sqrt{2}i}{1 + 2i} \times \frac{1 - 2i}{1 - 2i}$$

$$= \frac{(7 - 6\sqrt{2}i)(1 - 2i)}{1 - (2i)^2} = \frac{7 - 14i - 6\sqrt{2}i + 12\sqrt{2}i^2}{1 + 4}$$

$$= \frac{7 - i(14 + 6\sqrt{2}) - 12\sqrt{2}}{5} = \frac{(7 - 12\sqrt{2}) - i(14 + 6\sqrt{2})}{5}$$

$$Z = \left[\frac{7 - 12\sqrt{2}}{5} \right] - i \left[\frac{14 + 6\sqrt{2}}{5} \right]$$

$$|Z| = \sqrt{\left[\frac{7 - 12\sqrt{2}}{5} \right]^2 + \left[\frac{14 + 6\sqrt{2}}{5} \right]^2}$$

$$= \sqrt{\frac{49 + 288 - 168\sqrt{2}}{25} + \frac{196 + 72 + 168\sqrt{2}}{25}}$$

$$= \frac{605}{25}$$

$$= \sqrt{121/5} = \frac{11}{\sqrt{5}}$$

$$\arg Z = \tan^{-1} \left[\frac{\frac{14 + 6\sqrt{2}}{5}}{\frac{7 - 12\sqrt{2}}{5}} \right] = \tan^{-1} \left[\frac{14 + 6\sqrt{2}}{7 - 12\sqrt{2}} \right]$$