

**Access to Science, Engineering and Agriculture:
Mathematics 2
MATH00040
Chapter 2 Exercises**

1. For each of the following pairs of complex numbers, calculate $|z|$, \bar{z} , $\operatorname{Re}(z)$, $\operatorname{Im}(z)$, $|w|$, \bar{w} , $\operatorname{Re}(w)$, $\operatorname{Im}(w)$, $z + w$, $z - w$, zw , $\frac{z}{w}$ and $\frac{w}{z}$.
 - (a) $z = 1 + i$ and $w = 2 + 2i$.
 - (b) $z = 1 - 2i$ and $w = -2 + 3i$.
 - (c) $z = -3i$ and $w = 4$.
 - (d) $z = -2 - 4i$ and $w = 2 - i$.

2. Convert the following complex numbers into polar form.
 - (a) 1
 - (b) $2 + 2i$
 - (c) $3i$
 - (d) $-2 + \frac{2}{\sqrt{3}}i$
 - (e) -4
 - (f) $-\sqrt{3} - i$
 - (g) $-4i$
 - (h) $1 - i$

3. Using your answers to Question 2, calculate
 - (a) 1^2
 - (b) $(2 + 2i)^3$
 - (c) $(3i)^4$
 - (d) $\left(-2 + \frac{2}{\sqrt{3}}i\right)^5$
 - (e) $(-4)^6$
 - (f) $(-\sqrt{3} - i)^7$
 - (g) $(-4i)^8$
 - (h) $(1 - i)^9$

In each case you should first express your answer in polar form and then use a calculator (if necessary) to express your answer in Cartesian form to three decimal places.

4. Again, using your answers to Question 2, calculate

- (a) All the third roots of 1
- (b) All the fourth roots of $2 + 2i$
- (c) All the fifth roots of $3i$
- (d) All the sixth roots of $-2 + \frac{2}{\sqrt{3}}i$
- (e) All the seventh roots of -4
- (f) All the eighth roots of $-\sqrt{3} - i$
- (g) All the ninth roots of $-4i$
- (h) All the tenth roots of $1 - i$

In each case you should first express all the roots exactly in polar form and then use a calculator (if necessary) to express them in Cartesian form to three decimal places.