

Exercise 1A

- 1 a $\sqrt{9}\sqrt{(-1)} = 3i$
- b $\sqrt{49}\sqrt{(-1)} = 7i$
- c $\sqrt{121}\sqrt{(-1)} = 11i$
- d $\sqrt{10\,000}\sqrt{(-1)} = 100i$
- e $\sqrt{225}\sqrt{(-1)} = 15i$
- f $\sqrt{5}\sqrt{(-1)} = i\sqrt{5}$
- g $\sqrt{12}\sqrt{(-1)} = \sqrt{4}\sqrt{3}\sqrt{(-1)} = 2i\sqrt{3}$
- h $\sqrt{45}\sqrt{(-1)} = \sqrt{9}\sqrt{5}\sqrt{(-1)} = 3i\sqrt{5}$
- i $\sqrt{200}\sqrt{(-1)} = \sqrt{100}\sqrt{2}\sqrt{(-1)} = 10i\sqrt{2}$
- j $\sqrt{147}\sqrt{(-1)} = \sqrt{49}\sqrt{3}\sqrt{(-1)} = 7i\sqrt{3}$
- 2 a $(5+8) + i(2+9) = 13+11i$
- b $(4+1) + i(10-8) = 5+2i$
- c $(7-3) + i(6-5) = 4+i$
- d $(\frac{1}{2} + \frac{5}{2}) + i(\frac{1}{3} + \frac{5}{3}) = 3+2i$
- e $(20-11) + i(12-3) = 9+9i$
- f $(2--5) + i(-1-3) = 7-4i$
- g $(-4--8) + i(-6--8) = 4+2i$
- h $(3\sqrt{2}-\sqrt{2}) + i(1--1) = 2\sqrt{2}+2i$
- i $(-2+1--12) + i(-7+3-1) = 11-5i$
- j $(18-15-3) + i(5--2-7) = 0$
- 3 a $14+4i$
- b $24-12i$
- c $(6+2i) + (6+3i) = (6+6) + i(2+3)$
 $= 12+5i$
- d $(20+15i) + (4-8i) = (20+4) + i(15-8)$
 $= 24+7i$
- e $\frac{6-4i}{2} = \frac{6}{2} - \frac{4}{2}i$
 $= 3-2i$
- f $\frac{15+25i}{5} = \frac{15}{5} - \frac{25}{5}i$
 $= 3+5i$
- g $\frac{9+11i}{3} = \frac{9}{3} + \frac{11}{3}i$
 $= 3+\frac{11}{3}i$
- h $\frac{-8+3i}{4} - \frac{7-2i}{2} = -2 + \frac{3}{4}i - \frac{7}{2} + i$
 $= \left(-\frac{4}{2} - \frac{7}{2}\right) + i\left(\frac{3}{4} + \frac{4}{4}\right)$
 $= -\frac{11}{2} + \frac{7}{4}i$
- 4 a $\frac{4-2i}{\sqrt{2}} = \frac{4-2i}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}}$
 $= \frac{4\sqrt{2}-2\sqrt{2}i}{2}$
 $= 2\sqrt{2}-i\sqrt{2}$
- b $\frac{2-6i}{1+\sqrt{3}} = \frac{2-6i}{1+\sqrt{3}} \times \frac{(1-\sqrt{3})}{(1-\sqrt{3})}$
 $= \frac{2-2\sqrt{3}-6i+6\sqrt{3}i}{1-3}$
 $= \frac{2-2\sqrt{3}}{-2} + \frac{6\sqrt{3}-6}{-2}i$
 $= (-1+\sqrt{3}) + (3-3\sqrt{3})i$

$$\begin{aligned}
 5 \text{ a } z - w &= (7 - 6i) - (7 + 6i) \\
 &= (7 - 7) + i(-6 - 6) \\
 &= -12i
 \end{aligned}$$

$$\begin{aligned}
 5 \text{ b } w + z &= (7 + 6i) + (7 - 6i) \\
 &= (7 + 7) + i(6 - 6) \\
 &= 14
 \end{aligned}$$

$$\begin{aligned}
 6 \quad 7 + 2i &= z_2 - z_1 \\
 &= (-3 + bi) - (a + 9i) \\
 &= (-3 - a) + (b - 9)i
 \end{aligned}$$

Equate real parts:

$$7 = -3 - a \Rightarrow a = -10$$

Equate imaginary parts:

$$2 = b - 9 \Rightarrow b = 11$$

$$\begin{aligned}
 7 \text{ a } z_1 - z_2 &= (4 + i) - (7 - 3i) \\
 &= (4 - 7) + i(1 - (-3)) \\
 &= -3 + 4i
 \end{aligned}$$

$$\begin{aligned}
 7 \text{ b } 4z_2 &= 4(7 - 3i) \\
 &= 28 - 12i
 \end{aligned}$$

$$\begin{aligned}
 7 \text{ c } 2z_1 + 5z_2 &= 2(4 + i) + 5(7 - 3i) \\
 &= 8 + 2i + 35 - 15i \\
 &= 43 - 13i
 \end{aligned}$$

$$\begin{aligned}
 8 \text{ a } z + w &= (a + bi) + a - bi \\
 &= 2a
 \end{aligned}$$

So $z + w$ is always real.

$$\begin{aligned}
 8 \text{ b } z - w &= (a + bi) - (a - bi) \\
 &= 2bi
 \end{aligned}$$

So $z - w$ is always imaginary.