1.1) Imaginary and complex numbers

Worked example	Your turn
Write in terms of i:	Write in terms of i:
$\sqrt{-39}$	$\sqrt{-49}$
	$7i$
$\sqrt{-40}$	$\sqrt{-20}$
	$(2\sqrt{5})i$

Worked example	Your turn
Simplify, giving your answers in the form $a + bi$, where $a, b \in \mathbb{R}$: $(2+5i)+(3+4i)$	Simplify, giving your answers in the form $a + bi$, where $a, b \in \mathbb{R}$: $(2+3i)+(4+5i)$ $6+8i$
$(2-5i)-(4-3i)$	$(2-3i)-(4-5i)$ $-2+2i$

Worked example	Your turn
Simplify, giving your answers in the form $a + bi$, where $a, b \in \mathbb{R}$:	Simplify, giving your answers in the form $a + bi$, where $a, b \in \mathbb{R}$:
$2(3 + 4i)$	$-8(9 + 10i)$
	$-72 - 80i$
$-5(6 - 7i)$	

Worked example	Your turn
Simplify, giving your answers in the form $a + bi$, where $a, b \in \mathbb{R}$: $$\frac{6 - 8i}{2}$$ $$\frac{-7 + 21i}{7}$$	Simplify, giving your answers in the form $a + bi$, where $a, b \in \mathbb{R}$: $$\frac{15 - 12i}{3}$$ $$5 - 4i$$

Worked example	Your turn
Given that $z_1 = a + 2i, z_2 = -3 + bi$, and $z_2 - z_1 = 5 + 7i$, find a and b, where $a, b \in \mathbb{R}$	Given that $z_1 = a + 5i, z_2 = -2 + 7i$, and $z_2 - z_1 = 3 + 11i$, find a and b, where $a, b \in \mathbb{R}$ $a = -5, b = 16$

Worked example	Your turn
Given that $z = a + bi$, and $w = a - bi$, where $a, b \in \mathbb{R}$, show that: $z + w$ is always real	Given that $z = a + bi$, and $w = a - bi$, where $a, b \in \mathbb{R}$, show that: $z - w$ is always imaginary $(a + bi) - (a - bi)$ $= a + bi - a + bi$ $= 2bi$ $= (2b)i$

Worked example	Your turn
Solve: $$z^2 = -9$$ $$z^2 + 16 = 0$$	Solve: $$z^2 + 25 = 0$$ $$z = \pm 5i$$

Worked example	Your turn
Solve: $$(z+2)^2+9=0$$ $$(z-3)^2+16=0$$	Solve: $$(z+4)^2+25=0$$ $$z=-4\pm 5i$$

Worked example	Your turn
Solve: $$z^2 + 4z + 13 = 0$$ $$z^2 - 6z + 25 = 0$$	Solve: $$z^2 + 8z + 41 = 0$$ $$z = -4 \pm 5i$$

Worked example	Your turn
Solve: $z^2 + 3z + 13 = 0$ $3z^2 - 7z + 25 = 0$	Solve: $2z^2 - 8z + 41 = 0$ $z = 2 \pm \frac{\sqrt{66}}{2} i$

Worked example	Your turn
The equation $z^2 + bz + 31 = 0$, where $b \in \mathbb{R}$, has distinct, non-real complex roots. Find the range of possible values of b	The equation $z^2 + bz + 13 = 0$, where $b \in \mathbb{R}$, has distinct, non-real complex roots. Find the range of possible values of b $-2\sqrt{13} < b < 2\sqrt{13}$