1.1 Applying Algebraic skills to complex numbers

- **Performing algebraic operations on complex numbers**

1. Express the following in the form $a+ib$

   (a) $c+d$, $c-d$, cd and $\frac{c}{d}$, where $c=k+i$ and $d=2-3i$

   (b) $2a+3b$, $3a-b$, $\frac{a}{b}$ and ab, where $a=2m+i$ and $b=4-3i$

   (c) $x+4y$, $2x-y$, xy and $\frac{y}{x}$, where $x=3-2i$ and $y=w+2i$

   (d) $3v_1-v_2+2v_3$, v_3-3v_2, $\frac{v_1}{v_3}$ and v_1v_2, where $v_1=4-3i$, $v_2=h+i$ and $v_3=3-i$

   (e) $4w_1+3w_2-w_3$, w_1-3w_3, $\frac{w_2}{w_3}$ and w_1w_3, where $w_1=3g-4i$, $w_2=1+i$ and $w_3=2-i$

1.3 Applying geometric skills to complex numbers

- **Performing geometric operations on complex numbers**

2. (a) Given $z=\sqrt{3}+i$

   (i) Find the modulus and argument of z using exact values.

   (ii) Write z in polar form.

(b) Given $z=-1+\sqrt{3}i$ (c) Given $z=-3+\sqrt{3}i$ (d) Given $z=5\sqrt{3}+5i$

(e) Given $z=2\sqrt{3}+6i$ (f) Given $z=-1-i$ (g) Given $z=\sqrt{2}(1+i)$

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Answers:

1 (a) $c+d=2+k-2i$, $c-d=k-2+4i$, $cd=2k+3+(2-3k)i$, $\frac{c}{d}=\frac{2k-3}{13}+\frac{(3k+2)}{13}i$

(b) $2a+3b=4m+12-7i$, $3a-b=6m-4+6i$, $ab=8m+3+2(2-3m)i$, $\frac{a}{b}=\frac{4m-3}{25}+\frac{2(3m+2)}{25}i$

(c) $x+4y=3+4w+6i$, $2x-y=6-w-6i$, $xy=3w+4+2(3-w)i$, $\frac{y}{x}=\frac{3w-4}{13}+\frac{2(w+3)}{13}i$

(d) $3v_1-v_2+2v_3=18-h-12i$, $v_3-3v_2=3-3h-4i$, $\frac{v_1}{v_3}=\frac{3}{2}-\frac{1}{2}i$, $v_1v_2=4h+3+(4-3h)i$

(e) $4w_1+3w_2-w_3=12g+1-12i$, $w_1-3w_3=3g-6-i$, $\frac{w_2}{w_3}=\frac{1}{5}+\frac{3}{5}i$, $w_1w_3=6h-4-(3h+8)i$

2 **(a) modulus =** 2**, argument =** $\frac{p}{6}$**, polar form =** $2(\cos\frac{p}{6}+i\sin\frac{p}{6})$

(b) modulus = 2**, argument =** $\frac{2p}{3}$**, polar form =** $2(\cos\frac{2p}{3}+i\sin\frac{2p}{3})$

(c) modulus = $2\sqrt{3}$ **, argument =** $\frac{5p}{6}$**, polar form =** $2(\cos\frac{5p}{6}+i\sin\frac{5p}{6})$

(d) modulus = 10**, argument =** $\frac{p}{6}$**, polar form =** $10(\cos\frac{p}{6}+i\sin\frac{p}{6})$

(e) modulus = $4\sqrt{3}$**, argument =** $\frac{p}{3}$**, polar form =** $4\sqrt{3}(\cos\frac{p}{3}+i\sin\frac{p}{3})$

(f) modulus = $\sqrt{2}$**, argument =** $\frac{3p}{4}$**, polar form =** $\sqrt{2}(\cos\frac{3p}{4}+i\sin\frac{3p}{4})$

(g) modulus = 2**, argument =** $\frac{p}{4}$**, polar form =** $2(\cos\frac{p}{4}+i\sin\frac{p}{4})$