

- ① (a) $16 + 29i$ (b) $3 + 11i$ (c) $6 - 3i$ (d) 20 (e) $8.3 + 5.3i$
 (f) $3.3 - 2.2i$ (g) $233 - 67i$ (h) $-4i$ (i) $\frac{13+i}{42}$ (j) $3.97 + 1.03i$
 or $\frac{33-22i}{10}$

- ② (a) $6 + 17i$ (b) $-16 + 29i$ (c) $-10 - 5i$ (d) 0 (e) $2 + 34i$
 (f) $-14 + 0.2i$ (g) $-12.09 - 77.35i$ (h) $-\frac{1}{20} - \frac{10}{21}i$ (i) $-\frac{7}{6} + \frac{7}{6}i$

- ③ (a) 3 (b) $161 - 112i$ (c) $10 + 2i$ (d) 41 (e) -41 (f) $9 + 7i$
 (g) $17.7 + 12.2i$ (h) -10 (i) $\frac{5}{16} + \frac{1}{4}i$ (j) $\frac{i}{3}$

- ④ (a) $\frac{3-2i}{13}$ (b) $\frac{1+3i}{2}$ (c) $\frac{11+2i}{25}$ (d) $1+i$ (e) $\frac{3-i}{2}$
 (f) $-5+12i$ (g) $\frac{24+3i}{26}$ (h) $\frac{-41-10i}{13}$ (i) $\frac{4-3i}{5}$

- ⑤ (a) 11 (b) $\sqrt{2}$ (c) 1 (d) 11 (e) $\sqrt{3}$ (f) $\sqrt{5}$
 (g) $\frac{1}{\sqrt{2}}$ (h) $\sqrt{85}$ (i) $\frac{10}{3}$ (j) $\frac{\sqrt{29}}{10}$

- ⑥ (a) 0 (b) π (c) $\frac{\pi}{2}$ (d) $-\frac{\pi}{2}$ (e) $\frac{\pi}{4}$ (f) $\frac{\pi}{6}$
 (g) $\frac{5\pi}{6}$ (h) $\frac{2\pi}{3}$ (i) 0 (j) $\frac{\pi}{5}$

- ⑦ (a) 1 (b) 1 (c) -8 (d) -512 (e) $\frac{2-\sqrt{3}i}{7}$ (f) $\frac{1-4\sqrt{3}i}{49}$
 (g) $-2i$ (h) 16 (i) 1 (j) $\frac{15+8i}{289}$

⑧ (a) $z = \frac{+1 \pm \sqrt{-3}}{2} = \frac{+1 \pm i\sqrt{3}}{2}$

(b) $z = \pm 3i$

(c) $z = 1$ or $z^2 + z + 1 = 0$ so $z = 1$ or $\frac{-1 \pm i\sqrt{3}}{2}$

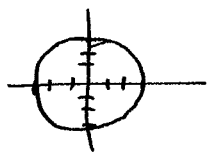
(d) $z = \frac{1+i}{\sqrt{2}}$ or $\frac{-1-i}{\sqrt{2}}$

(e) $z^2 = \pm 3i$ so $z = \pm \sqrt{\frac{3}{2}}(1+i)$

(f) $z^2 = -2$ or -3 so $z = \pm\sqrt{2}i$ or $\pm\sqrt{3}i$.

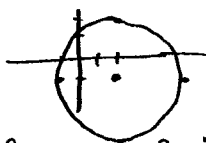
(g) $z^2 = 3$ or -2 so $z = \pm\sqrt{3}$ or $\pm\sqrt{2}i$.

9 (a)



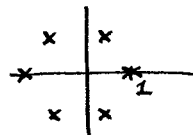
(circle centre 0 radius 3)

(b)



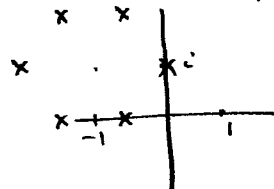
(circle centre $2-i$ radius 3)

(c)



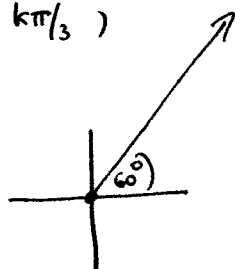
($\text{cis } k\pi/3$)

(d)

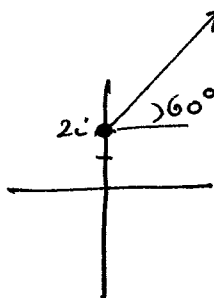


($-1+i + \text{cis } k\pi/3$)

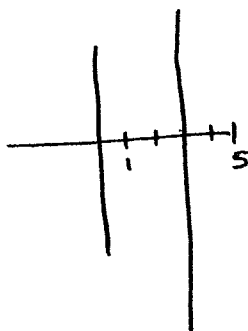
(e)



(f)

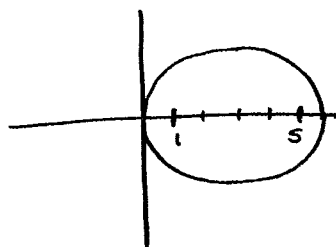


(g)



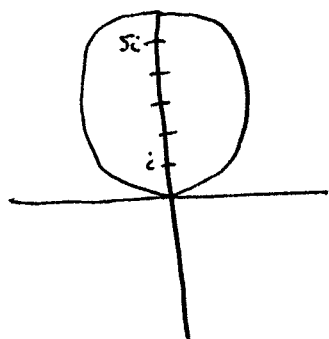
(\perp bisector)

(h)



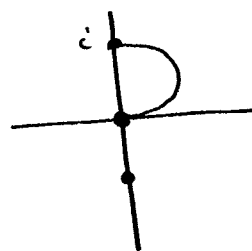
(ellipse)

(i)



(same ellipse rotated 90°)

(j)



(half of the circle centre $i/2$ turn 0 and i).

10

$$\begin{aligned}
 e^{ix} &= 1 + ix + \frac{(ix)^2}{2!} + \frac{(ix)^3}{3!} + \frac{(ix)^4}{4!} + \dots \\
 &= 1 + ix - \frac{x^2}{2!} - i\frac{x^3}{3!} + \frac{x^4}{4!} + i\frac{x^5}{5!} + \dots \\
 &= \left(1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + \dots\right) + i\left(x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \dots\right) = \text{"cis"} x.
 \end{aligned}$$