

**Question**

Describe the following loci in the Argand diagram:

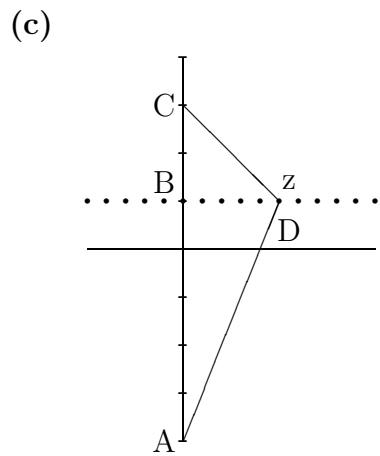
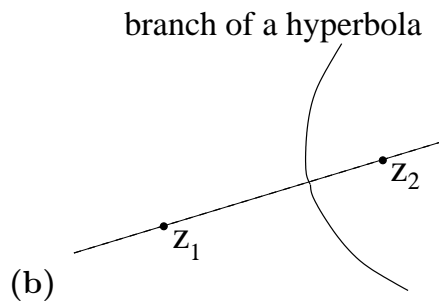
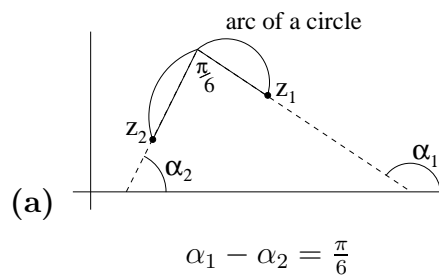
(a)  $\arg\left(\frac{z - z_1}{z - z_2}\right) = \frac{\pi}{6}$

(b)  $|z - z_1| - |z - z_2| = 1$

(c)  $|z + 3i|^2 - |z - 3i|^2 = 12$

(d)  $|z + ik|^2 + |z - ik|^2 = 10k^2$

**Answer**

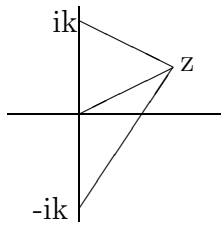


$$\begin{aligned}
|+3i|^2 - |z - 3i|^2 &= AD^2 - CD^2 \\
&= AB^2 + BD^2 - CB^2 - BD^2 \\
&= AB^2 - CB^2 \\
&= (AB + CB)(AB - CB) \\
&= 6(AB - BC) \\
&= 12
\end{aligned}$$

So  $AB - BC = 2$ ,  $AB + BC = 6$ . So B is at  $i$ .

So the locus is the line  $z = a + i$   $a \in \mathbf{R}$

(d)



$$\begin{aligned}
|z + ik|^2 + |z - ik|^2 &= 2k^2 + 2|z|^2 \text{ By Apollonius' Theorem} \\
&= 10k^2
\end{aligned}$$

So  $|z| = 2|k|$  – a circle