$$z := 32 \cdot \left(\cos\left(\frac{\mathrm{Pi}}{3} \right) + I \cdot \sin\left(\frac{\mathrm{Pi}}{3} \right) \right)$$

$$z := 16 + 16\,\mathrm{I}\sqrt{3} \tag{1}$$

$$z1 := 2 \cdot \left(\cos\left(\frac{\mathrm{Pi}}{15} \right) + I \cdot \sin\left(\frac{\mathrm{Pi}}{15} \right) \right)$$

$$z1 := 2\cos\left(\frac{\pi}{15} \right) + 2\,\mathrm{I}\sin\left(\frac{\pi}{15} \right) \tag{2}$$

$$z1^5$$

$$\left(2\cos\left(\frac{\pi}{15} \right) + 2\,\mathrm{I}\sin\left(\frac{\pi}{15} \right) \right)^5 \tag{3}$$

$$simplify(\%)$$

$$16 + 16\,\mathrm{I}\sqrt{3} \tag{4}$$

$$z2 := 2 \cdot \left(\cos\left(\frac{7 \cdot \mathrm{Pi}}{15} \right) + I \cdot \sin\left(\frac{7 \cdot \mathrm{Pi}}{15} \right) \right)$$

$$z2 := 2\cos\left(\frac{7\,\pi}{15} \right) + 2\,\mathrm{I}\sin\left(\frac{7\,\pi}{15} \right) \tag{5}$$

$$z2^5$$

$$\left(2\cos\left(\frac{7\,\pi}{15} \right) + 2\,\mathrm{I}\sin\left(\frac{7\,\pi}{15} \right) \right)^5 \tag{6}$$

$$simplify(\%)$$

$$16 + 16\,\mathrm{I}\sqrt{3} \tag{7}$$

$$z3 := 2 \cdot \left(\cos\left(\frac{13 \cdot \mathrm{Pi}}{15} \right) + I \cdot \sin\left(\frac{13 \cdot \mathrm{Pi}}{15} \right) \right)$$

$$z3 := -2\cos\left(\frac{2\,\pi}{15} \right) + 2\,\mathrm{I}\sin\left(\frac{2\,\pi}{15} \right) \tag{8}$$

$$z3^5$$

$$\left(-2\cos\left(\frac{2\,\pi}{15} \right) + 2\,\mathrm{I}\sin\left(\frac{2\,\pi}{15} \right) \right)^5 \tag{9}$$

$$simplify(\%)$$

$$16 + 16\,\mathrm{I}\sqrt{3} \tag{10}$$

$$z4 := 2 \cdot \left(\cos\left(\frac{19 \cdot \mathrm{Pi}}{15} \right) + I \cdot \sin\left(\frac{19 \cdot \mathrm{Pi}}{15} \right) \right)$$

$$z4 := -2\cos\left(\frac{4\,\pi}{15} \right) - 2\,\mathrm{I}\sin\left(\frac{4\,\pi}{15} \right) \tag{11}$$

$$z4^5$$

$$\left(-2\cos\left(\frac{4\,\pi}{15} \right) - 2\,\mathrm{I}\sin\left(\frac{4\,\pi}{15} \right) \right)^5 \tag{12}$$

simplify(%)

$$16 + 16\,\mathrm{I}\sqrt{3} \tag{13}$$

$z5 := 2\cdot\left(\cos\left(\frac{25\cdot \mathrm{Pi}}{15}\right) + I\cdot\sin\left(\frac{25\cdot \mathrm{Pi}}{15}\right)\right)$

$$z5 := 1 - \mathrm{I}\sqrt{3} \tag{14}$$

$z5^5$

$$\left(1 - \mathrm{I}\sqrt{3}\right)^5 \tag{15}$$

simplify(%)

$$-\left(\mathrm{I}\sqrt{3} - 1\right)^5 \tag{16}$$

Notice if we go beyond the 5th one, we're back to the first one. $\frac{31\,\pi}{15}$ is coterminal with $\frac{\pi}{15}$:

$\frac{31\ \mathrm{Pi}}{15}$

$$\frac{31\,\pi}{15} \tag{17}$$

$z6 := 2\cdot\left(\cos\left(\frac{31\cdot \mathrm{Pi}}{15}\right) + I\cdot\sin\left(\frac{31\cdot \mathrm{Pi}}{15}\right)\right)$

$$z6 := 2\cos\left(\frac{\pi}{15}\right) + 2\,\mathrm{I}\sin\left(\frac{\pi}{15}\right) \tag{18}$$

$z6^5$

$$\left(2\cos\left(\frac{\pi}{15}\right) + 2\,\mathrm{I}\sin\left(\frac{\pi}{15}\right)\right)^5 \tag{19}$$

simplify(%)

$$16 + 16\,\mathrm{I}\sqrt{3} \tag{20}$$