

2.57  
k5

$$\left(\cos x - \frac{1}{2}\right)^2 = \frac{1}{2\sin^2 x} (1 - \cos 2x)$$

$\sin x \neq 0$   
 $|x \neq \pi k|$

$$\cos^2 x - \cos x + \frac{1}{4} = \frac{1}{2\sin^2 x} \cdot 2\sin^2 x$$

$$\cos^2 x - \cos x + \frac{3}{4} = 0$$

$$4\cos^2 x - 4\cos x + 3 = 0$$

$$\cos x = 1.5 \rightarrow \text{no}$$

$$\cos x = -\frac{1}{2} \rightarrow \boxed{x = \pm \frac{2}{3}\pi + 2\pi k}$$

$$a_k = 1.5$$

$$a_{k+1} = -1$$

$$\rightarrow q = \frac{\frac{2}{3}}{-1} = -\frac{2}{3}$$

$$a_{k+2} = \frac{2}{3}$$

$$a_{15} = a_1 q^{14}$$

$$\frac{27}{8} = a_1 \left(-\frac{2}{3}\right)^{14} = a_1 \left(\frac{2}{3}\right)^{14}$$

$$\left(\frac{3}{2}\right)^3 = a_1 \left(\frac{2}{3}\right)^{14}$$

$$\left(\frac{2}{3}\right)^{-3} = a_1 \left(\frac{2}{3}\right)^{14}$$

$$\left(\frac{2}{3}\right)^{-17} = a_1$$

$$a_{k+2} = a_1 q^{k+1}$$

$$\left(\frac{2}{3}\right) = \left(\frac{2}{3}\right)^{-17} \left(-\frac{2}{3}\right)^{k+1}$$

$$\left(\frac{2}{3}\right)^{18} = \left(-\frac{2}{3}\right)^{k+1}$$

$$\boxed{k=17}$$