

三角関数

2800. 合成した三角関数の方程式

$0 \leq \theta < 2\pi$ のとき、
方程式 $\sin \theta + \sqrt{3} \cos \theta = \sqrt{2}$ を
満たす θ の値を求めよ。



今回の学習目標

三角関数を含む方程式

- 角の変換と定義域に注意

三角関数の合成

$A \sin \theta + B \cos \theta$ は、ひとつの波になる。

$$r \cos \alpha \cdot \sin \theta + r \sin \alpha \cdot \cos \theta = r \sin(\theta + \alpha)$$

例 1

$0 \leq \theta < 2\pi$ のとき、
方程式 $\sin \theta - \sqrt{3} \cos \theta = \sqrt{3}$ を解け



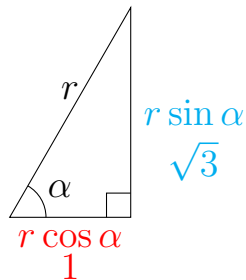
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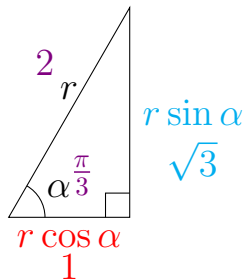
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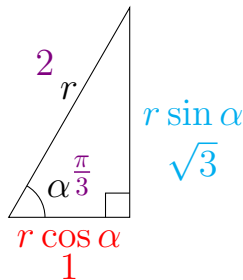


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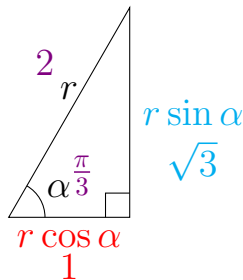
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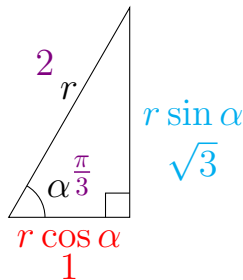
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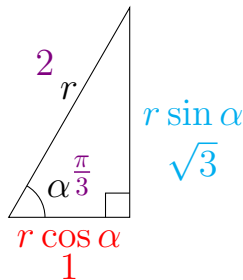
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ここで、 $x = \theta - \frac{\pi}{3}$ と置き換え



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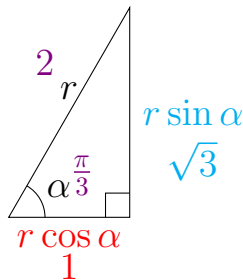
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ここで、 $x = \theta - \frac{\pi}{3}$ と置き換え

$$\sin x = \frac{\sqrt{3}}{2} \quad \left(-\frac{\pi}{3} \leq x < \frac{5}{3}\pi\right)$$



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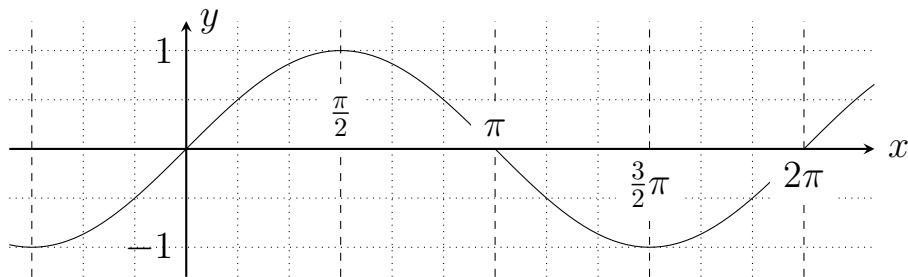
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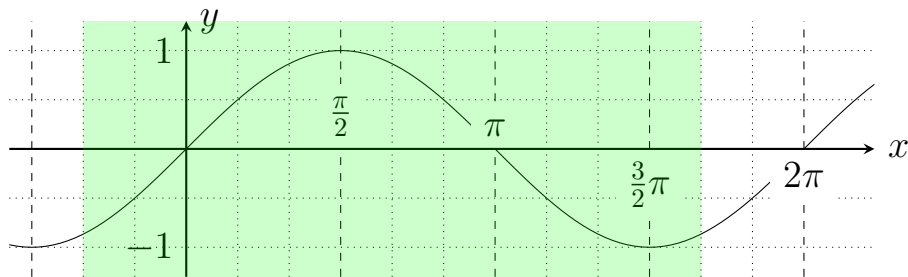
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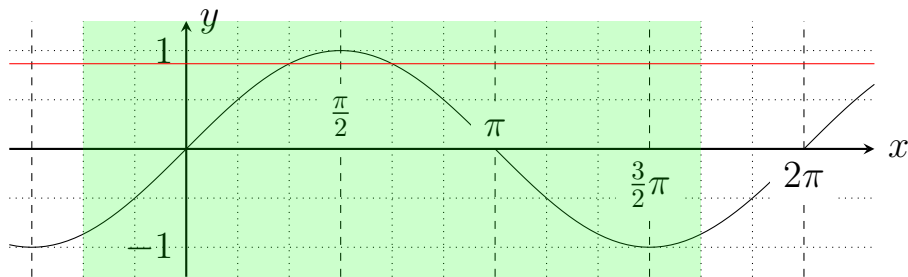
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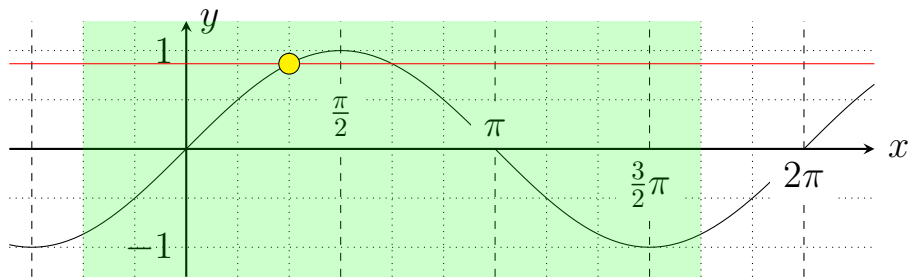
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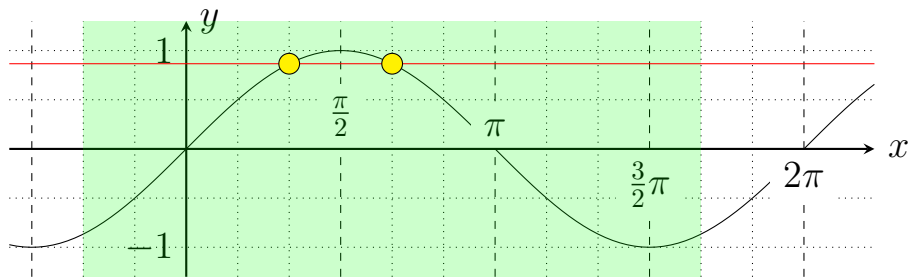
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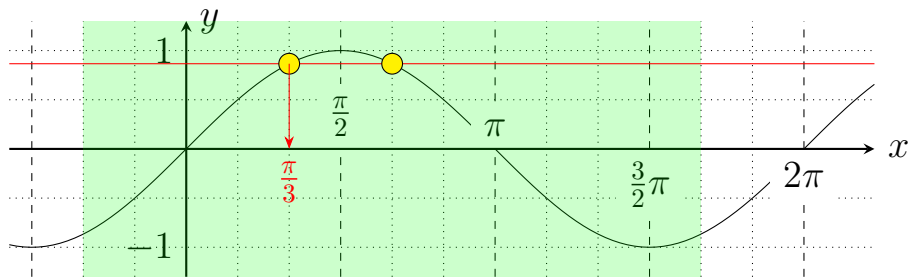
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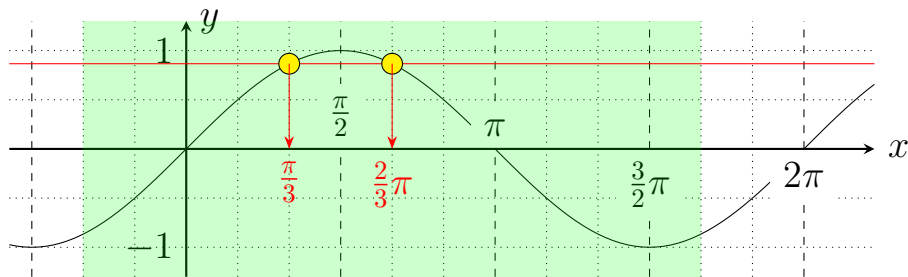
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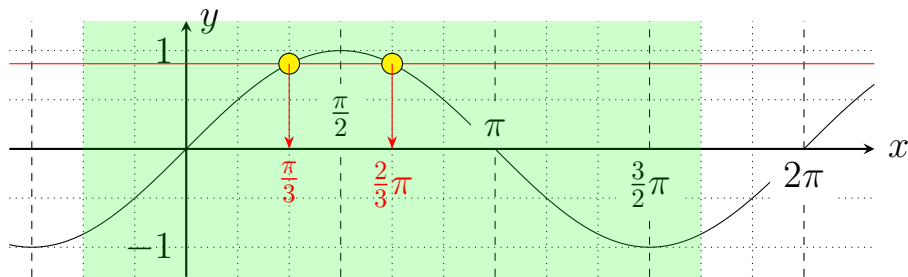
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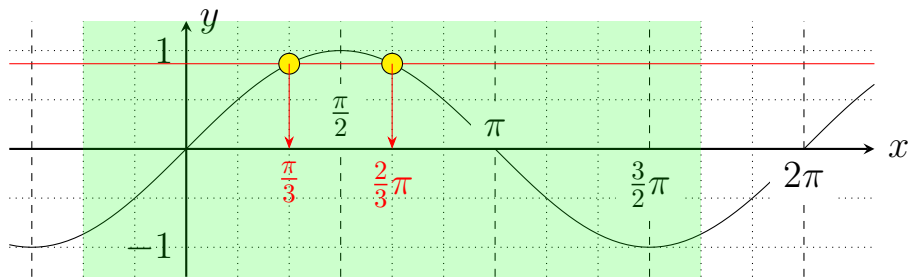


$$x = \frac{\pi}{3}, \frac{2}{3}\pi$$

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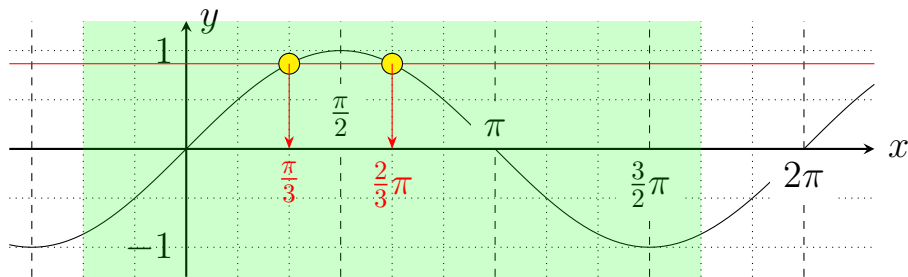


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$$\boxed{\text{答}} \quad \theta = \frac{2}{3}\pi, \pi$$

ビデオを止めて問題を解いてみよう

問 1

$0 \leq \theta < 2\pi$ のとき、次の方程式を満たす θ の値を求めよ。

(1) $\sin \theta + \cos \theta = 1$

(2) $\sin \theta - \cos \theta = \sqrt{2}$

(3) $\sin \theta + \sqrt{3} \cos \theta = \sqrt{2}$



問 1

$$(1) \quad \sin \theta + \cos \theta = 1 \quad (0 \leq \theta < 2\pi)$$

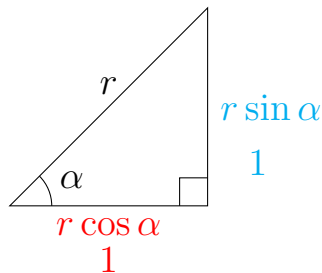


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$$1 \sin \theta + 1 \cos \theta = 1$$

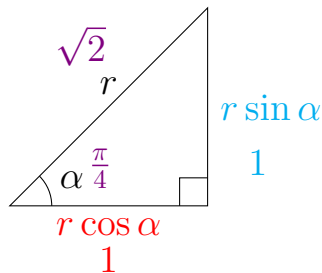
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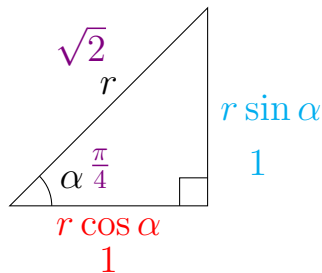
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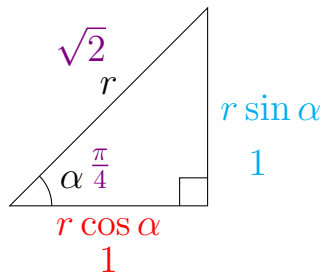


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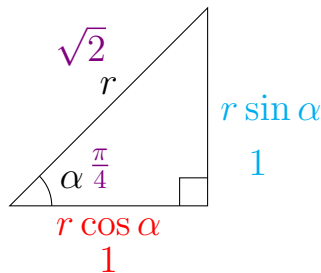
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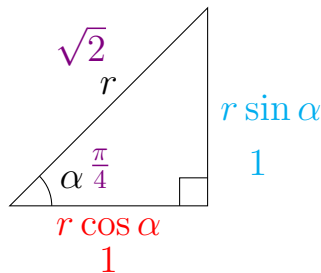
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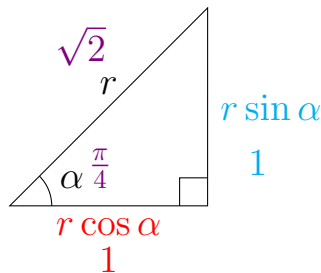
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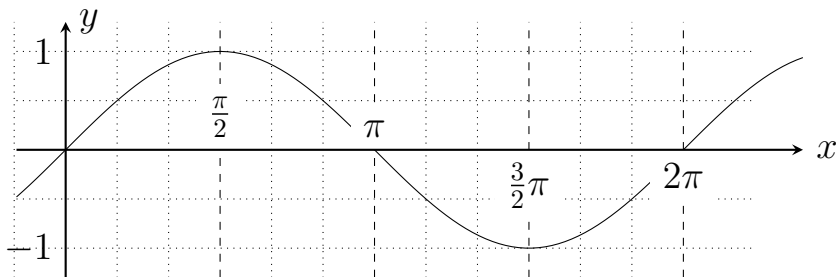


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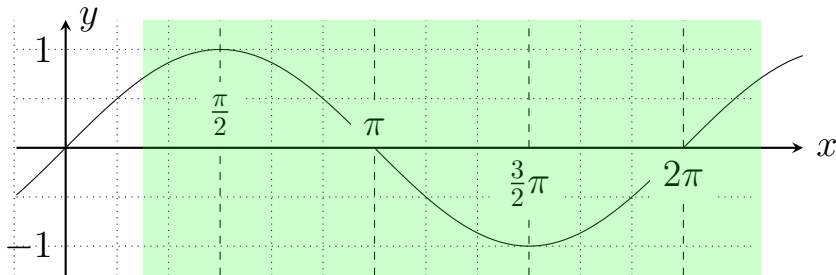
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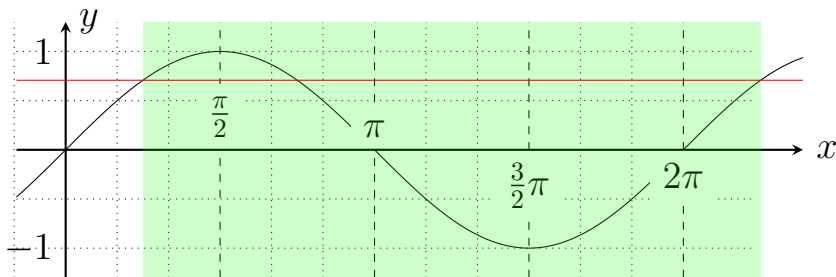
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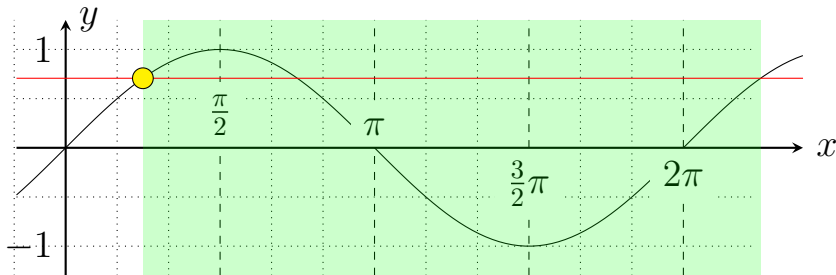
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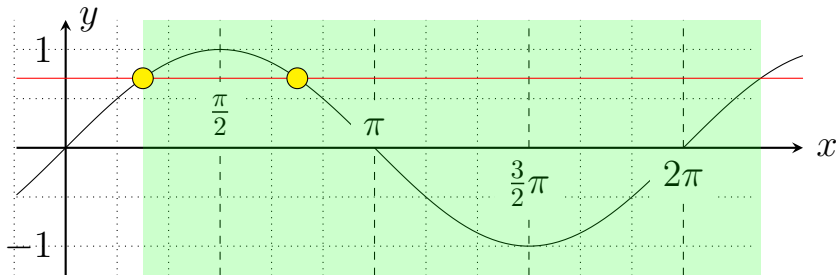
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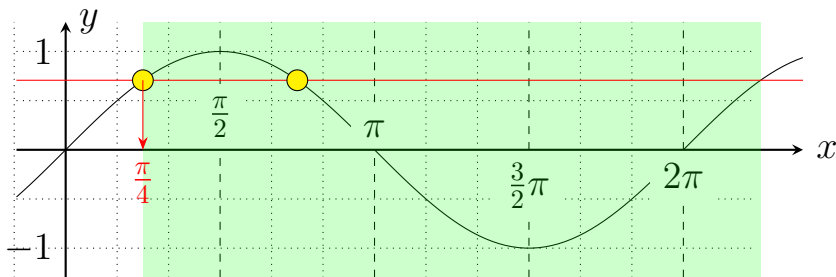
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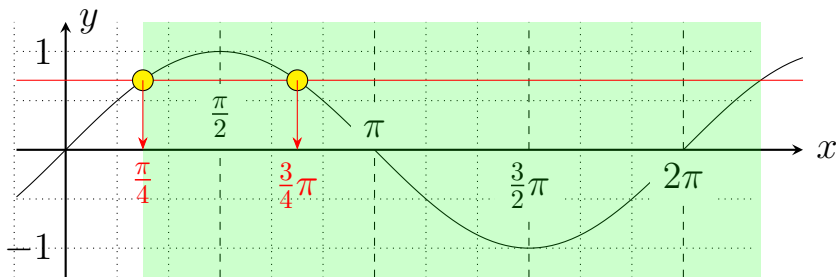
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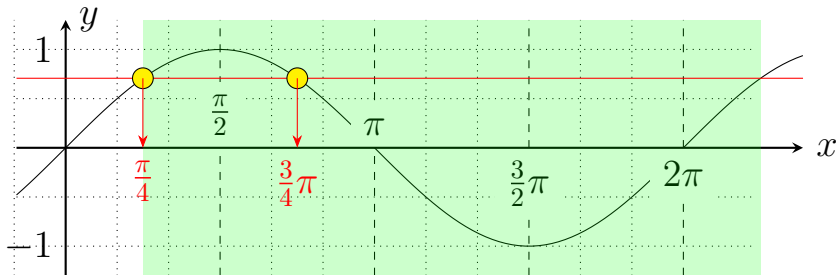
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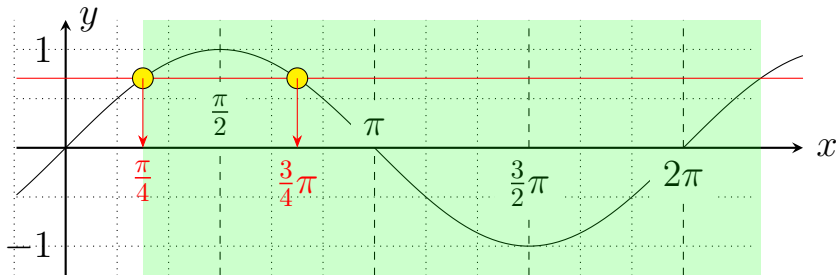
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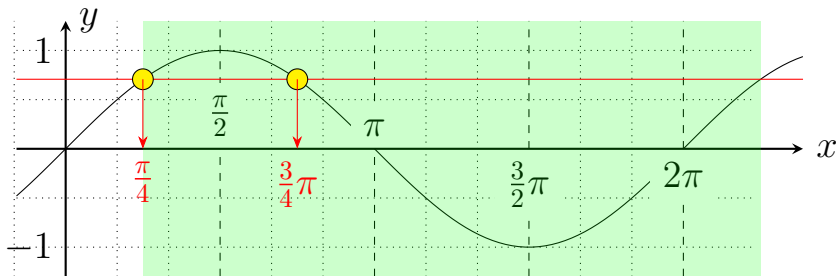
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$$x = \frac{\pi}{4}, \frac{3}{4}\pi \quad \rightarrow \quad \theta = x - \frac{\pi}{4}$$

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答 $\theta = 0, \frac{\pi}{2}$

問 1

$$(2) \quad \sin \theta - \cos \theta = \sqrt{2} \quad (0 \leq \theta < 2\pi)$$

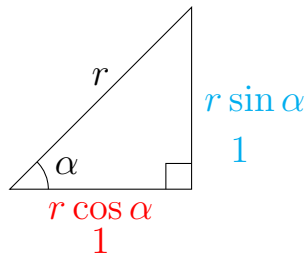


問 1 (2) $\sin \theta - \cos \theta = \sqrt{2} \quad (0 \leq \theta < 2\pi)$

$$1 \sin \theta - 1 \cos \theta = \sqrt{2}$$

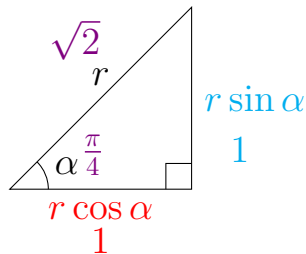
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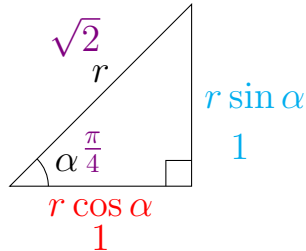
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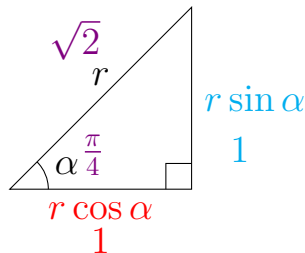


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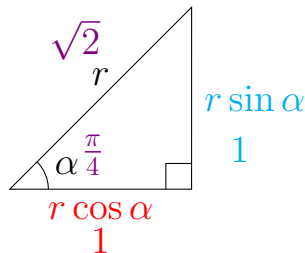
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$$\sqrt{2} \cos \frac{\pi}{4} \sin \theta - \sqrt{2} \sin \frac{\pi}{4} \cos \theta = \sqrt{2}$$

$$\sqrt{2} \sin(\theta - \frac{\pi}{4}) = \sqrt{2}$$

$$\sin(\theta - \frac{\pi}{4}) = 1$$



問 1 (2) $\sin \theta - \cos \theta = \sqrt{2} \quad (0 \leq \theta < 2\pi)$

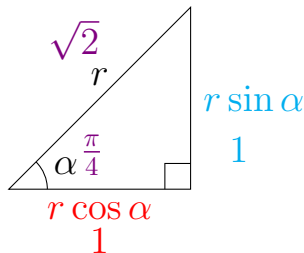
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ここで、 $x = \theta - \frac{\pi}{4}$ と置き換え



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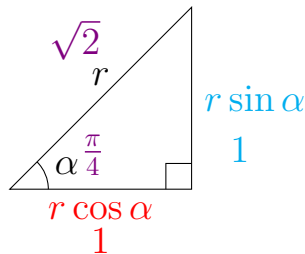
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$$\sin(\theta - \frac{\pi}{4}) = 1$$

ここで、 $x = \theta - \frac{\pi}{4}$ と置き換え

$$\sin x = 1 \quad (-\frac{\pi}{4} \leq x < \frac{7}{4}\pi)$$

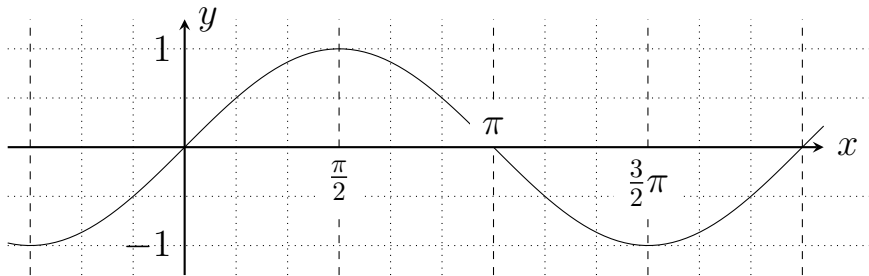


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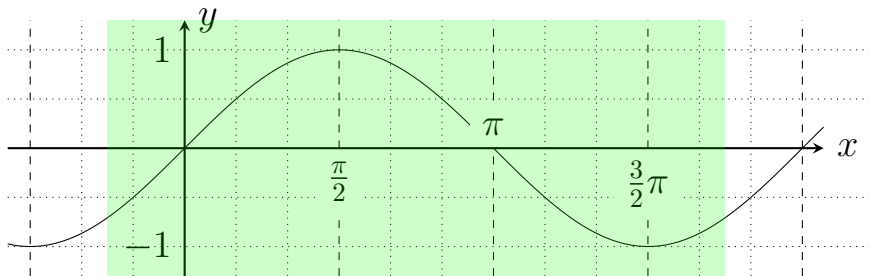
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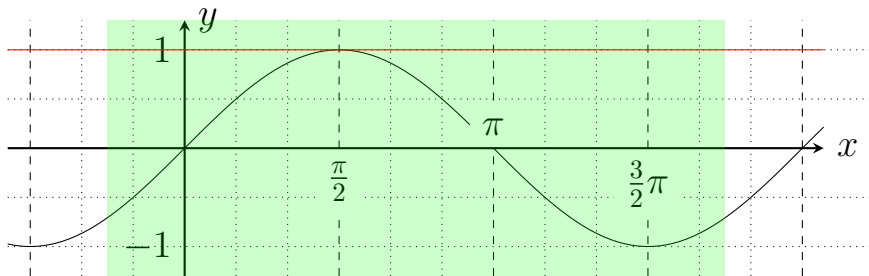
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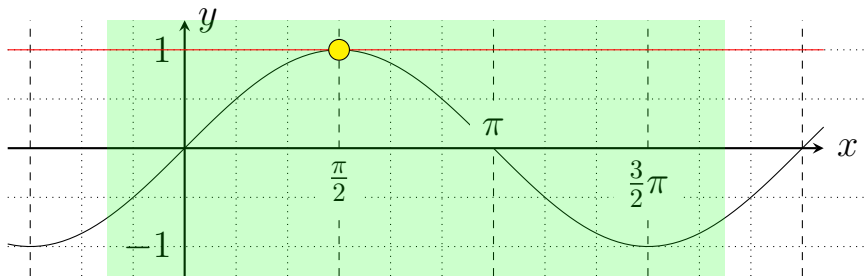
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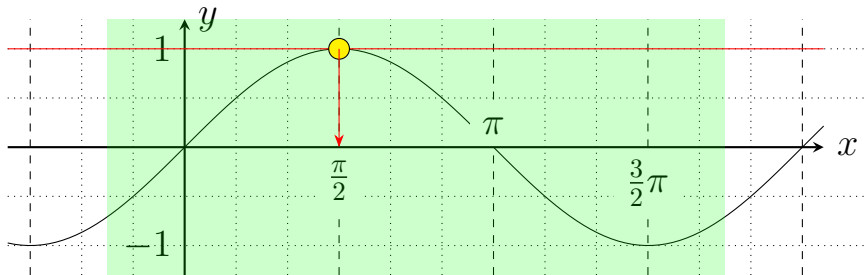
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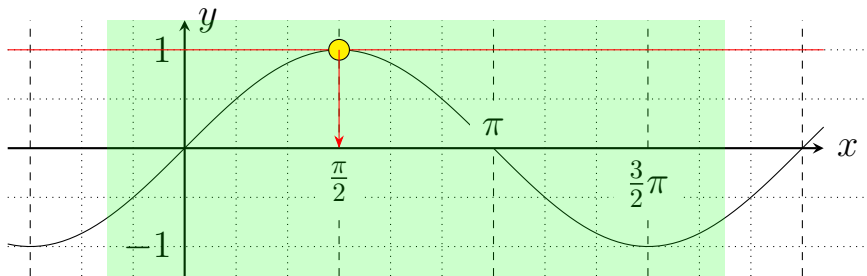
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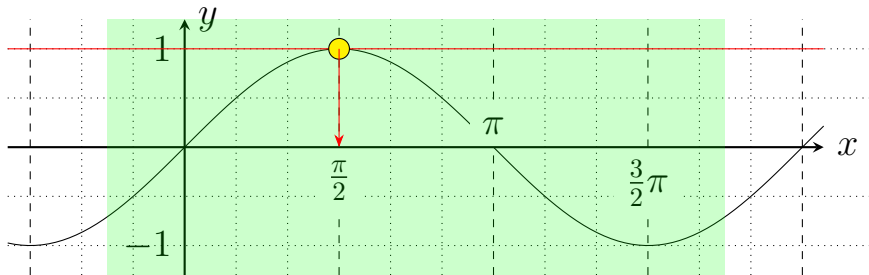
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$$x = \frac{\pi}{2}$$

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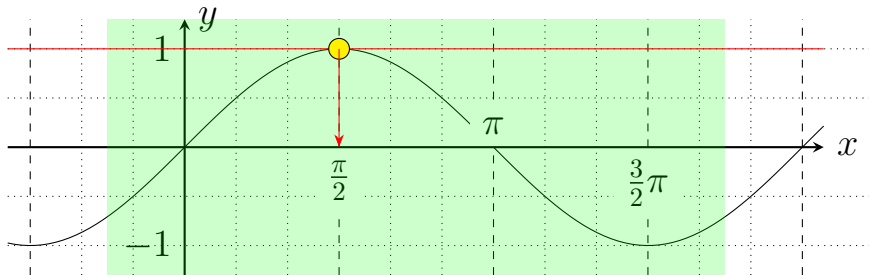
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$$x = \frac{\pi}{2} \quad \rightarrow \quad \theta = x + \frac{\pi}{4}$$

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$$x = \frac{\pi}{2} \quad \rightarrow \quad \theta = x + \frac{\pi}{4}$$

答 $\theta = \frac{3\pi}{4}$

問 1

$$(3) \quad \sin \theta + \sqrt{3} \cos \theta = \sqrt{2} \quad (0 \leq \theta < 2\pi)$$



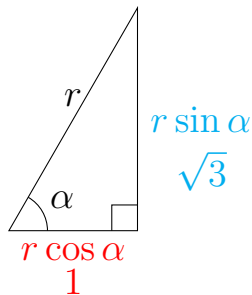
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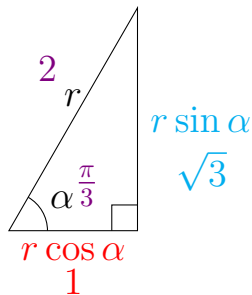
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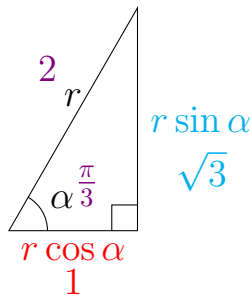
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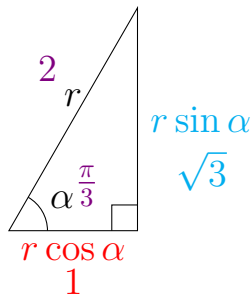


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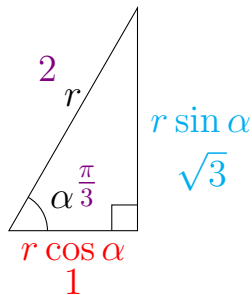
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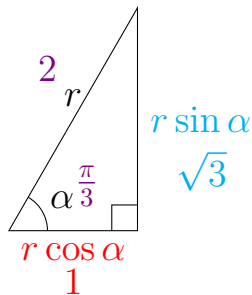
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ここで、 $x = \theta + \frac{\pi}{3}$ と置き換え



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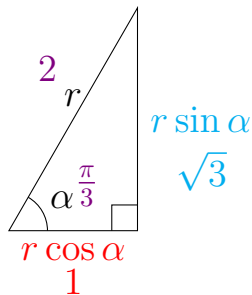
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ここで、 $x = \theta + \frac{\pi}{3}$ と置き換え

$$\sin x = \frac{\sqrt{2}}{2} \quad (\frac{\pi}{3} \leq x < \frac{7}{3}\pi)$$



問 1

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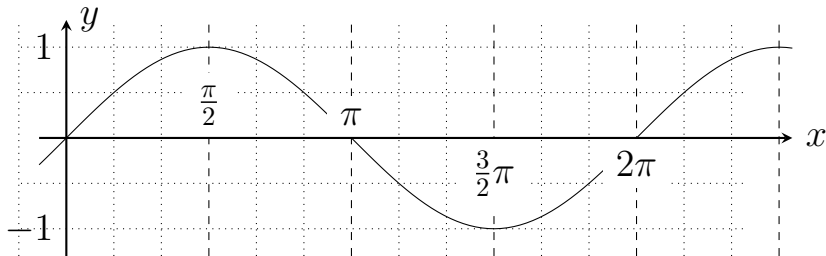
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問 1

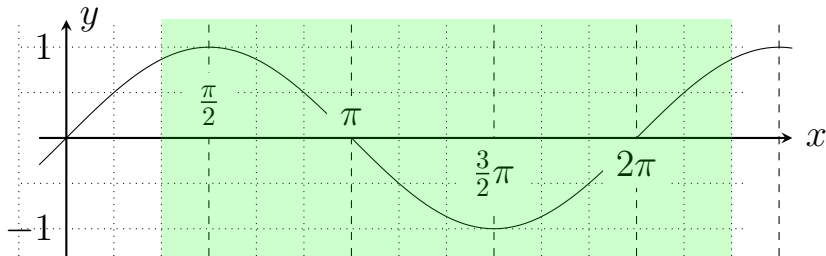
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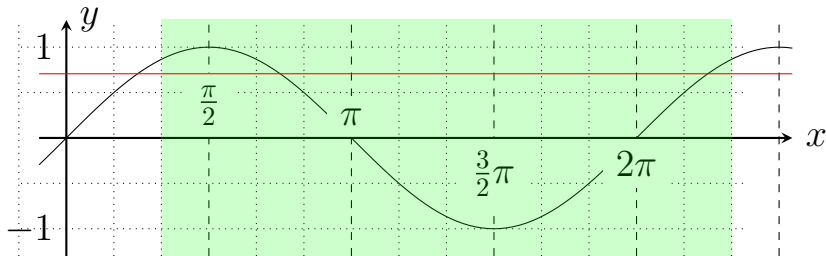
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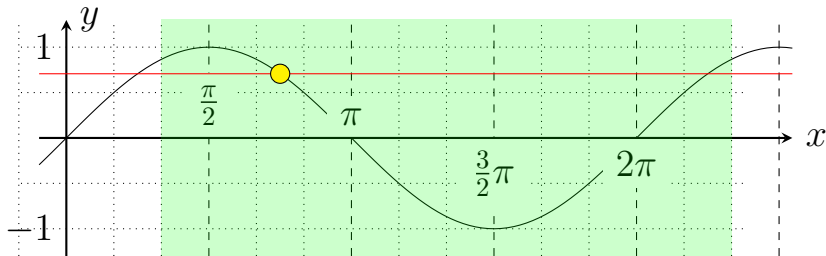
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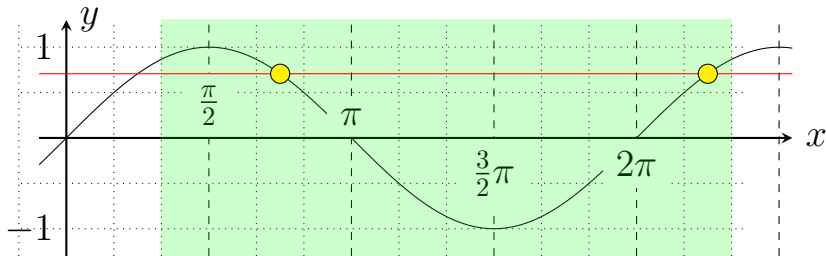
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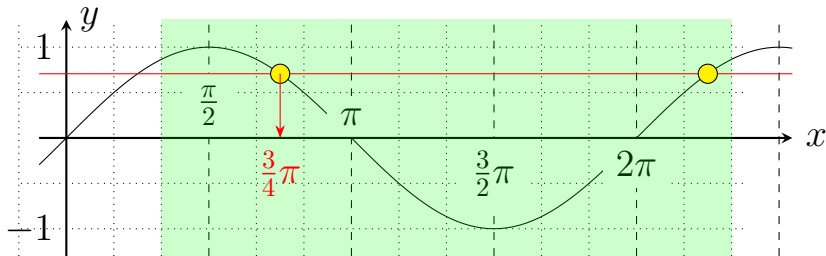
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問 1

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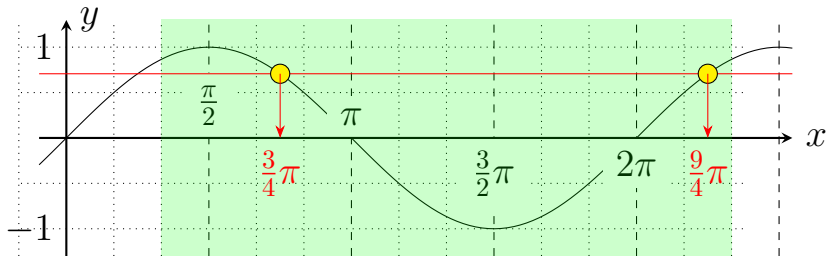
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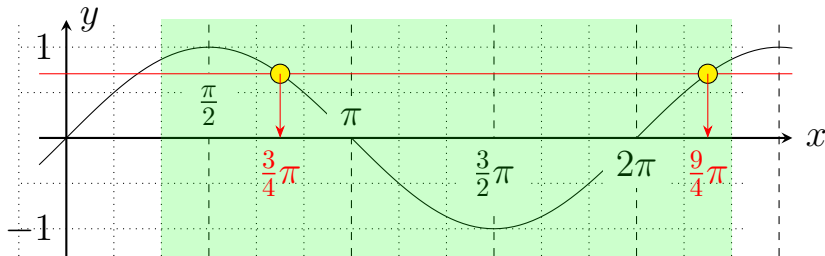
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問 1

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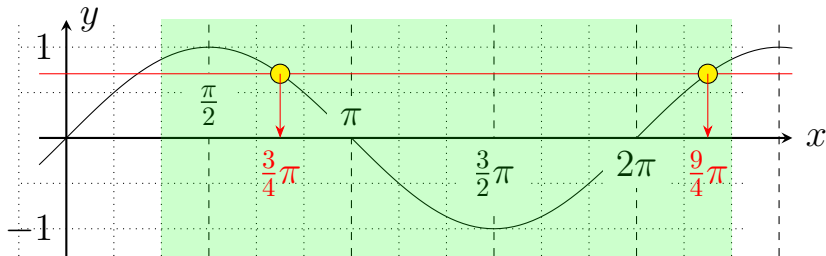
$$x = \frac{3}{4}\pi, \frac{9}{4}\pi$$



問 1

$$(3) \quad \sin \theta + \sqrt{3} \cos \theta = \sqrt{2} \quad (0 \leq \theta < 2\pi)$$

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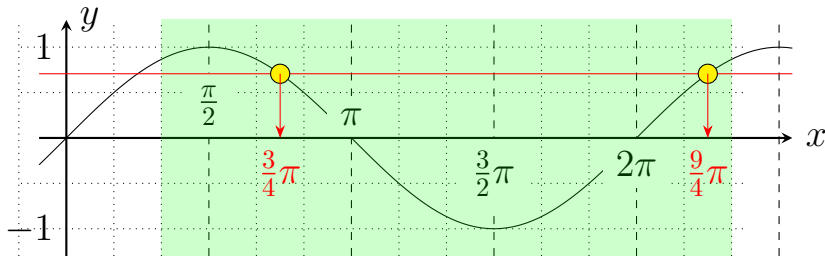


$$x = \frac{3}{4}\pi, \frac{9}{4}\pi \quad \rightarrow \quad \theta = x - \frac{\pi}{3}$$

問 1

$$(3) \quad \sin \theta + \sqrt{3} \cos \theta = \sqrt{2} \quad (0 \leq \theta < 2\pi)$$

$$\sin x = \frac{\sqrt{2}}{2} \quad \left(\frac{\pi}{3} \leq x < \frac{7}{3}\pi\right)$$



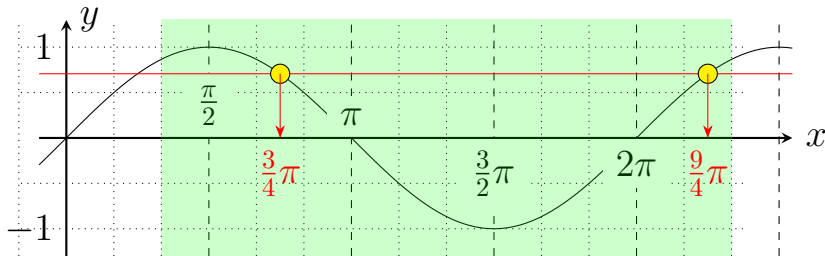
$$x = \frac{3}{4}\pi, \frac{9}{4}\pi \quad \rightarrow \quad \theta = x - \frac{\pi}{3}$$

$$\theta = \frac{3\pi}{4} - \frac{\pi}{3} = \frac{9\pi - 4\pi}{12} = \frac{5\pi}{12}$$

問 1

$$(3) \quad \sin \theta + \sqrt{3} \cos \theta = \sqrt{2} \quad (0 \leq \theta < 2\pi)$$

$$\sin x = \frac{\sqrt{2}}{2} \quad \left(\frac{\pi}{3} \leq x < \frac{7}{3}\pi\right)$$



$$x = \frac{3}{4}\pi, \frac{9}{4}\pi \quad \rightarrow \quad \theta = x - \frac{\pi}{3}$$

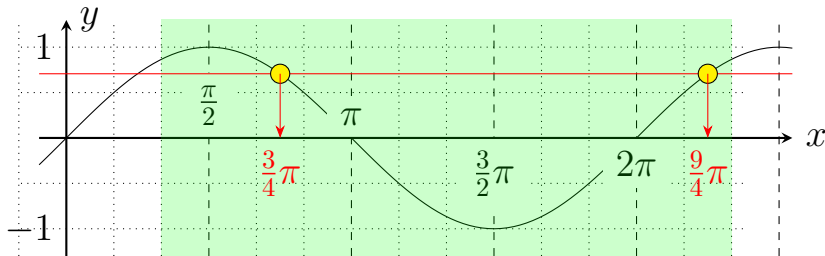
$$\theta = \frac{3\pi}{4} - \frac{\pi}{3} = \frac{9\pi - 4\pi}{12} = \frac{5\pi}{12}$$

$$\theta = \frac{9\pi}{4} - \frac{\pi}{3} = \frac{27\pi - 4\pi}{12} = \frac{23\pi}{12}$$

問 1

$$(3) \quad \sin \theta + \sqrt{3} \cos \theta = \sqrt{2} \quad (0 \leq \theta < 2\pi)$$

$$\sin x = \frac{\sqrt{2}}{2} \quad \left(\frac{\pi}{3} \leq x < \frac{7}{3}\pi\right)$$



$$x = \frac{3}{4}\pi, \frac{9}{4}\pi \quad \rightarrow \quad \theta = x - \frac{\pi}{3}$$

$$\theta = \frac{3\pi}{4} - \frac{\pi}{3} = \frac{9\pi-4\pi}{12} = \frac{5\pi}{12} \quad \theta = \frac{9\pi}{4} - \frac{\pi}{3} = \frac{27\pi-4\pi}{12} = \frac{23\pi}{12}$$

$$\boxed{\text{答}} \quad \theta = \frac{5\pi}{12}, \frac{23\pi}{12}$$

今回の学習目標

三角関数を含む方程式

- 角の変換と定義域に注意