電験どうでしょう管理人
KWG presents

電験オンライン塾

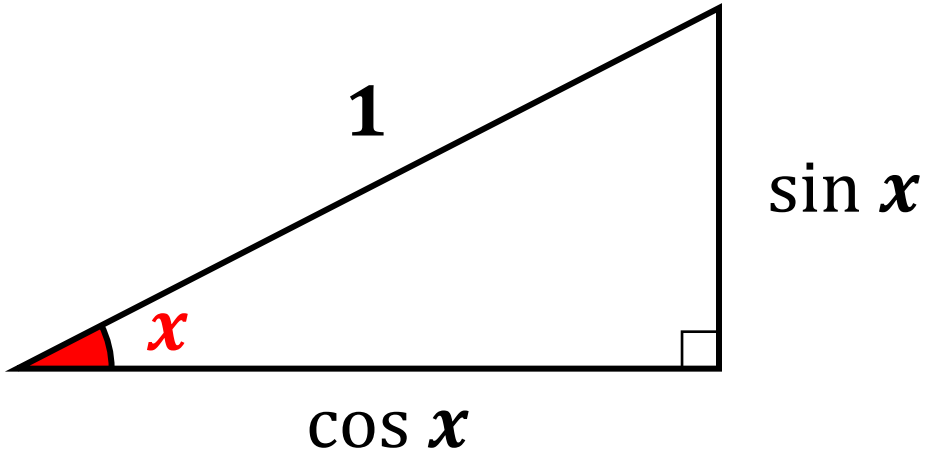
第10回　電気数学
三角関数（2）

2022.11.05 Sat

三角関数

直角三角形の1つの角を変数xで表し、xに対する三角比の値をyとした関数を“三角関数”という

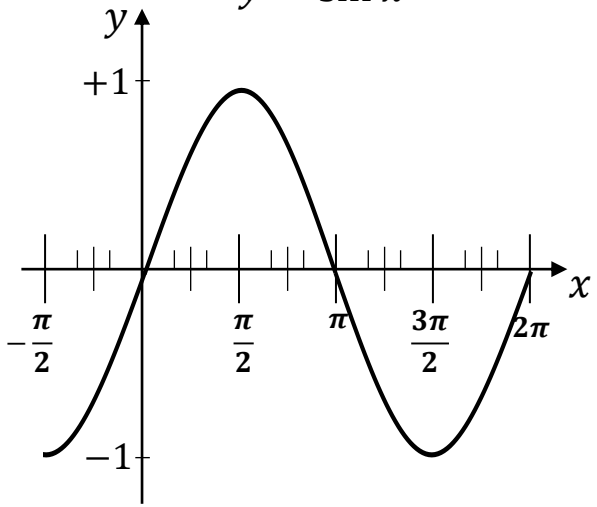
$$y = \sin x$$
$$y = \cos x$$
$$y = \tan x$$



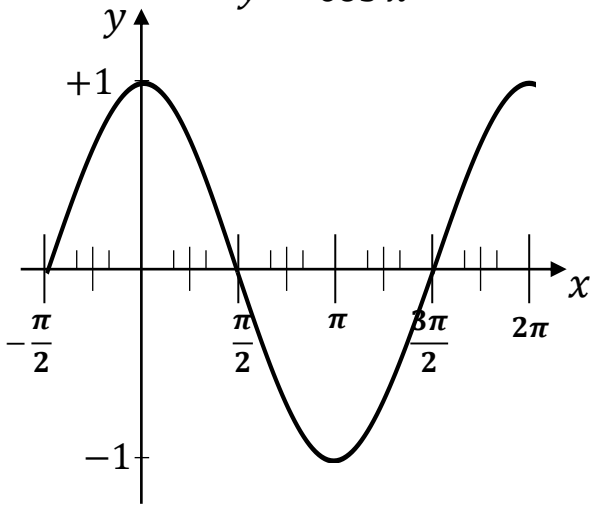
x [rad]	0	$\frac{\pi}{6}$	$\frac{\pi}{4}$	$\frac{\pi}{3}$	$\frac{\pi}{2}$	$\frac{2\pi}{3}$	$\frac{3\pi}{4}$	$\frac{5\pi}{6}$	π	$\frac{7\pi}{6}$	$\frac{5\pi}{4}$	$\frac{4\pi}{3}$	$\frac{3\pi}{2}$	$\frac{5\pi}{3}$	$\frac{7\pi}{4}$	$\frac{11\pi}{6}$	2π
$y = \sin x$	0	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	0	$-\frac{1}{2}$	$-\frac{1}{\sqrt{2}}$	$-\frac{\sqrt{3}}{2}$	-1	$-\frac{\sqrt{3}}{2}$	$-\frac{1}{\sqrt{2}}$	$-\frac{1}{2}$	0
$y = \cos x$	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	0	$-\frac{1}{2}$	$-\frac{1}{\sqrt{2}}$	$-\frac{\sqrt{3}}{2}$	-1	$-\frac{\sqrt{3}}{2}$	$-\frac{1}{\sqrt{2}}$	$-\frac{1}{2}$	0	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	1
$y = \tan x$	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$		$-\sqrt{3}$	-1	$-\frac{1}{\sqrt{3}}$	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$		$-\frac{1}{\sqrt{3}}$	-1	$-\sqrt{3}$	0

三角関数

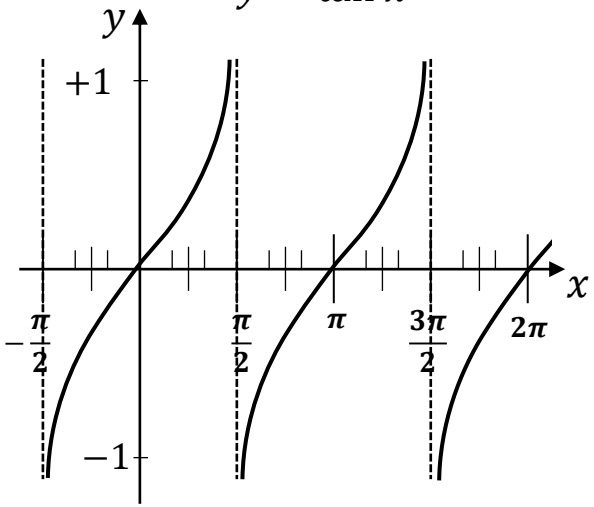
$y = \sin x$



$y = \cos x$



$y = \tan x$

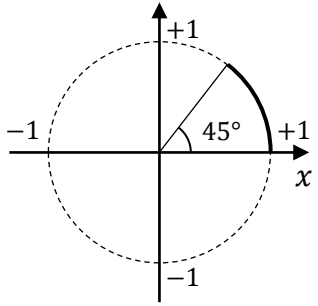


x [rad]	0	$\frac{\pi}{6}$	$\frac{\pi}{4}$	$\frac{\pi}{3}$	$\frac{\pi}{2}$	$\frac{2\pi}{3}$	$\frac{3\pi}{4}$	$\frac{5\pi}{6}$	π	$\frac{7\pi}{6}$	$\frac{5\pi}{4}$	$\frac{4\pi}{3}$	$\frac{3\pi}{2}$	$\frac{5\pi}{3}$	$\frac{7\pi}{4}$	$\frac{11\pi}{6}$	2π
$y = \sin x$	0	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	0	$-\frac{1}{2}$	$-\frac{1}{\sqrt{2}}$	$-\frac{\sqrt{3}}{2}$	-1	$-\frac{\sqrt{3}}{2}$	$-\frac{1}{\sqrt{2}}$	$-\frac{1}{2}$	0
$y = \cos x$	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	0	$-\frac{1}{2}$	$-\frac{1}{\sqrt{2}}$	$-\frac{\sqrt{3}}{2}$	-1	$-\frac{\sqrt{3}}{2}$	$-\frac{1}{\sqrt{2}}$	$-\frac{1}{2}$	0	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	1
$y = \tan x$	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$		$-\sqrt{3}$	-1	$-\frac{1}{\sqrt{3}}$	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$		$-\frac{1}{\sqrt{3}}$	-1	$-\sqrt{3}$	0

練習問題１

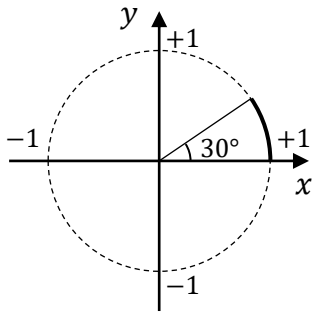
各問に答えよ。各問の円は半径１の単位円である。

（１）



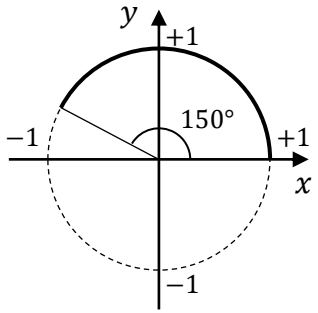
Ans. $\cos 45° =$

（２）



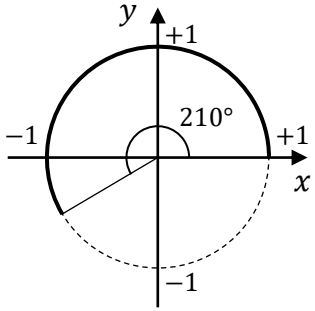
Ans. $\cos 30° =$

（３）



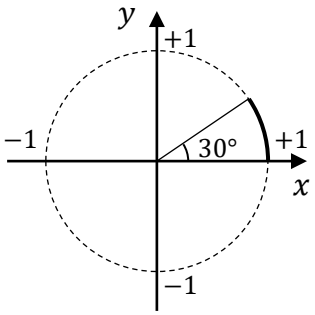
Ans. $\cos 150° =$

（４）



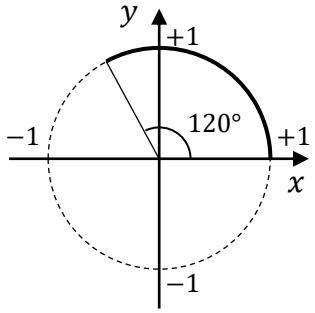
Ans. $\cos 210° =$

（５）



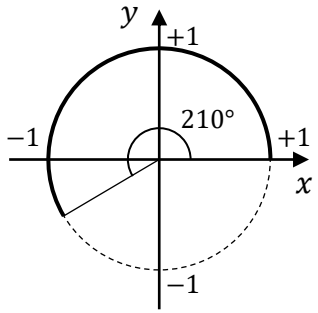
Ans. $\sin 30° =$

（６）



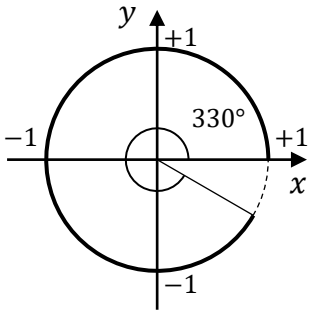
Ans. $\sin 120° =$

（７）



Ans. $\sin 210° =$

（８）



Ans. $\sin 330° =$

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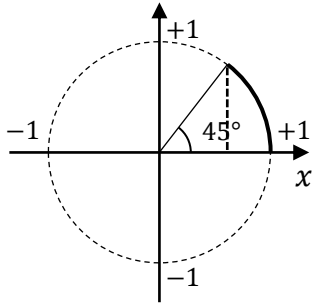
練習問題１（解答）

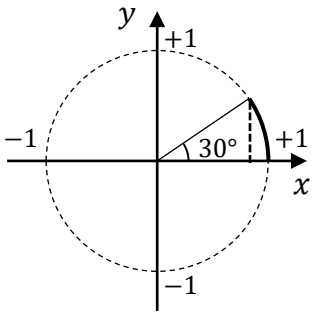
各問に答えよ。各問の円は半径１の単位円である。

（１）



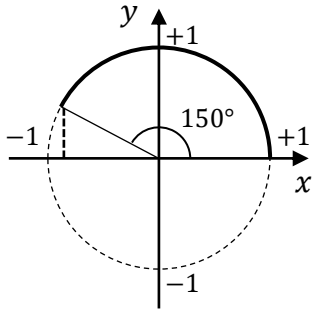
Ans. $\cos 45° = \frac{1}{\sqrt{2}}$

（２）



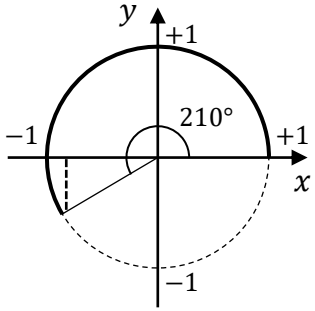
Ans. $\cos 30° = \frac{\sqrt{3}}{2}$

（３）



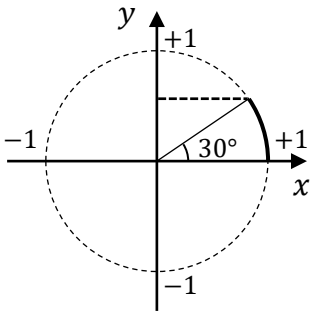
Ans. $\cos 150° = -\frac{\sqrt{3}}{2}$

（４）



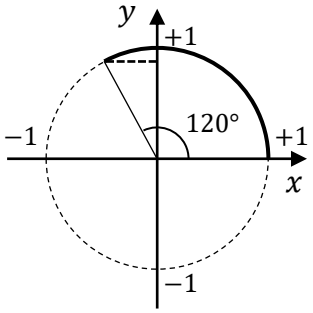
Ans. $\cos 210° = -\frac{\sqrt{3}}{2}$

（５）



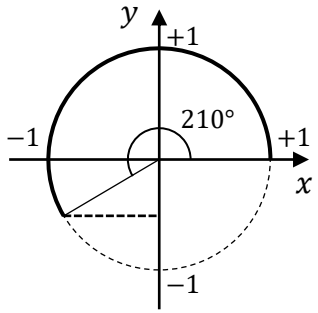
Ans. $\sin 30° = \frac{1}{2}$

（６）



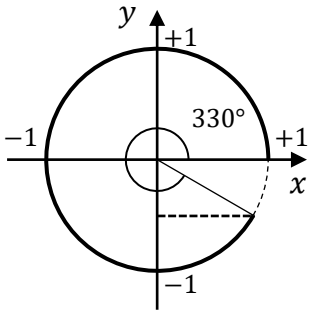
Ans. $\sin 120° = \frac{\sqrt{3}}{2}$

（７）



Ans. $\sin 210° = -\frac{1}{2}$

（８）



Ans. $\sin 330° = -\frac{1}{2}$

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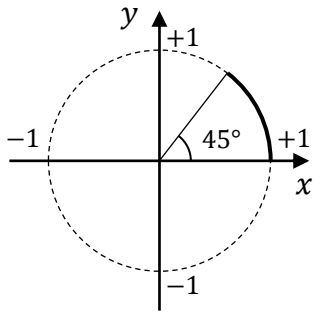
練習問題2

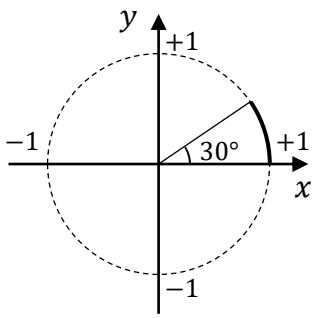
各問に答えよ。各問の円は半径１の単位円である。

（１）



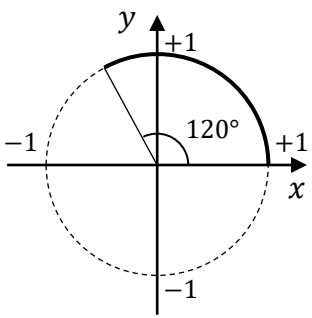
Ans. $\tan 45° =$

（２）



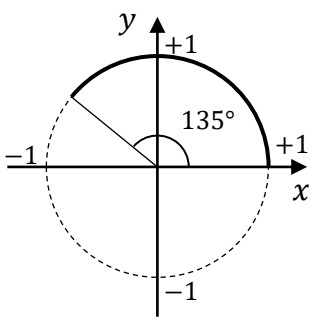
Ans. $\tan 30° =$

（３）



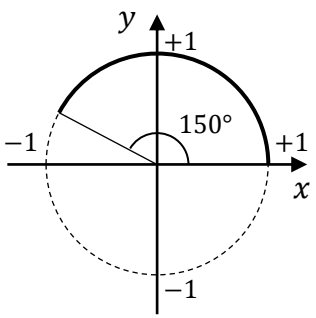
Ans. $\tan 120° =$

（４）



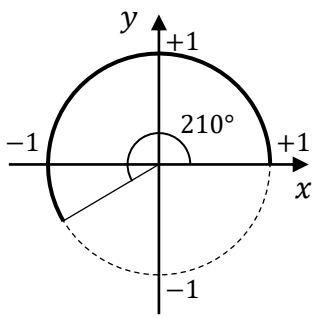
Ans. $\tan 135° =$

（５）



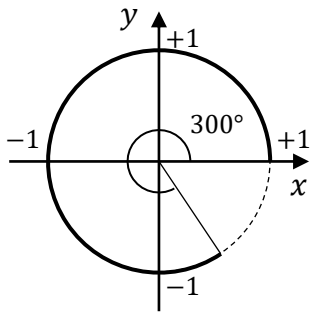
Ans. $\tan 150° =$

（６）



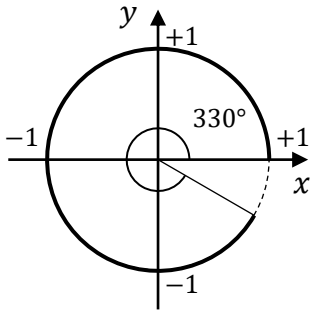
Ans. $\tan 210° =$

（７）



Ans. $\tan 300° =$

（８）



Ans. $\tan 330° =$

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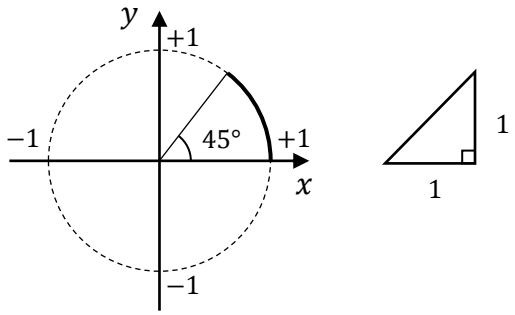
練習問題2（解答）

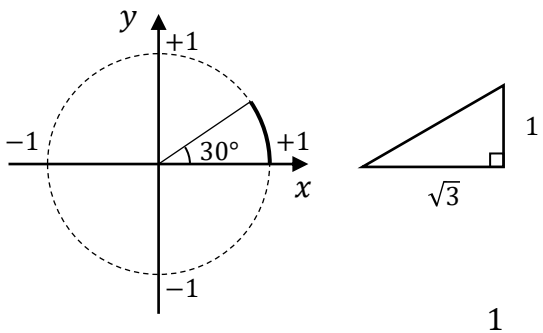
各問に答えよ。各問の円は半径１の単位円である。

（1）



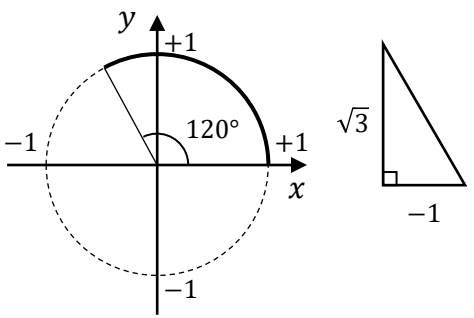
Ans. $\tan 45° = 1$

（2）



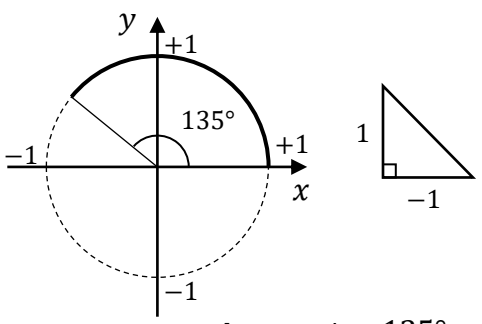
Ans. $\tan 30° = \frac{1}{\sqrt{3}}$

（3）



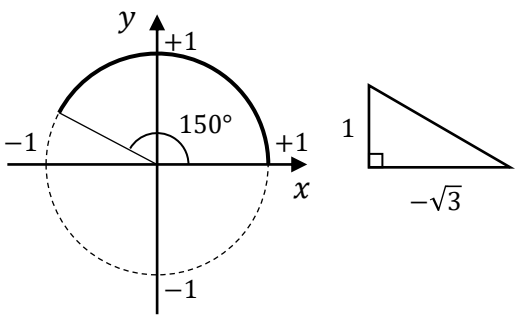
Ans. $\tan 120° = -\sqrt{3}$

（4）



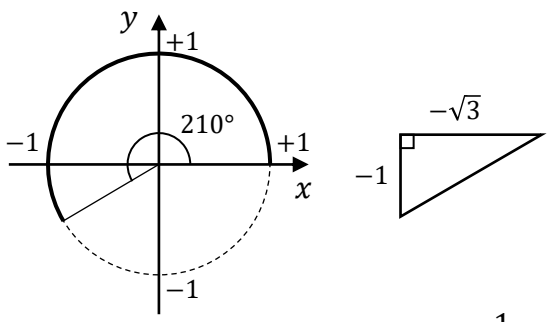
Ans. $\tan 135° = -1$

（5）



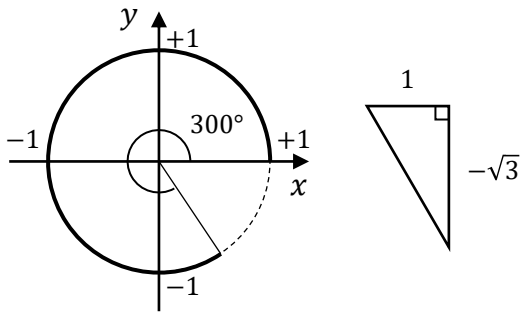
Ans. $\tan 150° = -\frac{1}{\sqrt{3}}$

（6）



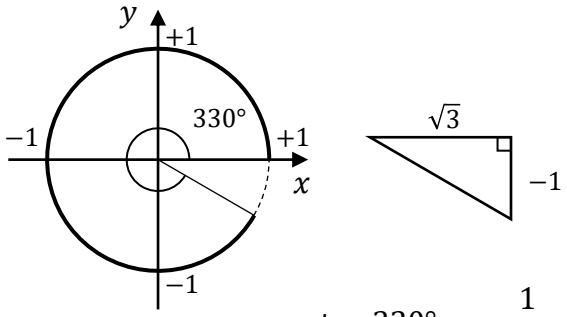
Ans. $\tan 210° = \frac{1}{\sqrt{3}}$

（7）



Ans. $\tan 300° = -\sqrt{3}$

（8）



Ans. $\tan 330° = -\frac{1}{\sqrt{3}}$

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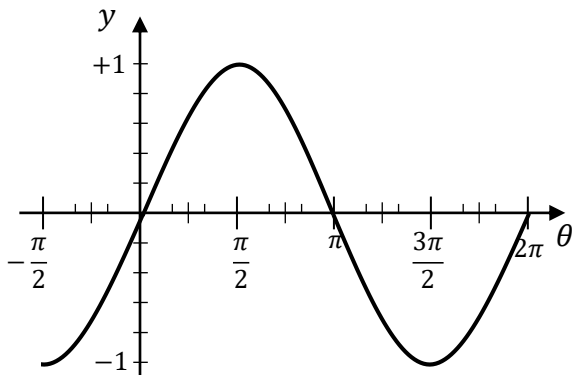
練習問題3

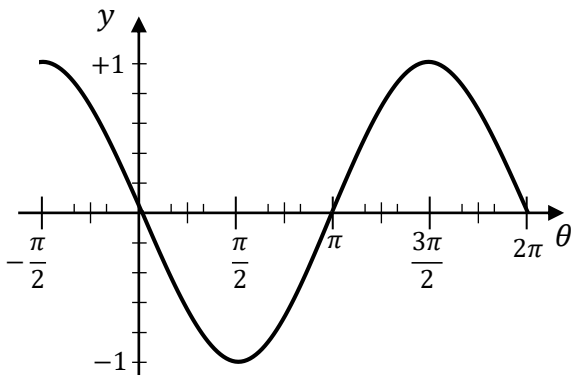
グラフを参照し、各問に答えよ。

（1） $y=1$となる角度[rad]示せ



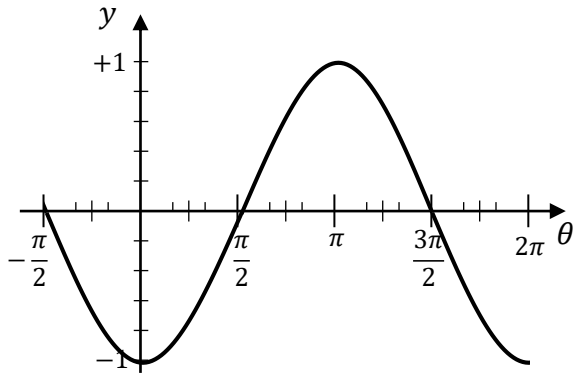
Ans. $\theta=$

（2） $y=1$となる角度[rad]示せ



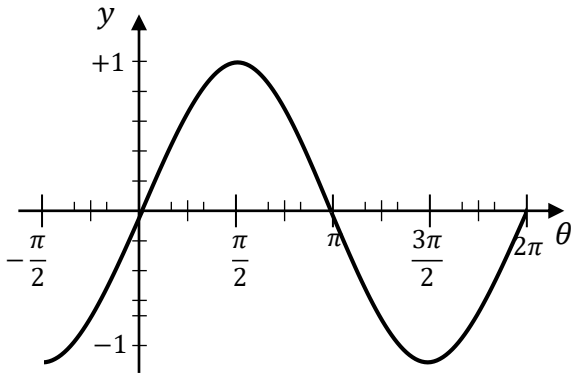
Ans. $\theta=$

（3） $y=1$となる角度[rad]示せ



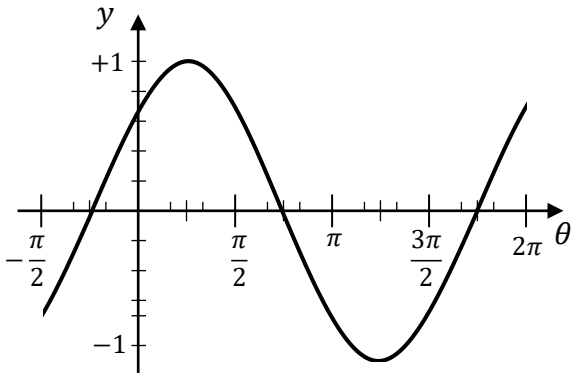
Ans. $\theta=$

（4） $y=0$となる角度[rad]示せ



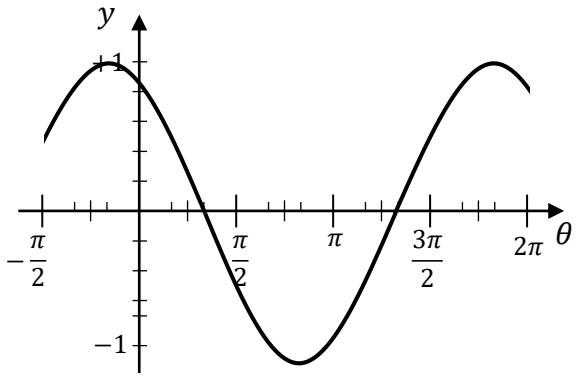
Ans. $\theta=$

（5） $y=0$となる角度[rad]示せ



Ans. $\theta=$

（6） $y=0$となる角度[rad]示せ



Ans. $\theta=$

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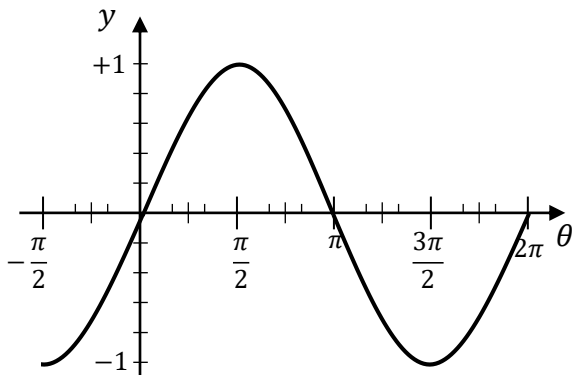
練習問題3（解答）

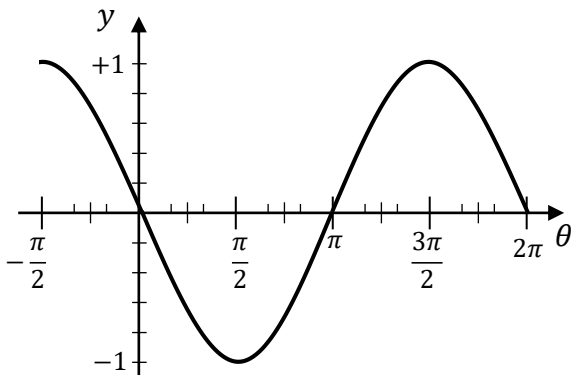
グラフを参照し、各問に答えよ。

（1） $y=1$となる角度[rad]示せ



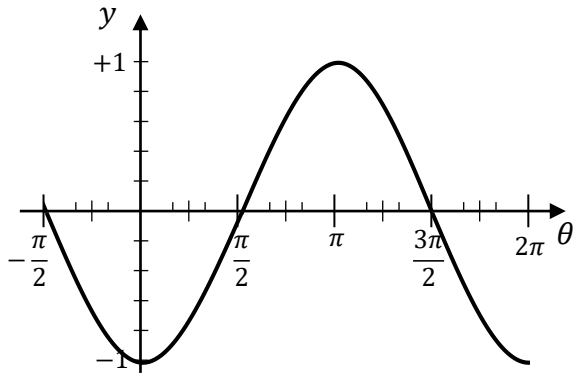
Ans. $\theta=\frac{\pi}{2}$

（2） $y=1$となる角度[rad]示せ



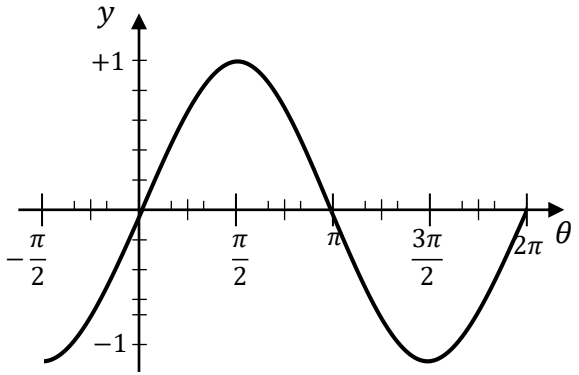
Ans. $\theta=\frac{3\pi}{2}$

（3） $y=1$となる角度[rad]示せ



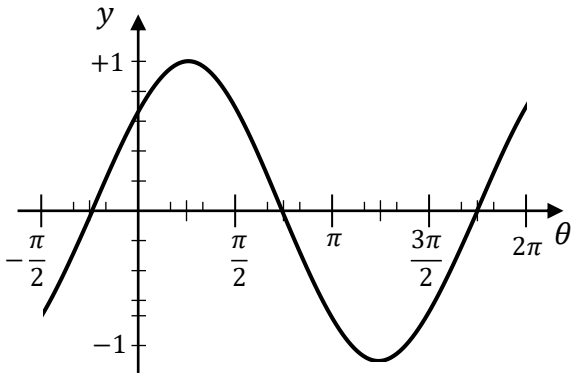
Ans. $\theta=\pi$

（4） $y=0$となる角度[rad]示せ



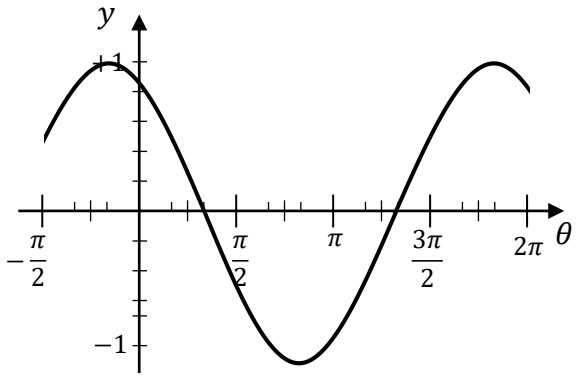
Ans. $\theta=0,\pi,2\pi$

（5） $y=0$となる角度[rad]示せ



Ans. $\theta=-\frac{\pi}{4},\frac{3\pi}{4},\frac{5\pi}{4}$

（6） $y=0$となる角度[rad]示せ



Ans. $\theta=\frac{\pi}{3},\frac{4\pi}{3}$

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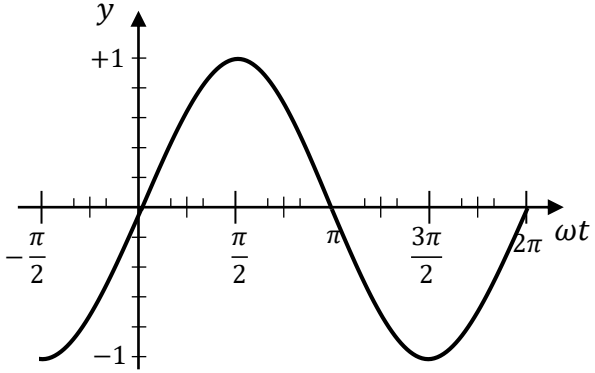
練習問題4

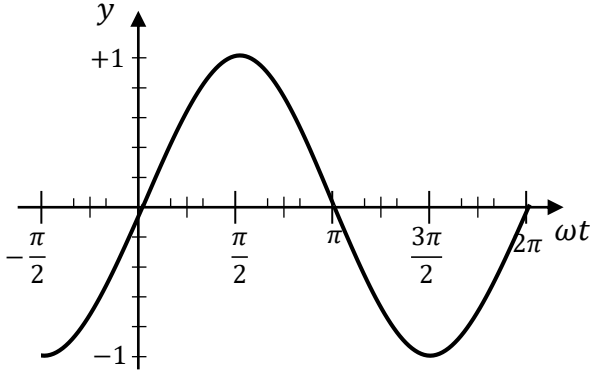
グラフを参照し、各問に答えよ。

（1） $\omega t = \frac{\pi}{2}$ における y の値



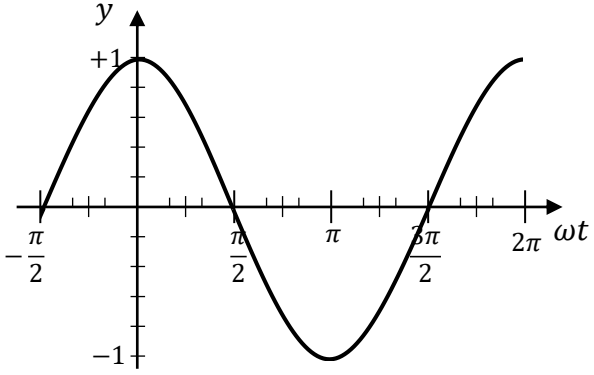
Ans. $y =$

（2） $\omega t = \frac{4\pi}{3}$ における y の値



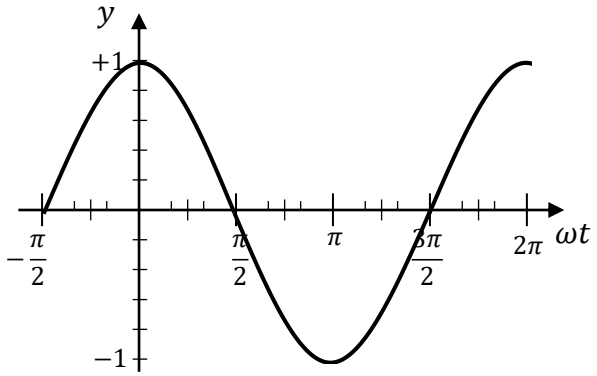
Ans. $y =$

（3） $\omega t = \frac{\pi}{6}$ における y の値



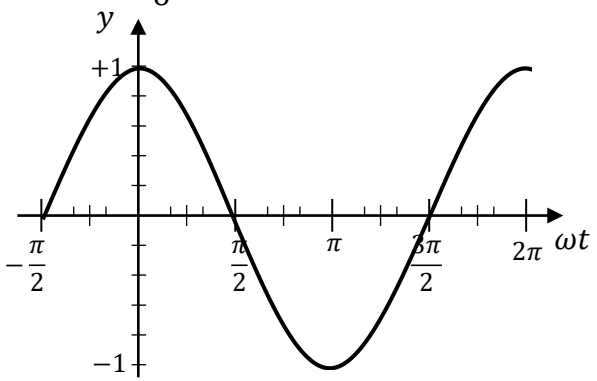
Ans. $y =$

（4） $\omega t = \frac{\pi}{3}$ における y の値



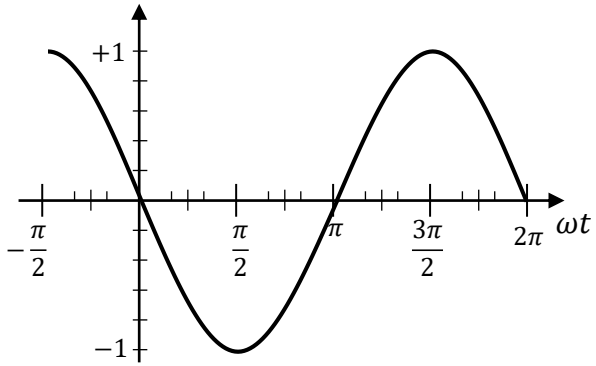
Ans. $y =$

（5） $\omega t = \frac{7\pi}{6}$ における y の値



Ans. $y =$

（6） $\omega t = \frac{3\pi}{4}$ における y の値



Ans. $y =$

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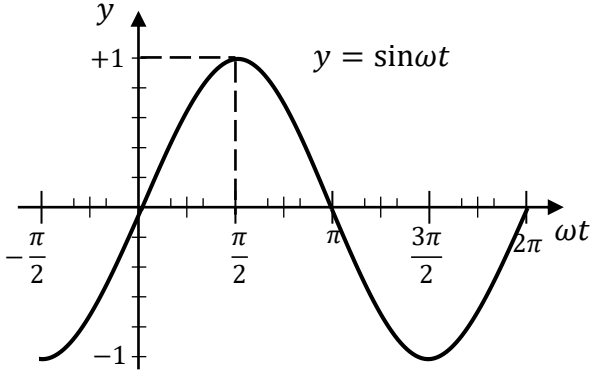
練習問題4（解答）

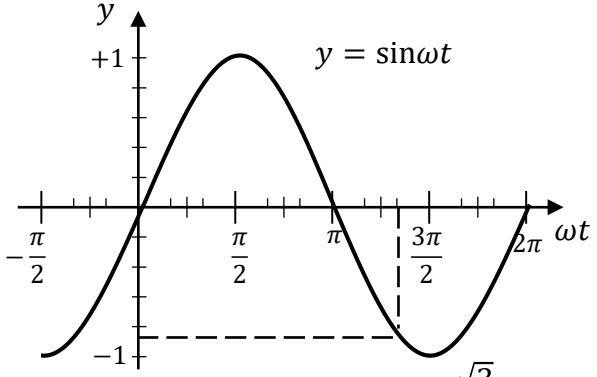
グラフを参照し、各問に答えよ。

（1） $\omega t = \frac{\pi}{2}$ における y の値



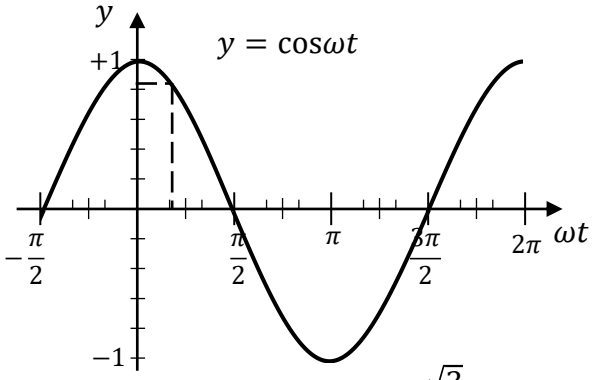
Ans. $y = 1$

（2） $\omega t = \frac{4\pi}{3}$ における y の値



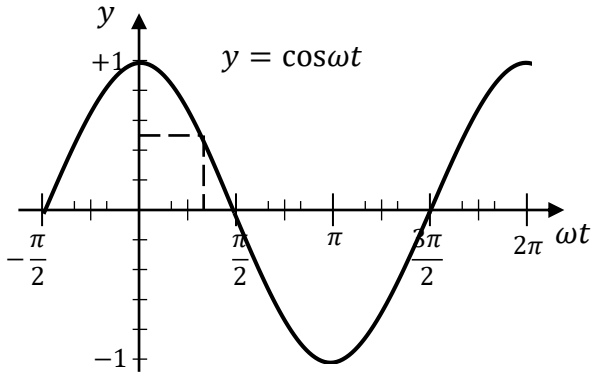
Ans. $y = -\frac{\sqrt{3}}{2}$

（3） $\omega t = \frac{\pi}{6}$ における y の値



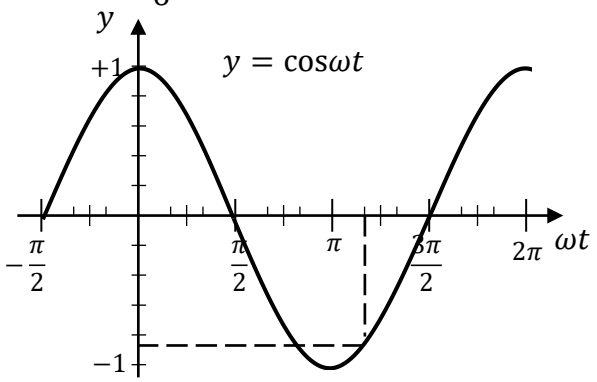
Ans. $y = \frac{\sqrt{3}}{2}$

（4） $\omega t = \frac{\pi}{3}$ における y の値



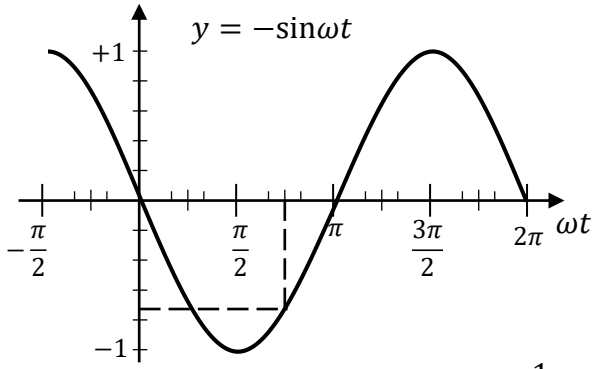
Ans. $y = \frac{1}{2}$

（5） $\omega t = \frac{7\pi}{6}$ における y の値



Ans. $y = -\frac{\sqrt{3}}{2}$

（6） $\omega t = \frac{3\pi}{4}$ における y の値



Ans. $y = -\frac{1}{\sqrt{2}}$

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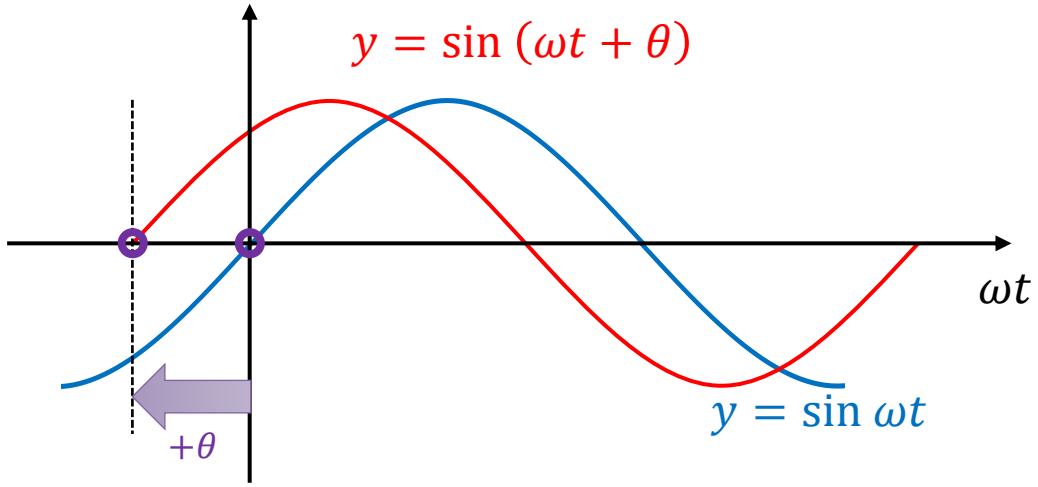
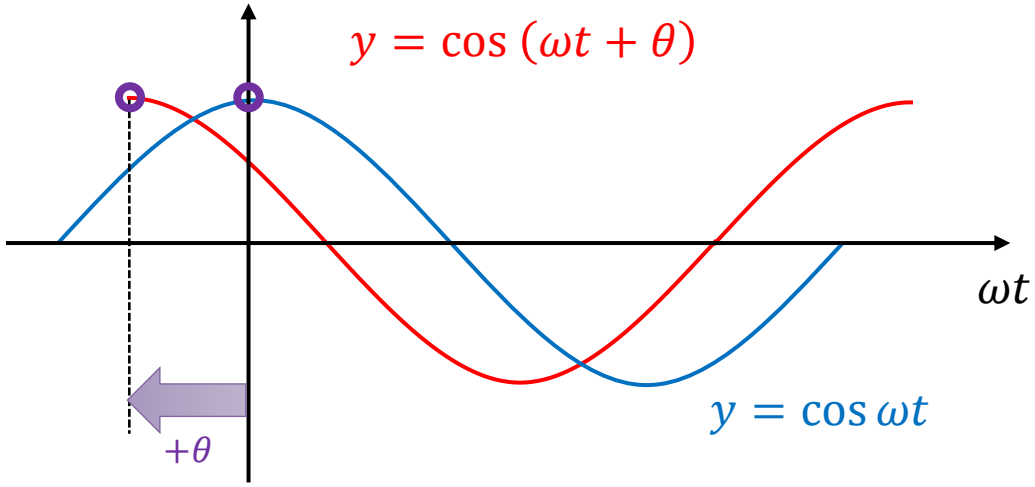
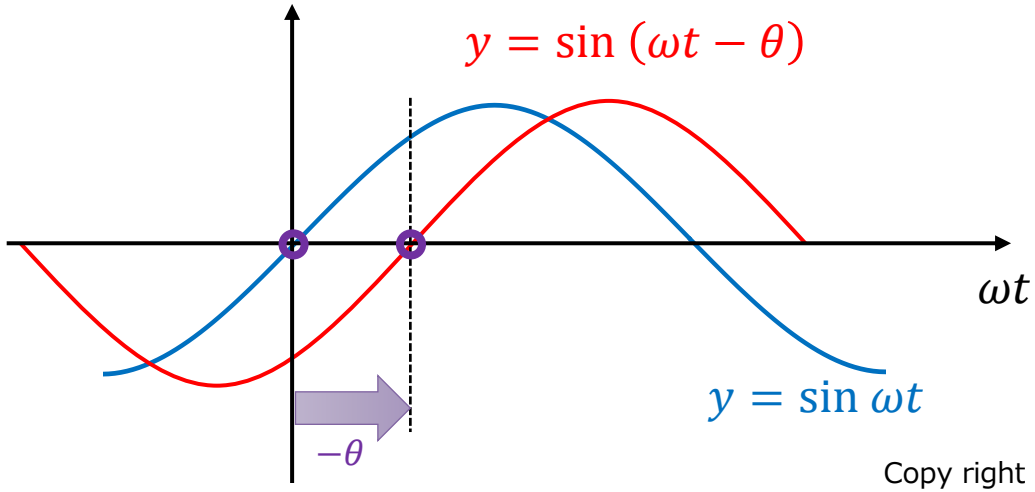
波形と位相差

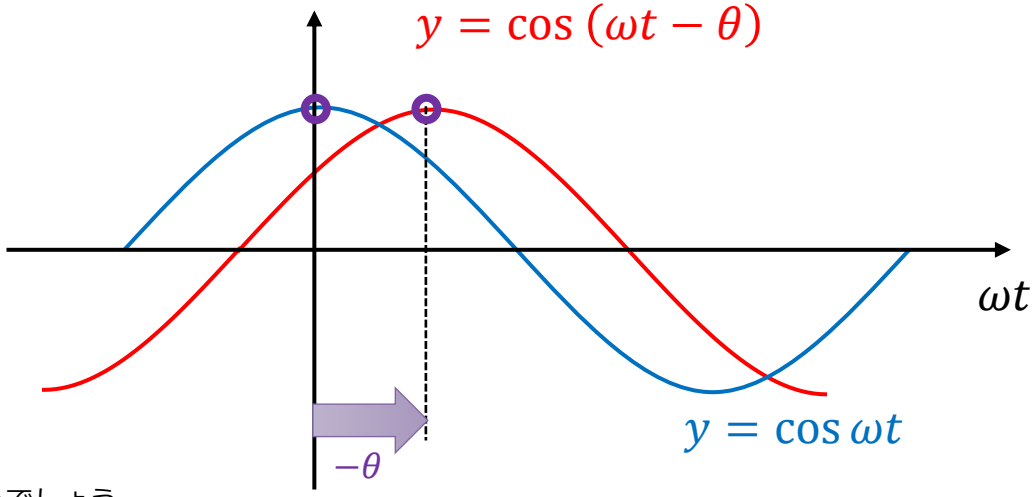
位相差が正だと波形は左にずれる





位相差が負だと波形は右にずれる





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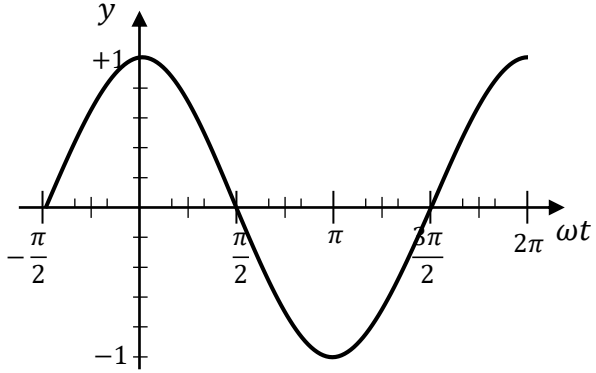
練習問題5

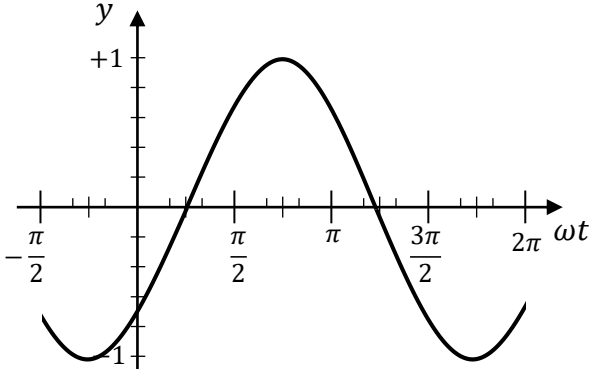
各問の位相差ϕの値を示せ。ただし、値は弧度法[rad]で表すこととする。

（1） $y = \sin(\omega t + \phi)$



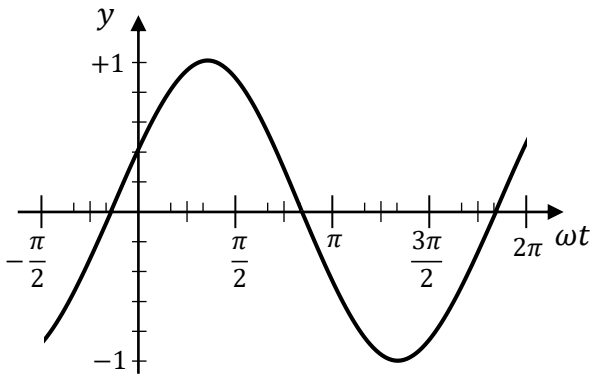
Ans. $\phi =$

（2） $y = \sin(\omega t + \phi)$



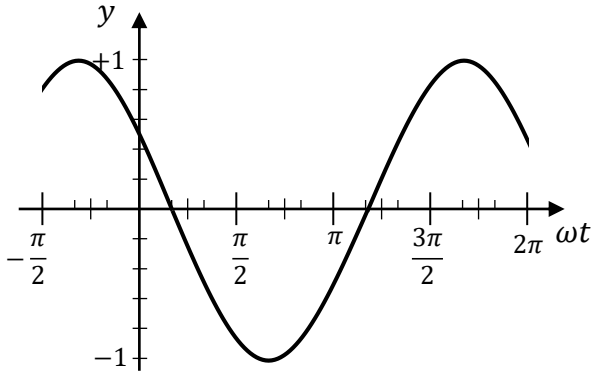
Ans. $\phi =$

（3） $y = \sin(\omega t + \phi)$



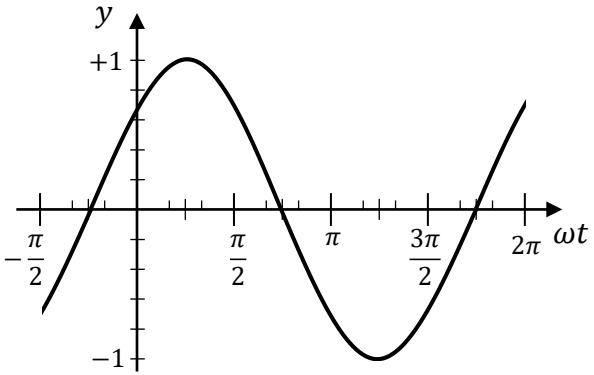
Ans. $\phi =$

（4） $y = \cos(\omega t + \phi)$



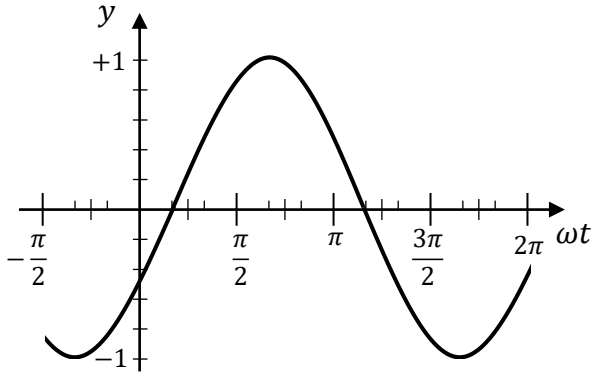
Ans. $\phi =$

（5） $y = \cos(\omega t + \phi)$



Ans. $\phi =$

（6） $y = \cos(\omega t + \phi)$



Ans. $\phi =$

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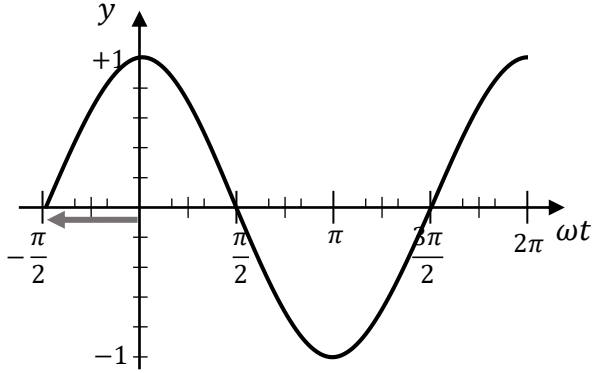
練習問題5（解答）

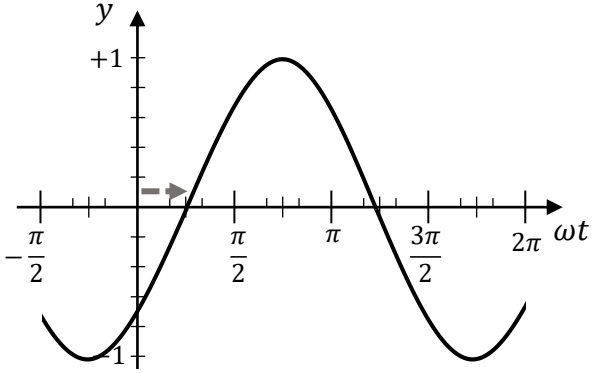
各問の位相差ϕの値を示せ。ただし、値は弧度法[rad]で表すこととする。

（1） $y = \sin(\omega t + \phi)$



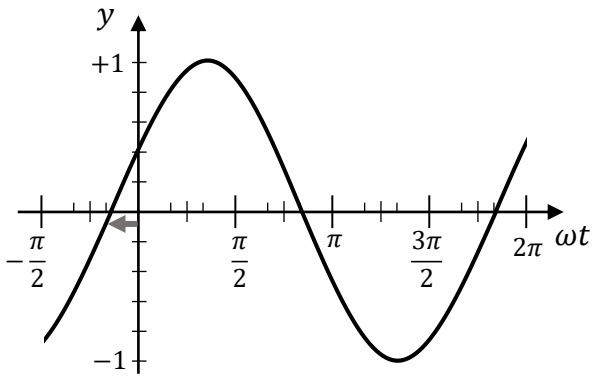
Ans. $\phi = \frac{\pi}{2}$

（2） $y = \sin(\omega t + \phi)$



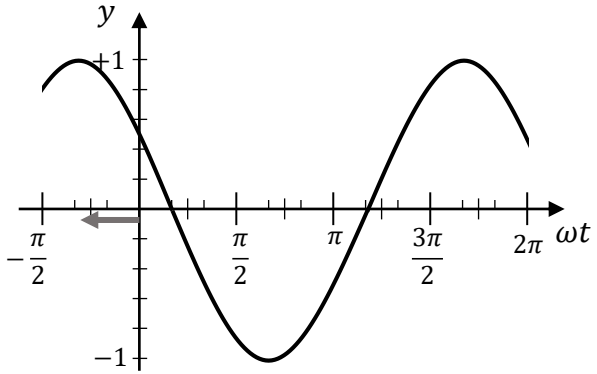
Ans. $\phi = -\frac{\pi}{4}$

（3） $y = \sin(\omega t + \phi)$



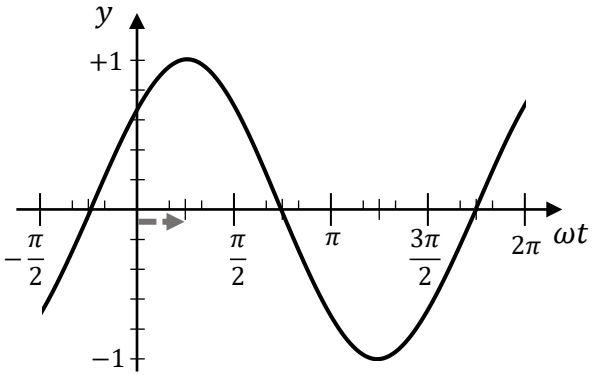
Ans. $\phi = \frac{\pi}{6}$

（4） $y = \cos(\omega t + \phi)$



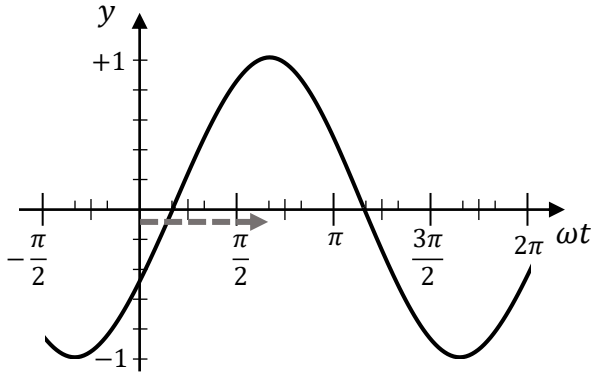
Ans. $\phi = \frac{\pi}{3}$

（5） $y = \cos(\omega t + \phi)$



Ans. $\phi = -\frac{\pi}{4}$

（6） $y = \cos(\omega t + \phi)$



Ans. $\phi = -\frac{2\pi}{3}$

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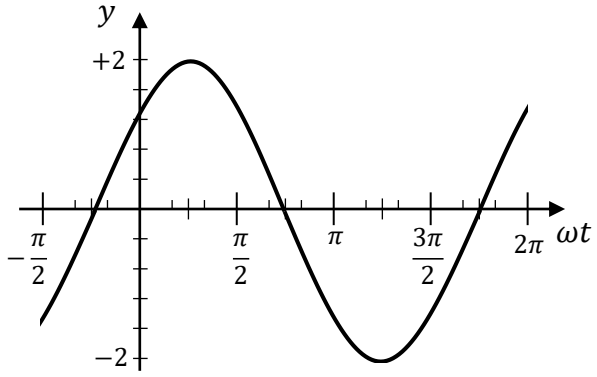
練習問題6

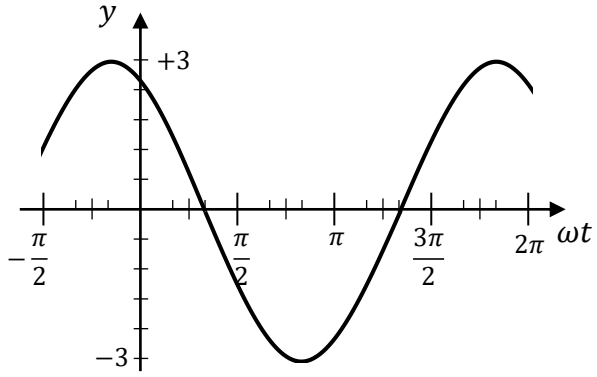
各問の振幅Aと位相差ϕの値を示せ。ただし、角度の値は弧度法[rad]で表すこととする。

（1） $y = A\sin(\omega t + \phi)$



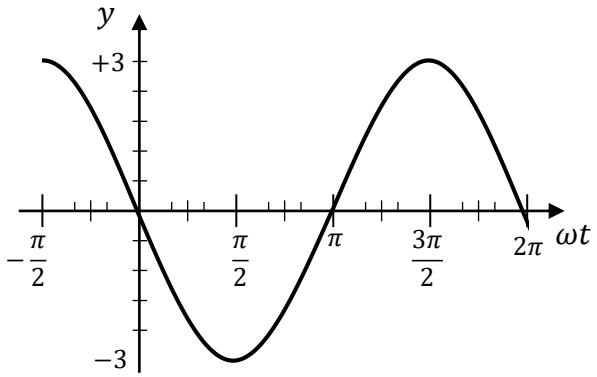
Ans. $A =$ $\phi =$

（2） $y = A\cos(\omega t + \phi)$



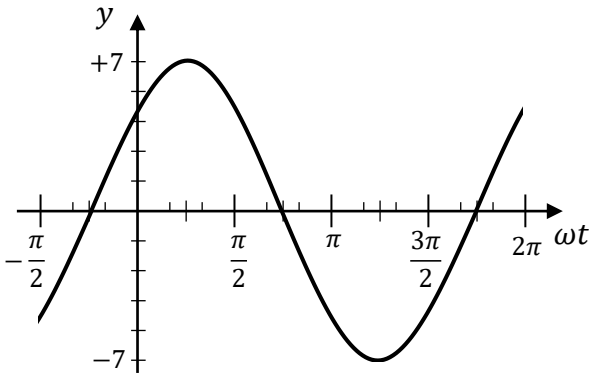
Ans. $A =$ $\phi =$

（3） $y = A\sin(\omega t + \phi)$



Ans. $A =$ $\phi =$

（4） $y = A\cos(\omega t + \phi)$



Ans. $A =$ $\phi =$

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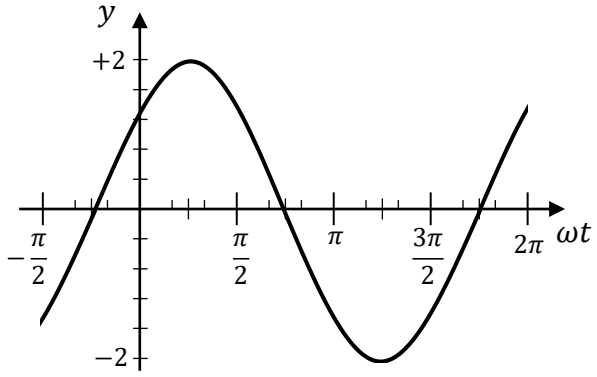
練習問題6（解答）

各問の振幅Aと位相差ϕの値を示せ。ただし、角度の値は弧度法[rad]で表すこととする。

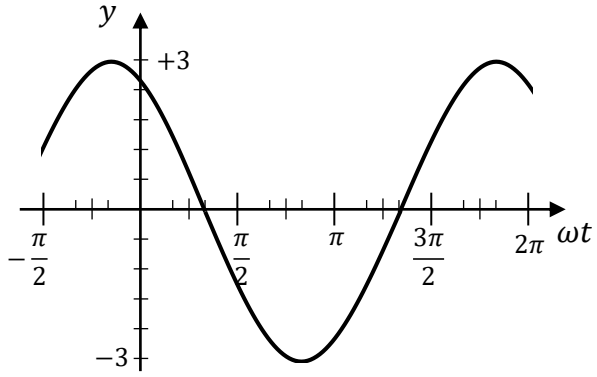
（1） $y = A\sin(\omega t + \phi)$



$y = 2\sin\left(\omega t + \frac{\pi}{4}\right)$

Ans. $A = 2$ $\phi = \frac{\pi}{4}$

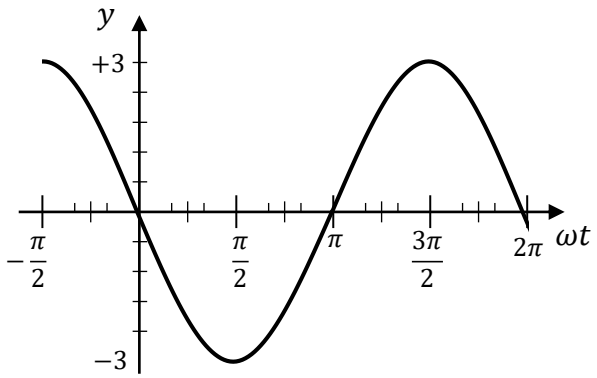
（2） $y = A\cos(\omega t + \phi)$



$y = 3\cos\left(\omega t + \frac{\pi}{6}\right)$

Ans. $A = 3$ $\phi = \frac{\pi}{6}$

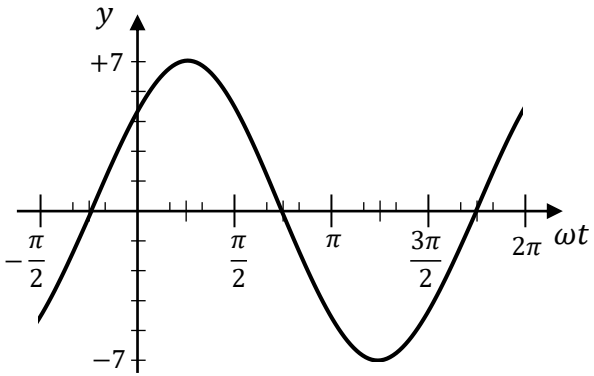
（3） $y = A\sin(\omega t + \phi)$



$y = 3\sin(\omega t + \pi)$
または、
$y = 3\sin(\omega t - \pi)$
$y = -3\sin\omega t$

Ans. $A = 3$ $\phi = \pi$

（4） $y = A\cos(\omega t + \phi)$



$y = 7\cos\left(\omega t - \frac{\pi}{4}\right)$

Ans. $A = 7$ $\phi = -\frac{\pi}{4}$

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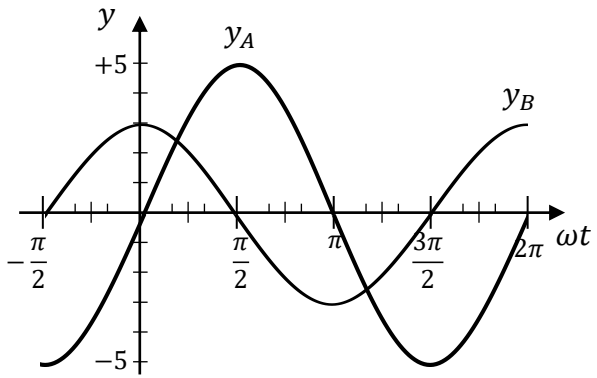
練習問題7

波形y_Aとy_Bの振幅A, Bと位相差$\phi_A, \phi_B, \phi_B - \phi_A$の値を示せ。
ただし、角度の値は弧度法[rad]で表すこととする。

（1） $y_A = A\sin(\omega t + \phi_A)$,　$y_B = B\sin(\omega t + \phi_B)$



$y_A =$

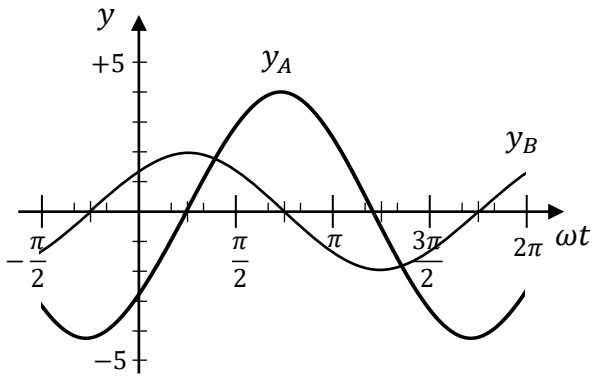
$y_B =$

$\phi_B - \phi_A =$

$A =$　$B =$

Ans. $\phi_A =$　$\phi_B =$　$\phi_B - \phi_A =$

（2） $y_A = A\sin(\omega t + \phi_A)$,　$y_B = B\sin(\omega t + \phi_B)$



$y_A =$

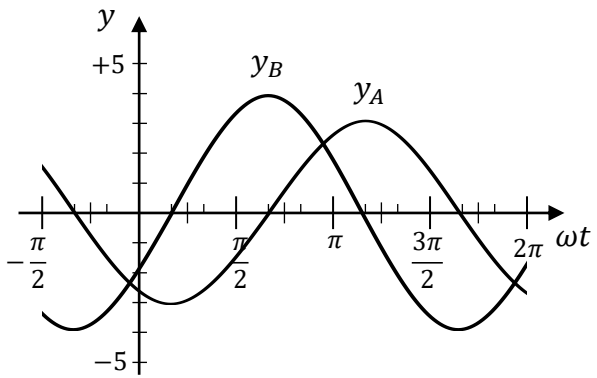
$y_B =$

$\phi_B - \phi_A =$

$A =$　$B =$

Ans. $\phi_A =$　$\phi_B =$　$\phi_B - \phi_A =$

（3） $y_A = A\sin(\omega t + \phi_A)$,　$y_B = B\sin(\omega t + \phi_B)$



$y_A =$

$y_B =$

$\phi_B - \phi_A =$

$A =$　$B =$

Ans. $\phi_A =$　$\phi_B =$　$\phi_B - \phi_A =$

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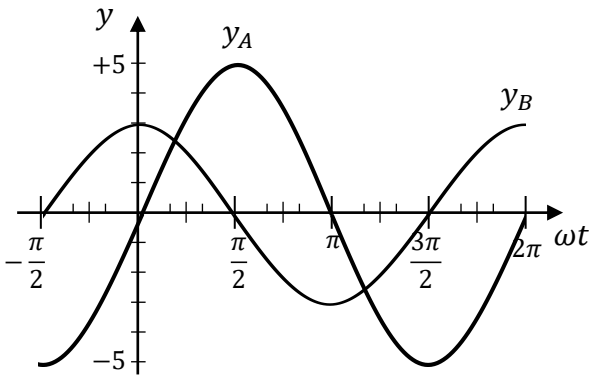
練習問題7（解答）

波形y_Aとy_Bの振幅A, Bと位相差$\phi_A, \phi_B, \phi_B - \phi_A$の値を示せ。
ただし、角度の値は弧度法[rad]で表すこととする。

（1） $y_A = A\sin(\omega t + \phi_A)$,　$y_B = B\sin(\omega t + \phi_B)$

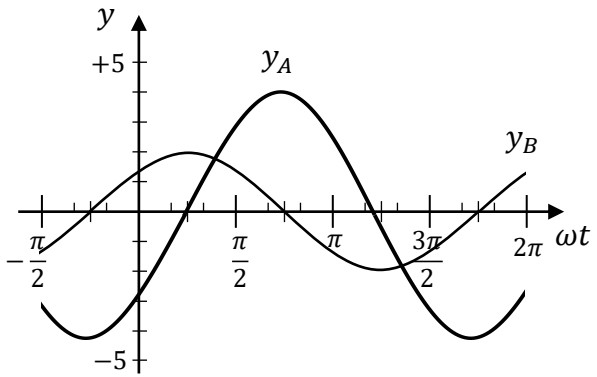


$$y_A = 5\sin\omega t$$
$$y_B = 3\sin\left(\omega t + \frac{\pi}{2}\right)$$
$$\phi_B - \phi_A = \frac{\pi}{2} - 0 = \frac{\pi}{2}$$

$A = 5$　$B = 3$

Ans. $\phi_A = 0$　$\phi_B = \frac{\pi}{2}$　$\phi_B - \phi_A = \frac{\pi}{2}$

（2） $y_A = A\sin(\omega t + \phi_A)$,　$y_B = B\sin(\omega t + \phi_B)$

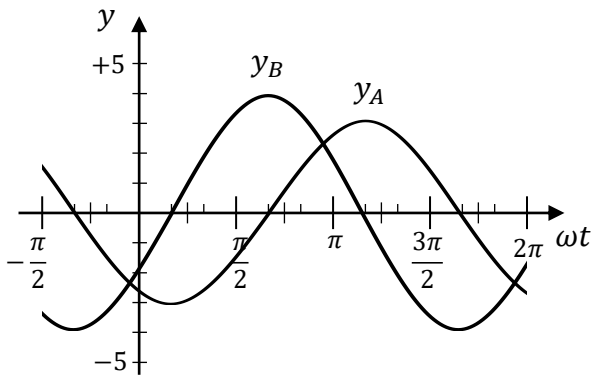


$$y_A = 4\sin\left(\omega t - \frac{\pi}{4}\right)$$
$$y_B = 2\sin\left(\omega t + \frac{\pi}{4}\right)$$
$$\phi_B - \phi_A = \frac{\pi}{4} - \left(-\frac{\pi}{4}\right) = \frac{\pi}{2}$$

$A = 4$　$B = 2$

Ans. $\phi_A = -\frac{\pi}{4}$　$\phi_B = \frac{\pi}{4}$　$\phi_B - \phi_A = \frac{\pi}{2}$

（3） $y_A = A\sin(\omega t + \phi_A)$,　$y_B = B\sin(\omega t + \phi_B)$



$$y_A = 3\sin\left(\omega t - \frac{2\pi}{3}\right)$$
$$y_B = 4\sin\left(\omega t - \frac{\pi}{6}\right)$$
$$\phi_B - \phi_A = -\frac{\pi}{6} - \left(-\frac{2\pi}{3}\right) = -\frac{\pi}{6} + \frac{4\pi}{6} = \frac{\pi}{2}$$

$A = 3$　$B = 4$

Ans. $\phi_A = -\frac{2\pi}{3}$　$\phi_B = -\frac{\pi}{6}$　$\phi_B - \phi_A = \frac{\pi}{2}$

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