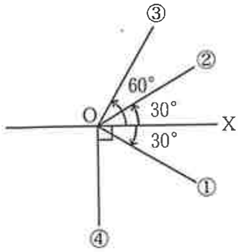
23　一般角(1)と弧度法〔P 120～P 125〕

◇確認問題〔P 120～P 122〕

1 (1)



(2)①　$135° + 360° \times n$（n は整数）

②　$-120° + 360° \times n$ あるいは $240° + 360° \times n$（n は整数）

［解説］

(1)②　$390° = 30° + 360° \times 1$

③　$780° = 60° + 360° \times 2$

④　$-450° = -90° + 360° \times (-1)$

2 (1)

度	0°	30°	45°	60°	90°	120°	135°	150°	180°
弧度	0	$\frac{\pi}{6}$	$\frac{\pi}{4}$	$\frac{\pi}{3}$	$\frac{\pi}{2}$	$\frac{2}{3}\pi$	$\frac{3}{4}\pi$	$\frac{5}{6}\pi$	π

(2)①　$\frac{7}{18}\pi$　②　$\frac{13}{18}\pi$　③　36°　④　$\left(\frac{1080}{7}\right)^{\circ}$

(3)

弧度	0	$\frac{\pi}{6}$	$\frac{\pi}{4}$	$\frac{\pi}{3}$	$\frac{\pi}{2}$	$\frac{2}{3}\pi$	$\frac{3}{4}\pi$	$\frac{5}{6}\pi$	π
$\sin\theta$	0	$\frac{1}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{3}}{2}$	1	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{1}{2}$	0
$\cos\theta$	1	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{1}{2}$	0	$-\frac{1}{2}$	$-\frac{\sqrt{2}}{2}$	$-\frac{\sqrt{3}}{2}$	-1
$\tan\theta$	0	$\frac{\sqrt{3}}{3}$	1	$\sqrt{3}$	／	$-\sqrt{3}$	-1	$-\frac{\sqrt{3}}{3}$	0

3 (1)　弧の長さ　2π，面積　6π

(2)　弧の長さ　9π，面積　54π

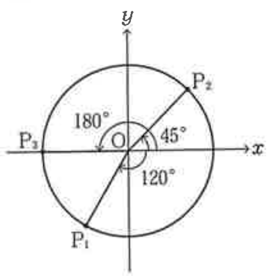
4 (1)　$\sin(-120°) = -\frac{\sqrt{3}}{2}$，$\cos(-120°) = -\frac{1}{2}$，

$\tan(-120°) = \sqrt{3}$

(2)　$\sin 765° = \frac{\sqrt{2}}{2}$，$\cos 765° = \frac{\sqrt{2}}{2}$，$\tan 765° = 1$

(3)　$\sin(-540°) = 0$，$\cos(-540°) = -1$，$\tan(-540°) = 0$

［解説］



(1)　点 P_1 の座標は $\left(-\frac{1}{2},\ -\frac{\sqrt{3}}{2}\right)$

(2)　$765° = 45° + 360° \times 2$ より

点 P_2 の座標は $\left(\frac{\sqrt{2}}{2},\ \frac{\sqrt{2}}{2}\right)$

(3)　$-540° = 180° + 360° \times (-2)$ より

点 P_3 の座標は $(-1,\ 0)$

5 (1)　$\sin(-880°) < 0$，$\cos(-880°) < 0$，$\tan(-880°) > 0$

(2)　$\sin 1000° < 0$，$\cos 1000° > 0$，$\tan 1000° < 0$

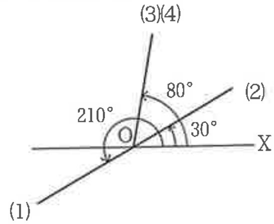
［解説］

(1)　$-880° = 200° + 360° \times (-3)$ より，$-880°$ は第 3 象限に属する．

(2)　$1000° = -80° + 360° \times 3$ より，$1000°$ は第 4 象限に属する．

◇練成問題A〔P 123～P 124〕

1



［解説］

(2)　$750° = 30° + 360° \times 2$

(3)　$-280° = 80° + 360° \times (-1)$

(4)　$-1000° = 80° + 360° \times (-3)$

2 (1)　$100° + 360° \times n$（n は整数）

(2)　$-20° + 360° \times n$ あるいは $340° + 360° \times n$（n は整数）

(3)　$180° + 360° \times n$（n は整数）

3

度	180°	210°	225°	240°	270°	300°	315°	330°	360°
弧度	π	$\frac{7}{6}\pi$	$\frac{5}{4}\pi$	$\frac{4}{3}\pi$	$\frac{3}{2}\pi$	$\frac{5}{3}\pi$	$\frac{7}{4}\pi$	$\frac{11}{6}\pi$	2π

4 (1)　$\frac{16}{9}\pi$　(2)　$\frac{5}{12}\pi$　(3)　$\left(\frac{495}{2}\right)^{\circ}$　(4)　80°

5

弧度	π	$\frac{7}{6}\pi$	$\frac{5}{4}\pi$	$\frac{4}{3}\pi$	$\frac{3}{2}\pi$	$\frac{5}{3}\pi$	$\frac{7}{4}\pi$	$\frac{11}{6}\pi$	2π
$\sin\theta$	0	$-\frac{1}{2}$	$-\frac{\sqrt{2}}{2}$	$-\frac{\sqrt{3}}{2}$	-1	$-\frac{\sqrt{3}}{2}$	$-\frac{\sqrt{2}}{2}$	$-\frac{1}{2}$	0
$\cos\theta$	-1	$-\frac{\sqrt{3}}{2}$	$-\frac{\sqrt{2}}{2}$	$-\frac{1}{2}$	0	$\frac{1}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{3}}{2}$	1
$\tan\theta$	0	$\frac{\sqrt{3}}{3}$	1	$\sqrt{3}$	／	$-\sqrt{3}$	-1	$-\frac{\sqrt{3}}{3}$	0

6 (1)　弧の長さ　$\frac{\pi}{2}$，面積　$\frac{3}{4}\pi$

(2)　弧の長さ $\frac{16}{3}\pi$，面積　$\frac{64}{3}\pi$

7 (1)　$\sin 840° = \frac{\sqrt{3}}{2}$，$\cos 840° = -\frac{1}{2}$，$\tan 840° = -\sqrt{3}$

(2)　$\sin(-390°) = -\frac{1}{2}$，$\cos(-390°) = \frac{\sqrt{3}}{2}$，

$\tan(-390°) = -\frac{\sqrt{3}}{3}$

(3)　$\sin(-675°) = \frac{\sqrt{2}}{2}$，$\cos(-675°) = \frac{\sqrt{2}}{2}$，

$\tan(-675°) = 1$

(4) $\sin(-510°) = -\frac{1}{2}$, $\cos(-510°) = -\frac{\sqrt{3}}{2}$,

$\tan(-510°) = \frac{\sqrt{3}}{3}$

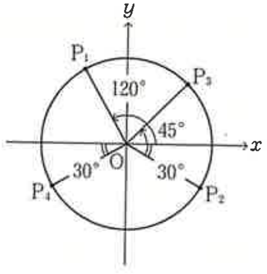
[解説]

(1) $840° = 120° + 360° \times 2$

(2) $-390° = -30° + 360° \times (-1)$

(3) $-675° = 45° + 360° \times (-2)$

(4) $-510° = 210° + 360° \times (-2)$



P_1 の座標 $\left(-\frac{1}{2}, \frac{\sqrt{3}}{2}\right)$

P_2 の座標 $\left(\frac{\sqrt{3}}{2}, -\frac{1}{2}\right)$

P_3 の座標 $\left(\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2}\right)$

P_4 の座標 $\left(-\frac{\sqrt{3}}{2}, -\frac{1}{2}\right)$

8 (1) $\sin\theta > 0$, $\cos\theta < 0$, $\tan\theta < 0$

(2) $\sin\theta < 0$, $\cos\theta > 0$, $\tan\theta < 0$

(3) $\sin\theta < 0$, $\cos\theta < 0$, $\tan\theta > 0$

(4) $\sin\theta < 0$, $\cos\theta > 0$, $\tan\theta < 0$

[解説]

(1) $144°$ は第 2 象限に属する.

(2) $-72°$ は第 4 象限に属する.

(3) $250°$ は第 3 象限に属する.

(4) $-410° = -50° + 360° \times (-1)$ より第 4 象限に属する.

9 (1) 2　(2) 3　(3) 1, 3　(4) 1

◇練成問題Ｂ〔P 125〕

1 (1) $\sin\theta\cos\theta < 0$　(2) $\sin\theta\tan\theta < 0$

[解説]

(1) θ が第 4 象限なら, $\sin\theta < 0$, $\cos\theta > 0$

(2) θ が第 3 象限なら, $\sin\theta < 0$, $\tan\theta > 0$

2 (1) 1, 2　(2) 2, 4　(3) 1, 3　(4) 2, 3

[解説]

(3) $\sin\theta > 0$ かつ $\cos\theta > 0$ の場合 → 第 1 象限
$\sin\theta < 0$ かつ $\cos\theta < 0$ の場合 → 第 3 象限

(4) $\tan\theta > 0$ かつ $\sin\theta < 0$ の場合 → 第 3 象限
$\tan\theta < 0$ かつ $\sin\theta > 0$ の場合 → 第 2 象限

3 (1) 1　(2) $-\frac{1}{2}$　(3) $-\frac{\sqrt{2}}{2}$　(4) $-\frac{\sqrt{3}}{3}$

(5) -1　(6) $-\frac{\sqrt{3}}{2}$

[解説]

(1) $\tan\left(-\frac{11}{4}\pi\right) = -\tan\frac{11}{4}\pi = -\tan\frac{3}{4}\pi$

(2) $\cos\left(-\frac{8}{3}\pi\right) = \cos\frac{8}{3}\pi = \cos\frac{2}{3}\pi$

(3) $\sin\frac{13}{4}\pi = \sin\frac{5}{4}\pi = -\sin\frac{\pi}{4}$

(4) $\tan\frac{17}{6}\pi = \tan\frac{5}{6}\pi$

(5) $\cos 3\pi = \cos\pi$

(6) $\sin\left(-\frac{13}{3}\pi\right) = -\sin\frac{13}{3}\pi = -\sin\frac{\pi}{3}$

4 (1) $\frac{7}{6}\pi + 2\pi \times n$ および $\frac{11}{6}\pi + 2\pi \times n$ (n は整数)

(2) $\frac{3}{4}\pi + 2\pi \times n$ および $\frac{5}{4}\pi + 2\pi \times n$ (n は整数)

(3) $\frac{2}{3}\pi + 2\pi \times n$ および $\frac{5}{3}\pi + 2\pi \times n$ (n は整数)

(4) $\frac{4}{3}\pi + 2\pi \times n$ および $\frac{5}{3}\pi + 2\pi \times n$ (n は整数)

[解説]

(1) $0 \leqq \theta < 2\pi$ の範囲で $\sin\theta = -\frac{1}{2}$ をみたすのは,

$\theta = \frac{7}{6}\pi, \frac{11}{6}\pi$

(2) $0 \leqq \theta < 2\pi$ の範囲で $\cos\theta = -\frac{\sqrt{2}}{2}$ をみたすのは,

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

(3) $0 \leqq \theta < 2\pi$ の範囲で $\tan\theta = -\sqrt{3}$ をみたすのは,

$\theta = \frac{2}{3}\pi, \frac{5}{3}\pi$

(4) $0 \leqq \theta < 2\pi$ の範囲で $\sin\theta = -\frac{\sqrt{3}}{2}$ をみたすのは,

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

24　三角関数の相互関係と一般角(2)〔P 126～P 131〕

◇確認問題〔P 126～P 128〕

1 (1)① $\sin\theta = -\frac{2\sqrt{6}}{5}$, $\tan\theta = 2\sqrt{6}$

② $\sin\theta = -\frac{3\sqrt{10}}{10}$, $\cos\theta = \frac{\sqrt{10}}{10}$

(2)① $\frac{1}{\cos^2\theta}$　② 2

(3)① $\frac{4}{9}$　② $-\frac{13}{27}$

[解説]

(1)① θ の範囲より　$\sin\theta < 0$, $\tan\theta > 0$

$\therefore\ \sin\theta = -\sqrt{1-\left(-\frac{1}{5}\right)^2} = -\frac{2\sqrt{6}}{5}$

$\tan\theta = \frac{-\frac{2\sqrt{6}}{5}}{-\frac{1}{5}}$

② θ の範囲より　$\sin\theta < 0$, $\cos\theta > 0$

$\dfrac{\sin\theta}{\cos\theta} = -3$ より　$\sin\theta = -3\cos\theta$

$\sin^2\theta + \cos^2\theta = 10\cos^2\theta = 1$

$\therefore\ \cos\theta = \dfrac{1}{\sqrt{10}}$

$\therefore\ \sin\theta = (-3)\dfrac{1}{\sqrt{10}}$

(2)① 与式 $= \dfrac{\sin^2\theta}{\cos^2\theta} + 1 = \dfrac{\sin^2\theta + \cos^2\theta}{\cos^2\theta}$

② 与式 $= \sin^2\theta + 2\sin\theta\cos\theta + \cos^2\theta$
$+ \cos^2\theta - 2\sin\theta\cos\theta + \sin^2\theta$

(3)① $(\sin\theta - \cos\theta)^2 = 1 - 2\sin\theta\cos\theta = \dfrac{1}{9}$ より

$\sin\theta\cos\theta = \dfrac{4}{9}$

② $\sin^3\theta - \cos^3\theta = (\sin\theta - \cos\theta)$
$\times(\sin^2\theta + \sin\theta\cos\theta + \cos^2\theta)$
$= \left(-\dfrac{1}{3}\right)\left(1 + \dfrac{4}{9}\right)$

2 (1) $\dfrac{\sqrt{2}}{2}$　(2) $\dfrac{\sqrt{2}}{2}$　(3) $-\dfrac{\sqrt{3}}{3}$

[解説]

(1) $\sin\dfrac{11}{4}\pi = \sin\left(\dfrac{11}{4}\pi - 2\pi\right) = \sin\dfrac{3}{4}\pi$

(2) $\cos\dfrac{17}{4}\pi = \cos\left(\dfrac{17}{4}\pi - 2\pi\times 2\right) = \cos\dfrac{\pi}{4}$

(3) $\tan\dfrac{29}{6}\pi = \tan\left(\dfrac{29}{6}\pi - 2\pi\times 2\right) = \tan\dfrac{5}{6}\pi$

3 (1) $-\dfrac{\sqrt{3}}{3}$　(2) $-\dfrac{\sqrt{2}}{2}$　(3) $-\dfrac{\sqrt{3}}{2}$

[解説]

(1) $\tan\left(-\dfrac{\pi}{6}\right) = -\tan\dfrac{\pi}{6}$

(2) $\sin\left(-\dfrac{3}{4}\pi\right) = -\sin\dfrac{3}{4}\pi$

(3) $\cos\left(-\dfrac{5}{6}\pi\right) = \cos\dfrac{5}{6}\pi$

4 (1) $-\dfrac{1}{2}$　(2) $\dfrac{\sqrt{2}}{2}$

[解説]

(1) $\cos\dfrac{4}{3}\pi = \cos\left(\dfrac{\pi}{3} + \pi\right) = -\cos\dfrac{\pi}{3}$

(2) $\sin\left(-\dfrac{5}{4}\pi\right) = -\sin\dfrac{5}{4}\pi = -\sin\left(\dfrac{\pi}{4} + \pi\right)$
$= \sin\dfrac{\pi}{4}$

5 (1) $-\dfrac{1}{\tan\theta}$　(2) $-\sin\theta$

[解説]

(1) $\tan\left(\theta + \dfrac{5}{2}\pi\right) = \tan\left(\theta + \dfrac{\pi}{2}\right)$

(2) $\cos\left(\theta - \dfrac{3}{2}\pi\right) = \cos\left(\theta - \dfrac{3}{2}\pi + 2\pi\right)$
$= \cos\left(\theta + \dfrac{\pi}{2}\right)$

6 (1) -0.1736　(2) 0.6561　(3) -4.0108

[解説]

(1) $\sin 710^\circ = \sin(-10^\circ + 720^\circ) = \sin(-10^\circ)$
$= -\sin 10^\circ$

(2) $\cos(-311^\circ) = \cos(-311^\circ + 360^\circ) = \cos 49^\circ$

(3) $\tan(-256^\circ) = \tan(-256^\circ + 360^\circ) = \tan 104^\circ$
$= \tan(-76^\circ + 180^\circ) = \tan(-76^\circ) = -\tan 76^\circ$

◇練成問題A〔P 129～P 130〕

1 (1) $\cos\theta = -\dfrac{2\sqrt{2}}{3}$, $\tan\theta = \dfrac{\sqrt{2}}{4}$

(2) $\sin\theta = -\dfrac{\sqrt{21}}{5}$, $\tan\theta = \dfrac{\sqrt{21}}{2}$

(3) $\sin\theta = -\dfrac{3\sqrt{10}}{10}$, $\cos\theta = -\dfrac{\sqrt{10}}{10}$

(4) $\cos\theta = -\dfrac{3}{5}$, $\tan\theta = \dfrac{4}{3}$

[解説]

θ の範囲より，$\sin\theta < 0$, $\cos\theta < 0$, $\tan\theta > 0$

(1) $\cos\theta = -\sqrt{1 - \left(-\dfrac{1}{3}\right)^2} = -\dfrac{2\sqrt{2}}{3}$, $\tan\theta = \dfrac{-\frac{1}{3}}{-\frac{2\sqrt{2}}{3}}$

(2) $\sin\theta = -\sqrt{1 - \left(-\dfrac{2}{5}\right)^2} = -\dfrac{\sqrt{21}}{5}$, $\tan\theta = \dfrac{-\frac{\sqrt{21}}{5}}{-\frac{2}{5}}$

(3) $\dfrac{\sin\theta}{\cos\theta} = 3$ より　$\sin\theta = 3\cos\theta$

$1 = \sin^2\theta + \cos^2\theta = 10\cos^2\theta$

$\therefore\ \cos\theta = -\sqrt{\dfrac{1}{10}}$, $\sin\theta = 3\times\left(-\sqrt{\dfrac{1}{10}}\right)$

(4) $\cos\theta = -\sqrt{1 - \left(-\dfrac{4}{5}\right)^2} = -\dfrac{3}{5}$, $\tan\theta = \dfrac{-\frac{4}{5}}{-\frac{3}{5}}$

2 (1) $\cos\theta = \dfrac{\sqrt{15}}{4}$, $\tan\theta = -\dfrac{\sqrt{15}}{15}$

(2) $\sin\theta = -\dfrac{4}{5}$, $\tan\theta = -\dfrac{4}{3}$

(3) $\sin\theta = -\dfrac{\sqrt{6}}{3}$, $\cos\theta = \dfrac{\sqrt{3}}{3}$

(4) $\sin\theta = -\dfrac{\sqrt{7}}{3}$, $\tan\theta = -\dfrac{\sqrt{14}}{2}$

[解説]

θ の範囲より，$\sin\theta < 0$, $\cos\theta > 0$, $\tan\theta < 0$

(1) $\cos\theta = \sqrt{1 - \left(-\dfrac{1}{4}\right)^2} = \dfrac{\sqrt{15}}{4}$, $\tan\theta = \dfrac{-\frac{1}{4}}{\frac{\sqrt{15}}{4}}$

(2) $\sin\theta = -\sqrt{1 - \left(\dfrac{3}{5}\right)^2} = -\dfrac{4}{5}$, $\tan\theta = \dfrac{-\frac{4}{5}}{\frac{3}{5}}$

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

$1 = \sin^2\theta + \cos^2\theta = 3\cos^2\theta$

$\therefore\ \cos\theta = \sqrt{\dfrac{1}{3}}$, $\sin\theta = -\sqrt{2}\times\sqrt{\dfrac{1}{3}}$

(4) $\sin\theta = -\sqrt{1-\left(\frac{\sqrt{2}}{3}\right)^2} = -\frac{\sqrt{7}}{3}$, $\tan\theta = \dfrac{-\frac{\sqrt{7}}{3}}{\frac{\sqrt{2}}{3}}$

3 (1) $\cos\theta = \pm\frac{2\sqrt{2}}{3}$, $\tan\theta = \mp\frac{\sqrt{2}}{4}$ (複号同順)

(2) $\sin\theta = -\frac{\sqrt{5}}{3}$, $\tan\theta = -\frac{\sqrt{5}}{2}$

(3) $\sin\theta = -\frac{4\sqrt{17}}{17}$, $\cos\theta = -\frac{\sqrt{17}}{17}$

(4) $\sin\theta = -\frac{\sqrt{5}}{5}$, $\cos\theta = \frac{2\sqrt{5}}{5}$

[解説]

θ の範囲より $\sin\theta < 0$ である。

(1) $\cos\theta = \pm\sqrt{1-\left(-\frac{1}{3}\right)^2} = \pm\frac{2\sqrt{2}}{3}$, $\tan\theta = \dfrac{-\frac{1}{3}}{\pm\frac{2\sqrt{2}}{3}}$

(2) $\sin\theta = -\sqrt{1-\left(\frac{2}{3}\right)^2} = -\frac{\sqrt{5}}{3}$, $\tan\theta = \dfrac{-\frac{\sqrt{5}}{3}}{\frac{2}{3}}$

(3) $\tan\theta > 0$ より θ は第3象限にある。

よって $\cos\theta < 0$

$\frac{\sin\theta}{\cos\theta} = 4$ より $\sin\theta = 4\cos\theta$

$1 = \sin^2\theta + \cos^2\theta = 17\cos^2\theta$

$\cos\theta = -\sqrt{\frac{1}{17}}$, $\sin\theta = 4\times\left(-\sqrt{\frac{1}{17}}\right)$

(4) $\tan\theta < 0$ より θ は第4象限にある。

よって $\cos\theta > 0$

$\tan\theta = -\frac{1}{2}$ より $\cos\theta = -2\sin\theta$

$1 = \sin^2\theta + \cos^2\theta = 5\sin^2\theta$

$\therefore\ \sin\theta = -\sqrt{\frac{1}{5}}$, $\cos\theta = (-2)\left(-\sqrt{\frac{1}{5}}\right)$

4 (1) $\frac{2}{\sin\theta}$ (2) $\frac{1}{\cos^4\theta}$ (3) $2\sin\theta\cos\theta$

[解説]

(1) 与式 $= \dfrac{1-2\cos\theta+\cos^2\theta+\sin^2\theta}{\sin\theta(1-\cos\theta)}$

$= \dfrac{2(1-\cos\theta)}{\sin\theta(1-\cos\theta)}$

(2) 与式 $= (\tan^2\theta+1)^2 = \left(\frac{1}{\cos^2\theta}\right)^2$

(3) 与式 $= (\sin\theta+\cos\theta)^2 - 1$

$= \sin^2\theta + 2\sin\theta\cos\theta + \cos^2\theta - 1$

5 (1) $-\frac{3}{8}$ (2) $-\frac{11}{16}$ (3) $\frac{23}{32}$

[解説]

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

$\therefore\ \sin\theta\cos\theta = \frac{1}{2}\left(\frac{1}{4}-1\right)$

(2) $\sin^3\theta + \cos^3\theta$

$= (\sin\theta+\cos\theta)(\sin^2\theta - \sin\theta\cos\theta + \cos^2\theta)$

$= \left(-\frac{1}{2}\right)\left\{1-\left(-\frac{3}{8}\right)\right\}$

(3) $\sin^4\theta + \cos^4\theta = (\sin^2\theta+\cos^2\theta)^2 - 2\sin^2\theta\cos^2\theta$

$= 1 - 2\left(-\frac{3}{8}\right)^2$

6 (1) $\frac{3}{8}$ (2) $\frac{11}{16}$ (3) $\frac{23}{32}$

[解説]

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

$\therefore\ \sin\theta\cos\theta = \frac{1}{2}\left(1-\frac{1}{4}\right)$

(2) $\sin^3\theta - \cos^3\theta$

$= (\sin\theta-\cos\theta)(\sin^2\theta + \sin\theta\cos\theta + \cos^2\theta)$

$= \frac{1}{2}\times\left(1+\frac{3}{8}\right)$

(3) $\sin^4\theta + \cos^4\theta = (\sin^2\theta+\cos^2\theta)^2 - 2\sin^2\theta\cos^2\theta$

$= 1 - 2\left(\frac{3}{8}\right)^2$

7 (1) $\frac{\sqrt{3}}{2}$ (2) $-\frac{1}{2}$ (3) $-\frac{\sqrt{2}}{2}$ (4) $-\frac{\sqrt{3}}{3}$

[解説]

(1) $\sin\frac{13}{3}\pi = \sin\left(\frac{13}{3}\pi - 2\pi\times 2\right) = \sin\frac{\pi}{3}$

(2) $\cos\frac{8}{3}\pi = \cos\left(\frac{8}{3}\pi - 2\pi\right) = \cos\frac{2}{3}\pi$

(3) $\cos\frac{11}{4}\pi = \cos\left(\frac{11}{4}\pi - 2\pi\right) = \cos\frac{3}{4}\pi$

(4) $\tan\frac{17}{6}\pi = \tan\left(\frac{17}{6}\pi - 2\pi\right) = \tan\frac{5}{6}\pi$

8 (1) $-\frac{1}{2}$ (2) $\frac{\sqrt{2}}{2}$ (3) $\frac{\sqrt{3}}{3}$ (4) $-\frac{\sqrt{3}}{3}$

[解説]

(1) $\sin\left(-\frac{5}{6}\pi\right) = -\sin\frac{5}{6}\pi$

(2) $\cos\left(-\frac{\pi}{4}\right) = \cos\frac{\pi}{4}$

(3) $\tan\left(-\frac{5}{6}\pi\right) = -\tan\frac{5}{6}\pi = -\left(-\frac{\sqrt{3}}{3}\right)$

(4) $\tan\left(-\frac{\pi}{6}\right) = -\tan\frac{\pi}{6}$

9 (1) $-\frac{\sqrt{2}}{2}$ (2) $\frac{\sqrt{2}}{2}$ (3) $\frac{\sqrt{3}}{2}$ (4) $\frac{\sqrt{3}}{3}$

[解説]

(1) $\sin\frac{5}{4}\pi = \sin\left(\frac{\pi}{4}+\pi\right) = -\sin\frac{\pi}{4}$

(2) $\sin\left(-\frac{15}{4}\pi\right) = -\sin\frac{15}{4}\pi = -\sin\left(\frac{7}{4}\pi+2\pi\right)$

$= -\sin\frac{7}{4}\pi = -\sin\left(\frac{3}{4}\pi+\pi\right)$

$= \sin\frac{3}{4}\pi$

(3) $\cos\frac{11}{6}\pi = \cos\left(\frac{5}{6}\pi+\pi\right) = -\cos\frac{5}{6}\pi$

(4) $\tan\left(-\frac{35}{6}\pi\right) = -\tan\frac{35}{6}\pi = -\tan\left(\frac{11}{6}\pi+2\pi\times 2\right)$

$= -\tan\frac{11}{6}\pi = -\tan\left(\frac{5}{6}\pi+\pi\right)$

$= -\tan\frac{5}{6}\pi$

10 (1) $\cos\theta$　(2) $-\dfrac{1}{\tan\theta}$　(3) $-\sin\theta$　(4) $-\dfrac{1}{\tan\theta}$

[解説]

(1) 与式 $=\sin\left(\theta+\dfrac{5}{2}\pi-2\pi\right)=\sin\left(\theta+\dfrac{\pi}{2}\right)=\cos\theta$

(2) 与式 $=\tan\left(\theta-\dfrac{3}{2}\pi+2\pi\right)=\tan\left(\theta+\dfrac{\pi}{2}\right)$

(3) 与式 $=\cos\left(\theta-\dfrac{7}{2}\pi+2\pi\times2\right)=\cos\left(\theta+\dfrac{\pi}{2}\right)$
$=-\sin\theta$

(4) 与式 $=\tan\left(\theta+\dfrac{7}{2}\pi-2\pi\right)=\tan\left(\theta+\dfrac{3}{2}\pi\right)$
$=\tan\left(\theta+\dfrac{\pi}{2}+\pi\right)=\tan\left(\theta+\dfrac{\pi}{2}\right)$

11 (1) -0.9962　(2) -0.9848　(3) 1.1918
(4) -0.1763

[解説]

(1) $\sin275^\circ=\sin(95^\circ+180^\circ)=-\sin95^\circ$
$=-\sin(5^\circ+90^\circ)=-\cos5^\circ$

(2) $\cos(550^\circ)=\cos(550^\circ-360^\circ\times2)=\cos(-170^\circ)$
$=\cos(80^\circ+90^\circ)=-\sin80^\circ$

(3) $\tan(410^\circ)=\tan(410^\circ-360^\circ)=\tan50^\circ$

(4) $\tan(530^\circ)=\tan(530^\circ-360^\circ)=\tan170^\circ$
$=\tan(-10^\circ+180^\circ)=-\tan10^\circ$

12 (1) 0.9397　(2) -0.6428　(3) 0.6428
(4) -11.4301

[解説]

(1) $\sin(-250^\circ)=-\sin250^\circ=-\sin(70^\circ+180^\circ)$
$=\sin70^\circ$

(2) $\sin(-500^\circ)=\sin(-500^\circ+360^\circ\times2)=\sin220^\circ$
$=\sin(40^\circ+180^\circ)=-\sin40^\circ$

(3) $\cos(-410^\circ)=\cos(-410^\circ+360^\circ)=\cos(-50^\circ)$
$=\cos50^\circ$

(4) $\tan(-625^\circ)=\tan(-625^\circ+360^\circ\times2)=\tan95^\circ$
$=\tan(-85^\circ+180^\circ)=\tan(-85^\circ)$
$=-\tan85^\circ$

◇練成問題B〔P 131〕

1 (1) $\cos\theta=-\dfrac{\sqrt{7}}{4}$, $\tan\theta=\dfrac{3\sqrt{7}}{7}$

(2) $\sin\theta=-\dfrac{\sqrt{2}}{2}$　(3) $\sin\theta\cos\theta=\dfrac{2}{5}$

(4) $\alpha=\dfrac{1}{5}$, $\sin\theta=-\dfrac{4}{5}$, $\cos\theta=-\dfrac{3}{5}$, $\tan\theta=\dfrac{4}{3}$

[解説]

θは第3象限なので，$\sin\theta<0$, $\cos\theta<0$, $\tan\theta>0$

(1) $\cos\theta=-\sqrt{1-\left(-\dfrac{3}{4}\right)^2}=-\dfrac{\sqrt{7}}{4}$, $\tan\theta=\dfrac{-\dfrac{3}{4}}{-\dfrac{\sqrt{7}}{4}}$

(2) $1=\sin^2\theta+\cos^2\theta=2\sin^2\theta$
$\therefore\ \sin^2\theta=\dfrac{1}{2}$, $\sin\theta=-\sqrt{\dfrac{1}{2}}$

(3) $1=\sin^2\theta+\cos^2\theta=5\cos^2\theta$
$\therefore\ \cos^2\theta=\dfrac{1}{5}$, $\cos\theta=-\sqrt{\dfrac{1}{5}}$
$\therefore\ \sin\theta\cos\theta=\left(-\dfrac{2}{\sqrt{5}}\right)\left(-\dfrac{1}{\sqrt{5}}\right)$

(4) $1=\sin^2\theta+\cos^2\theta$
$=1-2\alpha+\alpha^2+1-4\alpha+4\alpha^2$
$\therefore\ 5\alpha^2-6\alpha+1=0$

これを解いて

$\alpha=\dfrac{1}{5}$, 1

$\alpha=1$なら$\sin\theta=0$となり，θは第3象限に属さない．

$\alpha=\dfrac{1}{5}$なら$\sin\theta=-\dfrac{4}{5}$, $\cos\theta=-\dfrac{3}{5}$, $\tan\theta=\dfrac{-\dfrac{4}{5}}{-\dfrac{3}{5}}$

となって適．

2 (1) $\theta=-60^\circ$　(2) $\cos\theta=\dfrac{4}{5}$, $\tan\theta=-\dfrac{3}{4}$

(3) $\theta=-45^\circ$　(4) $\cos^2\theta=\dfrac{1}{2}$, $\sin^2\theta=\dfrac{1}{2}$

[解説]

θの範囲より，$\sin\theta<0$, $\cos\theta\geqq0$, $\tan\theta<0$

(1) 与式より　$3-3\cos\theta=1+\cos\theta$　$\therefore\ \cos\theta=\dfrac{1}{2}$

(2) 与式より　$1-\sin\theta=4+4\sin\theta$　$\therefore\ \sin\theta=-\dfrac{3}{5}$

$\cos\theta=\sqrt{1-\left(-\dfrac{3}{5}\right)^2}=\dfrac{4}{5}$

(3) $1=\sin^2\theta+\cos^2\theta=(-\cos\theta)^2+\cos^2\theta$

$\therefore\ \cos\theta=\sqrt{\dfrac{1}{2}}$

(4) $\sin^2\theta\cos^2\theta=\dfrac{1}{4}$に$\sin^2\theta=1-\cos^2\theta$を代入して

$(1-\cos^2\theta)\cos^2\theta=\dfrac{1}{4}$
$\therefore\ 4\cos^4\theta-4\cos^2\theta+1=0$
$(2\cos^2\theta-1)^2=0$
$\cos^2\theta=\dfrac{1}{2}$
$\sin^2\theta=1-\cos^2\theta=\dfrac{1}{2}$

3 $\theta=45^\circ+360^\circ\times n$ (nは整数)

[解説]

$1=\sin^2\theta+(\sqrt{2}-\sin\theta)^2$
$=2\sin^2\theta-2\sqrt{2}\sin\theta+2$
$\therefore\ 2\sin^2\theta-2\sqrt{2}\sin\theta+1=0$

これを解くと，$\sin\theta=\dfrac{1}{\sqrt{2}}$

このとき

$\cos\theta=\sqrt{2}-\dfrac{\sqrt{2}}{2}=\dfrac{\sqrt{2}}{2}$

よって，$\sin\theta=\dfrac{\sqrt{2}}{2}$, $\cos\theta=\dfrac{\sqrt{2}}{2}$となる$\theta$は

$\theta=45^\circ+360^\circ\times n$ (nは整数)

4 (1) $\cos\dfrac{8}{9}\pi$　(2) $\sin\left(-\dfrac{5}{18}\pi\right)$　(3) $\cos\dfrac{11}{18}\pi$

(4) $\sin\dfrac{5}{18}\pi$

[解説]

(1) $\sin\dfrac{65}{18}\pi=\sin\left(\dfrac{28}{9}\pi+\dfrac{\pi}{2}\right)=\cos\dfrac{28}{9}\pi=\cos\dfrac{10}{9}\pi$
$=\cos\left(-\dfrac{10}{9}\pi\right)=\cos\left(-\dfrac{10}{9}\pi+2\pi\right)$

(2) $\cos\left(-\frac{25}{9}\pi\right) = \cos\left(-\frac{59}{18}\pi + \frac{\pi}{2}\right) = -\sin\left(-\frac{59}{18}\pi\right)$

$= \sin\frac{59}{18}\pi = \sin\frac{23}{18}\pi$

$= \sin\left(\frac{5}{18}\pi + \pi\right) = -\sin\frac{5}{18}\pi$

$= \sin\left(-\frac{5}{18}\pi\right)$

(3) $\sin\left(-\frac{19}{9}\pi\right) = \sin\left(-\frac{47}{18}\pi + \frac{\pi}{2}\right) = \cos\left(-\frac{47}{18}\pi\right)$

$= \cos\left(-\frac{11}{18}\pi\right) = \cos\frac{11}{18}\pi$

(4) $\cos\frac{34}{9}\pi = \cos\left(\frac{59}{18}\pi + \frac{\pi}{2}\right) = -\sin\frac{59}{18}\pi$

$= -\sin\frac{23}{18}\pi = -\sin\left(\frac{5}{18}\pi + \pi\right)$

$= \sin\frac{5}{18}\pi$

5 (1) 162° (2) 208° (3) 316° (4) 231°
(5) 249° (6) −109° (7) −34° (8) −70°

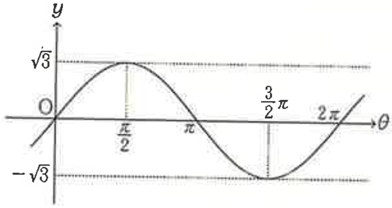
［解説］

(1) sin18° ≒ 0.31, sin(180° − 18°) = sin18°
(2) sin28° ≒ 0.47, sin(28° + 180°) = −sin28°
(3) cos44° ≒ 0.72, cos(360° − 44°) = cos44°
(4) cos51° ≒ 0.63, cos(51° + 180°) = −cos51°
(5) tan69° ≒ 2.6, tan(69° + 180°) = tan69°
(6) tan71° ≒ 2.9, tan(71° − 180°) = tan71°
(7) cos34° ≒ 0.83, cos(−34°) = cos34°
(8) sin70° ≒ 0.94, sin(−70°) = −sin70°

25 三角関数のグラフ〔P 132～P 137〕

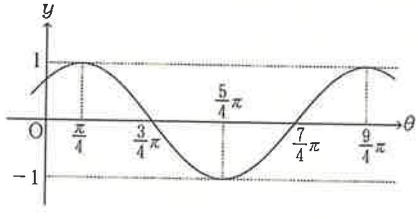
◇確認問題〔P 132～P 135〕

1 (1)



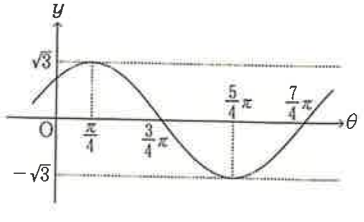
$y = \sin\theta$ のグラフを，y 軸方向に $\sqrt{3}$ 倍したもの

(2)



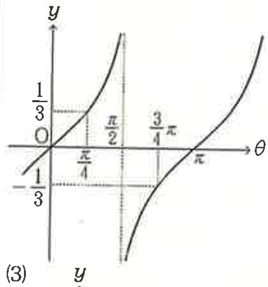
$y = \cos\theta$ のグラフを，θ 軸の正方向に $\frac{\pi}{4}$ 平行移動

(3)

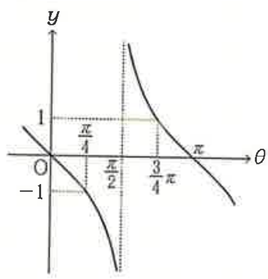


$y = \sin\theta$ のグラフを，θ 軸の負方向に $\frac{\pi}{4}$ 平行移動し，それを y 軸方向に $\sqrt{3}$ 倍したもの

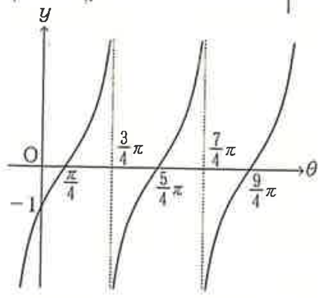
2 (1)



(2)



(3)



3 (1) $\theta = \frac{2}{3}\pi,\ \frac{4}{3}\pi$ (2) $\theta = \frac{\pi}{6},\ \frac{5}{6}\pi,\ \frac{7}{6}\pi,\ \frac{11}{6}\pi$

［解説］

(1) $y = \cos\theta$ のグラフと直線 $y = -\frac{1}{2}$ の交点をみつければよい．

(2) $y = \tan\theta$ のグラフと直線 $y = \frac{\sqrt{3}}{3}$，$y = -\frac{\sqrt{3}}{3}$ の交点をみつければよい．

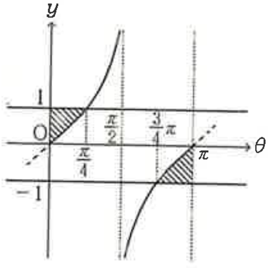
4 (1) $0 \leqq \theta \leqq \frac{\pi}{4},\ \frac{7}{4}\pi \leqq \theta < 2\pi$

(2) $0 \leqq \theta \leqq \frac{\pi}{4},\ \frac{3}{4}\pi \leqq \theta < \pi$

［解説］

(1) $y = \cos\theta$ のグラフが直線 $y = \frac{\sqrt{2}}{2}$ より上に出ている部分をみつければよい．

(2) $y = \tan\theta$ のグラフが直線 $y = 1$，$y = -1$ の作る帯状領域に入っている部分をみつければよい．



5 (1) 最大値 $3 + 2\sqrt{2}$ $\left(\theta = \frac{\pi}{2}\right)$

最小値 0 $\left(\theta = \frac{5}{4}\pi,\ \frac{7}{4}\pi\right)$

(2) 最大値　2　($\theta = \pi$)，最小値　$-\frac{1}{4}$　$\left(\theta = \frac{\pi}{3},\ \frac{5}{3}\pi\right)$

［解説］

(1)　$x = \sin\theta$ とおくと，$-1 \leqq x \leqq 1$ である．

$$f(x) = 2x^2 + 2\sqrt{2}\,x + 1 = \left(\sqrt{2}\,x + 1\right)^2$$

よって，$\begin{cases} x = -\dfrac{1}{\sqrt{2}} \text{ のとき，} f(x) \text{ は最小値 } 0 \\ x = 1 \text{ のとき，} f(x) \text{ は最大値 } 3 + 2\sqrt{2} \end{cases}$

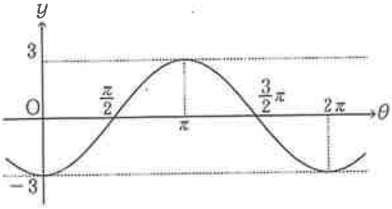
(2)　$x = \cos\theta$ とおくと，$-1 \leqq x \leqq 1$ である．

$$f(x) = x^2 - x = \left(x - \frac{1}{2}\right)^2 - \frac{1}{4}$$

よって，$\begin{cases} x = \dfrac{1}{2} \text{ のとき，} f(x) \text{ は最小値 } -\dfrac{1}{4} \\ x = -1 \text{ のとき，} f(x) \text{ は最大値 } 2 \end{cases}$

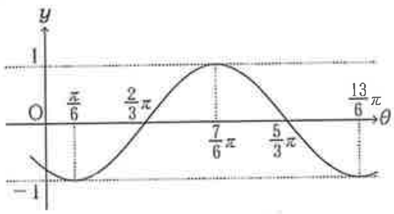
◇練成問題Ａ〔P 136〕

1 (1)



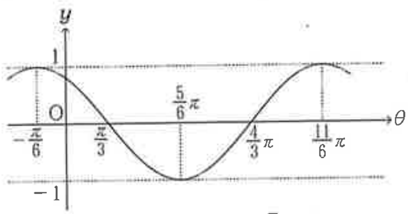
$y = \cos\theta$ を y 軸方向に -3 倍したもの

(2)



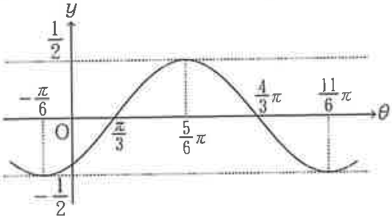
$y = \sin\theta$ を θ 軸の正方向に $\frac{2}{3}\pi$ ずらしたもの

(3)



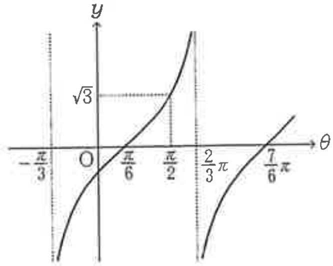
$y = \cos\theta$ を θ 軸の負方向に $\frac{\pi}{6}$ ずらしたもの

(4)



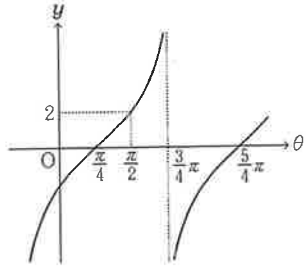
$y = \sin\theta$ を θ 軸方向に $\frac{\pi}{3}$ ずらし，y 軸方向に $\frac{1}{2}$ 倍したもの

2 (1)



$y = \tan\theta$ を θ 軸の負方向に $\frac{5}{6}\pi$ ずらしたもの

(2)



$y = \tan\theta$ を θ 軸の正方向に $\frac{\pi}{4}$ ずらし，y 軸方向に 2 倍したもの

3 (1)　$\theta = \frac{\pi}{6},\ \frac{11}{6}\pi$　　(2)　$\theta = \frac{5}{6}\pi,\ \frac{11}{6}\pi$

(3)　$\theta = \frac{\pi}{4},\ \frac{3}{4}\pi$　　(4)　$\theta = \pi$

［解説］

(1)　$y = \cos\theta$ のグラフと直線 $y = \frac{\sqrt{3}}{2}$ の交点をみつける．

(2)　$y = \tan\theta$ のグラフと直線 $y = -\frac{\sqrt{3}}{3}$ の交点をみつける．

(3)　$y = \sin\theta$ のグラフと直線 $y = \frac{\sqrt{2}}{2}$ の交点をみつける．

(4)　$y = \cos\theta$ のグラフと直線 $y = -1$ の交点をみつける．

4 (1)　$0 \leqq \theta \leqq \frac{2}{3}\pi,\ \frac{4}{3}\pi \leqq \theta < 2\pi$

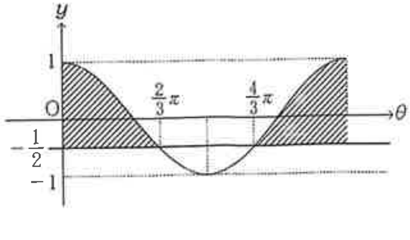
(2)　$\frac{4}{3}\pi < \theta < \frac{5}{3}\pi$

(3)　$0 \leqq \theta < \frac{\pi}{3},\ \frac{2}{3}\pi < \theta \leqq \frac{7}{6}\pi,\ \frac{11}{6}\pi \leqq \theta < 2\pi$

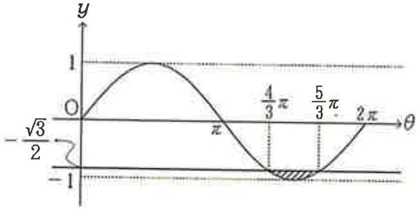
(4)　$\frac{\pi}{2} < \theta < \frac{2}{3}\pi,\ \frac{3}{2}\pi < \theta < \frac{5}{3}\pi$

［解説］

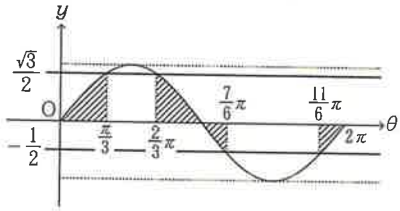
(1)　$\cos\theta \geqq -\frac{1}{2}$



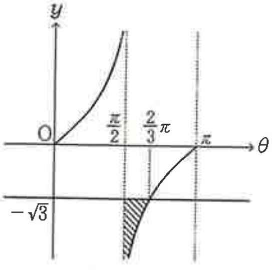
(2) $\sin\theta < -\dfrac{\sqrt{3}}{2}$



(3) $-\dfrac{1}{2} \leqq \sin\theta < \dfrac{\sqrt{3}}{2}$



(4)



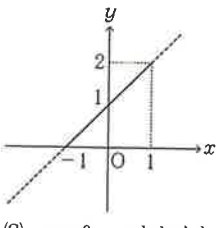
5 (1) 最大値　2 $\left(\theta = \dfrac{\pi}{2}\right)$, 最小値　0 $\left(\theta = \dfrac{3}{2}\pi\right)$

(2) 最大値 $-\dfrac{2}{3}$ $(\theta = 0)$, 最小値 $-\dfrac{4}{3}$ $(\theta = \pi)$

[解説]

(1) $\sin\theta = x$ とおくと　$-1 \leqq x \leqq 1$

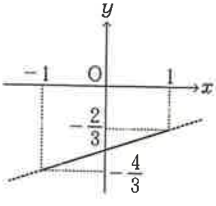
$y = x + 1$



$x = 1$ のとき
最大値 2 をとる
$x = -1$ のとき
最小値 0 をとる

(2) $\cos\theta = x$ とおくと　$-1 \leqq x \leqq 1$

$y = \dfrac{1}{3}x - 1$



$x = 1$ のとき
最大値 $-\dfrac{2}{3}$ をとる
$x = -1$ のとき
最小値 $-\dfrac{4}{3}$ をとる

6 最大値　$9 + 4\sqrt{3}$ $(\theta = \pi)$, 最小値　2 $\left(\theta = \dfrac{\pi}{6},\ \dfrac{11}{6}\pi\right)$

[解説]

$\cos\theta = x$ とおく．$-1 \leqq x \leqq 1$ である．

$$y = 4x^2 - 4\sqrt{3}\,x + 5 = 4\left(x - \frac{\sqrt{3}}{2}\right)^2 + 2$$

よって y は $x = \dfrac{\sqrt{3}}{2}$ のときに最小値2をとり，$x = -1$ のときに最大値 $9 + 4\sqrt{3}$ をとる．

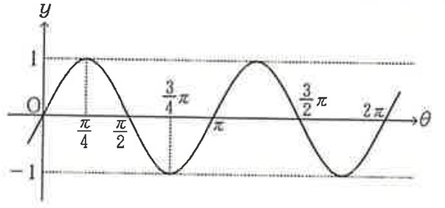
$x = \dfrac{\sqrt{3}}{2}$ のとき　$\cos\theta = \dfrac{\sqrt{3}}{2}$　　$\therefore\ \theta = \dfrac{\pi}{6},\ \dfrac{11}{6}\pi$

$x = -1$ のとき　$\cos\theta = -1$　　$\therefore\ \theta = \pi$

◇練成問題B〔P 137〕

1 (1) (b), (e)　　(2) (a), (c), (d), (f)　　(3) (e), (f)

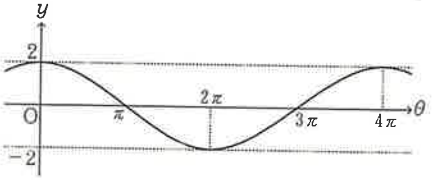
2 (1)



$y = \sin\theta$ のグラフを θ 軸方向に $\dfrac{1}{2}$ に縮めたもの

周期は π

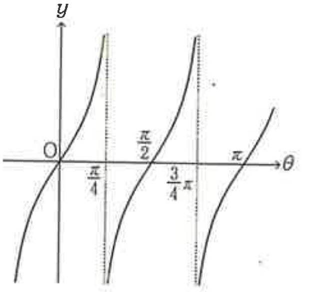
(2)



$y = \cos\theta$ のグラフを θ 軸方向に 2 倍に引き延ばし，y 軸方向に 2 倍したもの

周期は 4π

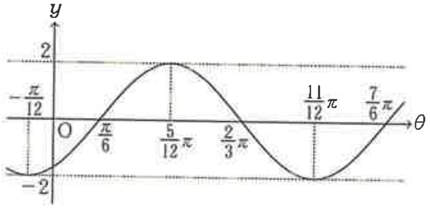
(3)



$y = \tan\theta$ のグラフを θ 軸方向に $\dfrac{1}{2}$ に縮めたもの

周期は $\dfrac{\pi}{2}$

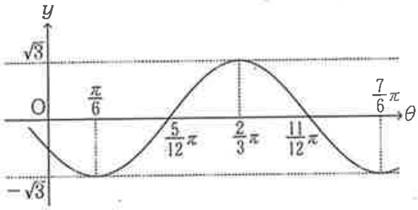
(4)



$y = \sin 2\theta$ のグラフを θ 軸の正方向に $\frac{\pi}{6}$ 平行移動し，y 軸方向（振幅）に 2 倍したもの

周期は π

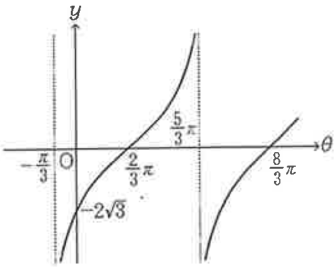
(5)



$y = \cos 2\theta$ のグラフを θ 軸の負方向に $\frac{\pi}{3}$ 平行移動し，y 軸方向（振幅）に $\sqrt{3}$ 倍したもの

周期は π

(6)



$y = \tan\frac{\theta}{2}$ のグラフを θ 軸の正方向に $\frac{2}{3}\pi$ 平行移動し，y 軸方向（振幅）に 2 倍したもの

周期は 2π

3 (1) $\theta = \frac{5}{8}\pi,\ \frac{7}{8}\pi,\ \frac{13}{8}\pi,\ \frac{15}{8}\pi$

(2) $\theta = \frac{\pi}{8},\ \frac{5}{8}\pi,\ \frac{9}{8}\pi,\ \frac{13}{8}\pi$

(3) $\theta = \frac{\pi}{3}$

(4) $\theta = \frac{\pi}{3},\ \frac{2}{3}\pi,\ \frac{4}{3}\pi,\ \frac{5}{3}\pi$

(5) $\theta = \frac{\pi}{3},\ \frac{2}{3}\pi,\ \frac{4}{3}\pi,\ \frac{5}{3}\pi$

(6) $\theta = \frac{\pi}{4},\ \frac{5}{4}\pi$

[解説]

(1) $0 \leqq 2\theta < 4\pi$ に注意する.

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

$\therefore\ 2\theta = \frac{5}{4}\pi,\ \frac{7}{4}\pi,\ \frac{5}{4}\pi + 2\pi,\ \frac{7}{4}\pi + 2\pi$

(2) $0 \leqq 2\theta < 4\pi$ に注意する.

$\tan 2\theta = 1$

$\therefore\ 2\theta = \frac{\pi}{4},\ \frac{\pi}{4} + \pi,\ \frac{\pi}{4} + \pi \times 2,\ \frac{\pi}{4} + \pi \times 3$

(3) $0 \leqq \frac{\theta}{2} < \pi$ に注意する.

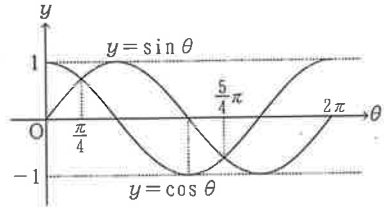
$\cos\frac{\theta}{2} = \frac{\sqrt{3}}{2}$

$\therefore\ \frac{\theta}{2} = \frac{\pi}{6}$

(4) $|\cos\theta| = \frac{1}{2}$，$\cos\theta = \frac{1}{2},\ -\frac{1}{2}$

(5) $\sin\theta = \pm\frac{\sqrt{3}}{2}$

(6) $y = \sin\theta$ のグラフと $y = \cos\theta$ のグラフの交点をみつける.



図より，$y = \cos\theta$ と $y = \sin\theta$ の交点は，$0 \leqq \theta < 2\pi$ の範囲に 2 つある.

4 (1) $\frac{\pi}{3} < \theta < \frac{2}{3}\pi,\ \frac{4}{3}\pi < \theta < \frac{5}{3}\pi$

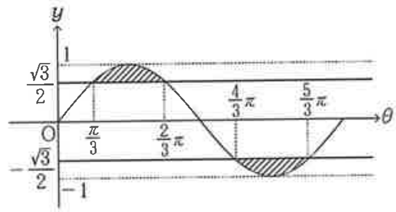
(2) $\frac{\pi}{6} < \theta < \frac{\pi}{3},\ \frac{5}{6}\pi < \theta < \frac{5}{3}\pi$

(3) $0 \leqq \theta < \frac{\pi}{4},\ \frac{3}{4}\pi < \theta < \frac{5}{4}\pi,\ \frac{7}{4}\pi < \theta < 2\pi$

(4) $0 \leqq \theta < \frac{\pi}{12},\ \frac{11}{12}\pi < \theta < \frac{13}{12}\pi,\ \frac{23}{12}\pi < \theta < 2\pi$

[解説]

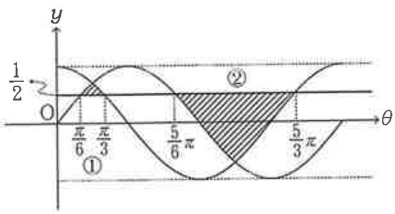
(1) $\sin\theta > \frac{\sqrt{3}}{2}$ または $\sin\theta < -\frac{\sqrt{3}}{2}$



(2) $\cos\theta > \frac{1}{2}$ かつ $\sin\theta > \frac{1}{2}$ …… ①

または

$\cos\theta < \frac{1}{2}$ かつ $\sin\theta < \frac{1}{2}$ …… ②



(3) $-1 < \tan\theta < 1$