

高知工科大学

基礎数学ワークブック

(2001年度版)

秋期入学者用

III

解答

## < 1 ページ. 対数の性質 1 >

### 問 1 の解答

$$(1) \log_2 \left( \frac{2^\alpha}{2^\beta} \right) = \log_2 (2^{\alpha-\beta}) = \alpha - \beta$$

$$(2) \log_2 (2^\alpha) - \log_2 (2^\beta) = \alpha - \beta$$

### 問 2 の解答

$$(1) 4 \log_2 M \qquad (2) 5 \log_2 M$$

### 問 3 の解答

$$(1) \log_2 ((2^\alpha)^r) = \log_2 (2^{\alpha r}) = \alpha r$$

$$(2) r \times \log_2 (2^\alpha) = r \times \alpha$$

### 問 4 の解答

$$\log_2 \left( \frac{M}{N} \right) = \log_2 M - \log_2 N$$

## < 2 ページ. 対数の性質 2 >

### 問 1 の解答

$$\log_a \left( \frac{M}{N} \right) = \log_a M - \log_a N$$

### 問 2 の解答

$$\log_a (M^r) = r \times \log_a M$$

### 問 3 の解答

$$(1) \log_2 \left( \frac{56}{7} \right) = \log_2 8 = 3$$

$$(2) \log_3 \left( \frac{135}{5} \right) = \log_3 (27) = 3$$

$$(3) \log_6 (3 \times 54 \times 2^3) = \log_6 (2^4 \times 3^4) = \log_6 (6^4) = 4$$

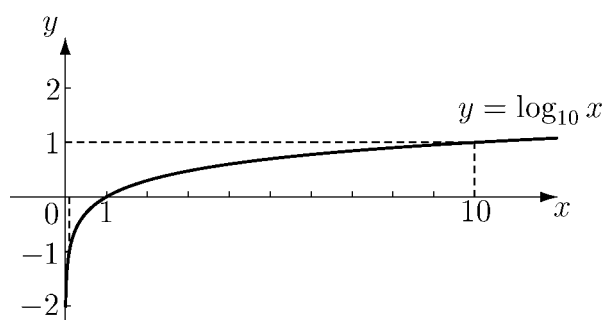
$$(4) \log_{10} \left( \frac{5 \times 8}{0.4} \right) = \log_{10} (100) = 2$$

## < 3 ページ. 対数関数 >

### 解答

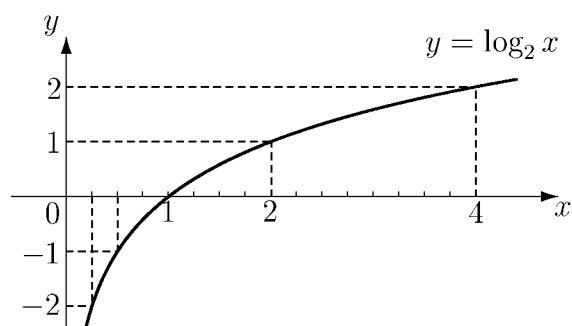
(1)  $y = \log_{10} x \quad (x > 0)$

$x$	0.1	1	$\sqrt{10}$	10
$y$	-1	0	$\frac{1}{2}$	1



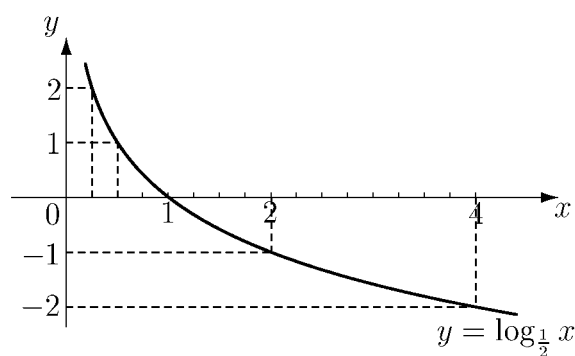
(2)  $y = \log_2 x \quad (x > 0)$

$x$	$\frac{1}{4}$	$\frac{1}{2}$	1	2	4
$y$	-2	-1	0	1	2



(3)  $y = \log_{\frac{1}{2}} x \quad (x > 0)$

$x$	$\frac{1}{4}$	$\frac{1}{2}$	1	2	4
$y$	2	1	0	-1	-2



## &lt; 4 ページ. ネピアの数 1 &gt;

解答

$$\lim_{n \rightarrow \infty} \left(1 + \frac{1}{n}\right)^n = e$$

## < 5 ページ. ネピアの数 2 >

解答

$$(1) \lim_{h \rightarrow 0} \frac{e^3 (e^h - 1)}{h} = \lim_{h \rightarrow 0} e^3 \times \left( \frac{e^h - 1}{h} \right) = e^3 \times 1 = e^3$$

$$(2) \lim_{h \rightarrow 0} \frac{e^x (e^h - 1)}{h} = \lim_{h \rightarrow 0} e^x \times \left( \frac{e^h - 1}{h} \right) = e^x \times 1 = e^x$$

## < 6 ページ. 指数関数 $e^x$ >

解答

$$f'(x) = \left(\frac{1}{2}e^x\right)' = \frac{1}{2}e^x$$

$$(1) f'(0) = \frac{1}{2}e^0 = \frac{1}{2}$$

$$(2) f'(1) = \frac{1}{2}e^1 = \frac{e}{2}$$

$$(3) f'(-1) = \frac{1}{2}e^{-1} = \frac{1}{2e}$$

**< 7 ページ. 指数関数  $e^x$  の微分・積分 >****問 1 の解答**

(1)  $9e^x$

(2)  $-2e^x$

(3)  $\frac{1}{4}e^x$

**問 2 の解答**

(1)  $3e^x + C$

(2)  $-\frac{1}{4}e^x + C$

**問 3 の解答**

(1)  $[e^x]_0^2 = e^2 - 1$

(2)  $[2e^x]_0^3 = 2e^3 - 2$

(3)  $[4e^x]_{-2}^2 = 4e^2 - \frac{4}{e^2}$

## &lt; 8 ページ. 対数関数の微分 &gt;

解答

$$\begin{aligned} f'(3) &= \lim_{h \rightarrow 0} \frac{f(3+h) - f(3)}{h} = \lim_{h \rightarrow 0} \frac{1}{h} \{ \log_{10}(3+h) - \log_{10} 3 \} \\ &= \lim_{h \rightarrow 0} \frac{1}{h} \log_{10} \left( \frac{3+h}{3} \right) = \lim_{h \rightarrow 0} \frac{1}{h} \log_{10} \left( 1 + \frac{h}{3} \right) \end{aligned}$$

 $t = \frac{h}{3}$  とおくと  $h \rightarrow 0$  のとき  $t \rightarrow 0$ 

$$\begin{aligned} f'(3) &= \lim_{h \rightarrow 0} \frac{1}{h} \log_{10} \left( 1 + \frac{h}{3} \right) = \lim_{t \rightarrow 0} \frac{1}{3t} \log_{10}(1+t) = \lim_{t \rightarrow 0} \frac{1}{3} \log_{10}(1+t)^{\frac{1}{t}} \\ &= \frac{1}{3} \log_{10} e \end{aligned}$$

$$f'(x) = \frac{1}{x} \log_{10} e$$

## &lt; 9 ページ. 自然対数 &gt;

## 問 1 の解答

$$(\log_a x)' = \frac{1}{x} \log_a e$$

## 問 2 の解答

$$(\log_e x)' = \frac{1}{x} \log_e e = \frac{1}{x}$$

## 問 3 の解答

(1)  $\log_e e = 1$

(2)  $\log_e (\sqrt[3]{e}) = \frac{1}{3}$

(3)  $\log_e \left(\frac{1}{e}\right) = -1$

(4)  $\log_e 1 = 0$

## 問 4 の解答

$$(\log x)' = (\log_e x)' = \frac{1}{x}$$

## 問 5 の解答

(1)  $\frac{2}{x}$

(2)  $\frac{5}{x}$

## < 10 ページ. $\frac{1}{x}$ の積分 >

### 問 1 の解答

(1)  $5 \log x + C$

(2) 
$$\int \left( x + \frac{1}{x} + \frac{1}{x^2} \right) dx$$
$$= \frac{1}{2} x^2 + \log x - \frac{1}{x} + C$$

### 問 2 の解答

(1)  $[\log x]_3^6 = \log 6 - \log 3 = \log 2$

(2)  $[\log x]_{\frac{1}{e}}^e = \log e - \log \left( \frac{1}{e} \right) = 1 - (-1) = 2 = 2$

(3)  $\int_1^e \left( 1 + \frac{1}{x} \right) dx = [x + \log x]_1^e = (e + \log e) - (1 + \log 1) = e + 1 - 1 = e$

## < 11 ページ. 三角関数の定義 >

解答

$$(1) \sin 180^\circ = 0 \quad , \quad \cos 180^\circ = -1 \quad , \quad \tan 180^\circ = 0$$

$$(2) \sin 270^\circ = -1 \quad , \quad \cos 270^\circ = 0$$

**< 12 ページ. 三角関数の値 1 >****問 1 の解答**

$$(1) \cos 30^\circ = \frac{\sqrt{3}}{2}$$

$$(2) \sin 30^\circ = \frac{1}{2}$$

$$(3) \tan 30^\circ = \frac{\sqrt{3}}{3}$$

**問 2 の解答**

$$(1) \cos 60^\circ = \frac{1}{2}$$

$$(2) \sin 60^\circ = \frac{\sqrt{3}}{2}$$

$$(3) \tan 60^\circ = \sqrt{3}$$

**問 3 の解答**

$$(1) \cos 45^\circ = \frac{\sqrt{2}}{2}$$

$$(2) \sin 45^\circ = \frac{\sqrt{2}}{2}$$

$$(3) \tan 45^\circ = 1$$

**問 4 の解答**

$$(1) \cos 135^\circ = -\frac{\sqrt{2}}{2}, \quad \sin 135^\circ = \frac{\sqrt{2}}{2}, \quad \tan 135^\circ = -1$$

$$(2) \cos 225^\circ = -\frac{\sqrt{2}}{2}, \quad \sin 225^\circ = -\frac{\sqrt{2}}{2}, \quad \tan 225^\circ = 1$$

$$(3) \cos 225^\circ = -\frac{\sqrt{2}}{2}, \quad \sin 225^\circ = -\frac{\sqrt{2}}{2}, \quad \tan 225^\circ = 1$$

## &lt; 13 ページ. 三角関数の値 2 &gt;

## 問 1 の解答

$$(1) \cos 150^\circ = -\frac{\sqrt{3}}{2}, \quad \sin 150^\circ = \frac{1}{2}, \quad \tan 150^\circ = -\frac{\sqrt{3}}{3}$$

$$(2) \cos 210^\circ = -\frac{\sqrt{3}}{2}, \quad \sin 210^\circ = -\frac{1}{2}, \quad \tan 210^\circ = \frac{\sqrt{3}}{3}$$

$$(3) \cos 330^\circ = \frac{\sqrt{3}}{2}, \quad \sin 330^\circ = -\frac{1}{2}, \quad \tan 330^\circ = -\frac{\sqrt{3}}{3}$$

## 問 2 の解答

$$(1) \cos 120^\circ = -\frac{1}{2}, \quad \sin 120^\circ = \frac{\sqrt{3}}{2}, \quad \tan 120^\circ = -\sqrt{3}$$

$$(2) \cos 240^\circ = -\frac{1}{2}, \quad \sin 240^\circ = -\frac{\sqrt{3}}{2}, \quad \tan 240^\circ = \sqrt{3}$$

$$(3) \cos 300^\circ = \frac{1}{2}, \quad \sin 300^\circ = -\frac{\sqrt{3}}{2}, \quad \tan 300^\circ = -\sqrt{3}$$

## 問 3 の解答

角度 $\theta$	$0^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$90^\circ$	$120^\circ$	$135^\circ$	$150^\circ$
$\sin \theta$	0	$\frac{1}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{3}}{2}$	1	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{1}{2}$
$\cos \theta$	1	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{1}{2}$	0	$-\frac{1}{2}$	$-\frac{\sqrt{2}}{2}$	$-\frac{\sqrt{3}}{2}$
$\tan \theta$	0	$\frac{\sqrt{3}}{3}$	1	$\sqrt{3}$	X	$-\sqrt{3}$	-1	$-\frac{\sqrt{3}}{3}$

	$180^\circ$	$210^\circ$	$225^\circ$	$240^\circ$	$270^\circ$	$300^\circ$	$315^\circ$	$330^\circ$	$360^\circ$
	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
	-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
	0	$\frac{\sqrt{3}}{3}$	1	$\sqrt{3}$	X	$-\sqrt{3}$	-1	$-\frac{\sqrt{3}}{3}$	0

**< 14 ページ. 一般角 >****解答**

(1)  $\sin(15^\circ)$                       (2)  $\cos(120^\circ)$                       (3)  $\tan(90^\circ)$

(4)  $\sin(345^\circ)$                       (5)  $\cos(240^\circ)$                       (6)  $\tan(45^\circ)$

## < 15 ページ. 三角関数の性質 1 >

### 問 1 の解答

$$(1) \sin(\theta + 180^\circ) = -\sin \theta$$

$$(2) \cos(\theta + 180^\circ) = -\cos \theta$$

$$(3) \tan(\theta + 180^\circ) = \tan \theta$$

### 問 2 の解答

$$(1) \sin(-\theta) = -\sin \theta$$

$$(2) \cos(-\theta) = \cos \theta$$

$$(3) \tan(-\theta) = -\tan \theta$$

## < 16 ページ. 三角関数の性質 2 >

### 問 1 の解答

$$(1) \sin(90^\circ - \theta) = \cos \theta \qquad (2) \cos(90^\circ - \theta) = \sin \theta$$

### 問 2 の解答

$$(1) \begin{array}{lll} \sin 200^\circ = -\sin 20^\circ & \cos 200^\circ = -\cos 20^\circ & \tan 200^\circ = \tan 20^\circ \\ = -0.342 & = -0.9397 & = 0.364 \end{array}$$

$$(2) \begin{array}{lll} \sin(-20^\circ) = -\sin 20^\circ & \cos(-20^\circ) = \cos 20^\circ & \tan(-20^\circ) = -\tan 20^\circ \\ = -0.342 & = 0.9397 & = -0.364 \end{array}$$

$$(3) \begin{array}{ll} \sin 70^\circ = \sin(90^\circ - 20^\circ) & \cos 70^\circ = \cos(90^\circ - 20^\circ) \\ = \cos 20^\circ & = \sin 20^\circ \\ = 0.9397 & = 0.342 \end{array}$$

## < 17 ページ. 三角関数の性質 3 >

### 問 1 の解答

$$\tan \theta = \frac{\sin \theta}{\cos \theta}$$

### 問 2 の解答

$\theta$	第1象限	第2象限	第3象限	第4象限
$\sin \theta$	+	+	-	-
$\cos \theta$	+	-	-	+
$\tan \theta$	+	-	+	-

### 問 3 の解答

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

## &lt; 18 ページ. 極座標 &gt;

## 解答

$$(1) (-1, \sqrt{3}) = (2 \cos 120^\circ, 2 \sin 120^\circ)$$

$$(2) \left( \frac{\sqrt{3}}{2}, -\frac{1}{2} \right) = (\cos(-30^\circ), \sin(-30^\circ)) \\ \left( = (\cos(330^\circ), \sin(330^\circ)) \right)$$

$$(3) (-1, -1) = (\sqrt{2} \cos(225^\circ), \sqrt{2} \sin(225^\circ)) \\ = (\sqrt{2} \cos(-135^\circ), \sqrt{2} \sin(-135^\circ))$$

$$(4) \left( \frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}} \right) = (\cos(45^\circ), \sin(45^\circ))$$

## < 19 ページ. 余弦定理 1 >

### 解答

$$(1) P(b \cos \theta, b \sin \theta)$$

$$Q(a, 0)$$

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

$$\begin{aligned} (3) PQ^2 &= b^2 \cos^2 \theta - 2ab \cos \theta + a^2 + b^2 \sin^2 \theta \\ &= a^2 + b^2(\cos^2 \theta + \sin^2 \theta) - 2ab \cos \theta \\ &= a^2 + b^2 - 2ab \cos \theta \end{aligned}$$

$$(4) c^2 = a^2 + b^2 - 2ab \cos \theta$$

## < 20 ページ. 余弦定理 2 >

### 問1の解答

$$c^2 = a^2 + b^2 - 2ab \cos \theta$$

### 問2の解答

$$(1) c^2 = 2^2 + (\sqrt{3})^2 - 2 \times 2 \times \sqrt{3} \times \cos 60^\circ$$

$$= 4 + 3 - 4\sqrt{3} \times \frac{\sqrt{3}}{2} = 7 - 6 = 1$$

$$\text{より } c = 1$$

$$(2) c^2 = 3^2 + (\sqrt{2})^2 - 2 \times 3 \times \sqrt{2} \times \cos 135^\circ$$

$$= 9 + 2 - 6\sqrt{2} \times \left(-\frac{\sqrt{2}}{2}\right)$$

$$= 11 + 6 = 17$$

$$\text{より } c = \sqrt{17}$$

## < 21 ページ. 加法定理 1 >

### 解答

$$(1) P(\cos \beta, \sin \beta)$$

$$(2) Q(\cos \alpha, -\sin \alpha)$$

$$\begin{aligned}(3) PQ^2 &= (\cos \alpha - \cos \beta)^2 + (-\sin \alpha - \sin \beta)^2 \\ &= \cos^2 \alpha - 2 \cos \alpha \cos \beta + \cos^2 \beta + \sin^2 \alpha + 2 \sin \alpha \sin \beta + \sin^2 \beta\end{aligned}$$

$$\begin{aligned}(4) PQ^2 &= (\cos^2 \alpha + \sin^2 \alpha) + (\cos^2 \beta + \sin^2 \beta) \\ &\quad - 2 \cos \alpha \cos \beta + 2 \sin \alpha \sin \beta \\ &= 2 - 2 \cos \alpha \cos \beta + 2 \sin \alpha \sin \beta\end{aligned}$$

$$\begin{aligned}(5) PQ^2 &= 1^2 + 1^2 - 2 \cos(\alpha + \beta) \\ &= 2 - 2 \cos(\alpha + \beta)\end{aligned}$$

$$(6) \cos(\alpha + \beta) = \cos \alpha \cos \beta - \sin \alpha \sin \beta$$

## < 22 ページ. 加法定理 2 >

### 問1の解答

$$\begin{aligned}(1) \cos(\alpha - \beta) &= \cos(\alpha + (-\beta)) = \cos \alpha \cos(-\beta) - \sin \alpha \sin(-\beta) \\ &= \cos \alpha \cos \beta + \sin \alpha \sin \beta\end{aligned}$$

$$\begin{aligned}(2) \sin(\alpha - \beta) &= \sin(\alpha + (-\beta)) = \sin \alpha \cos(-\beta) + \cos \alpha \sin(-\beta) \\ &= \sin \alpha \cos \beta - \cos \alpha \sin \beta\end{aligned}$$

### 問2の解答

$$\begin{aligned}(1) \cos 75^\circ &= \cos(40^\circ + 30^\circ) = \cos 40^\circ \cos 30^\circ - \sin 40^\circ \sin 30^\circ \\ &= \frac{\sqrt{2}}{2} \times \frac{\sqrt{3}}{2} - \frac{\sqrt{2}}{2} \times \frac{1}{2} = \frac{\sqrt{6} - \sqrt{2}}{4}\end{aligned}$$

$$\begin{aligned}(2) \sin 105^\circ &= \sin(60^\circ + 45^\circ) = \sin 60^\circ \cos 45^\circ + \cos 60^\circ \sin 45^\circ \\ &= \frac{\sqrt{3}}{2} \times \frac{\sqrt{2}}{2} + \frac{1}{2} \times \frac{\sqrt{2}}{2} = \frac{\sqrt{6} + \sqrt{2}}{4}\end{aligned}$$

## < 23 ページ. 倍角・半角の公式 >

### 問1の解答

$$(1)'' \cos(2\alpha) = \cos^2 \alpha - \sin^2 \alpha = (1 - \sin^2 \alpha) - \sin^2 \alpha = 1 - 2\sin^2 \alpha$$

### 問2の解答

$$(4) \sin^2 \alpha = \frac{1 - \cos(2\alpha)}{2}$$

### 問3の解答

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

## &lt; 24 ページ. 円周率 &gt;

## 問1の解答

(1)  $l = \pi(\text{cm})$

(2)  $l = 2\pi r$

## 問2の解答

(1)  $l = \pi r$

(2)  $l = \frac{\pi r}{2}$

(3)  $l = \frac{\pi r}{3}$

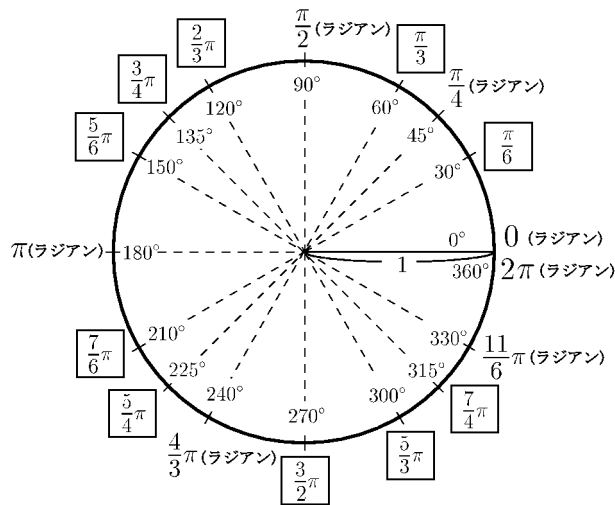
## &lt; 25 ページ. 弧度法 1 &gt;

## 解答

度数法	0°	30°	45°	60°	90°	120°	135°	150°	180°	210°	225°	240°	270°	300°	315°	330°	360°
弧度法	0	$\frac{\pi}{6}$	$\frac{\pi}{4}$	$\frac{\pi}{3}$	$\frac{\pi}{2}$	$\frac{2}{3}\pi$	$\frac{3}{4}\pi$	$\frac{5}{6}\pi$	$\pi$	$\frac{7}{6}\pi$	$\frac{5}{4}\pi$	$\frac{4}{3}\pi$	$\frac{3}{2}\pi$	$\frac{5}{3}\pi$	$\frac{7}{4}\pi$	$\frac{11}{6}\pi$	$2\pi$

## &lt; 26 ページ. 弧度法 2 &gt;

## 問1の解答



## 問2の解答

$$(1) \begin{aligned} 450^\circ &= 360^\circ + 90^\circ \\ &= 2\pi + \frac{\pi}{2} = \frac{5}{2}\pi \end{aligned}$$

$$(2) -240^\circ = -\frac{4}{3}\pi$$

$$(3) 500^\circ = \frac{25}{9}\pi$$

$$(4) \begin{aligned} -390^\circ &= -360^\circ - 30^\circ \\ &= -2\pi - \frac{\pi}{6} \\ &= -\frac{13}{6}\pi \end{aligned}$$

$$(5) \begin{aligned} 765^\circ &= 720^\circ + 45^\circ \\ &= 4\pi + \frac{\pi}{4} \\ &= \frac{17}{4}\pi \end{aligned}$$

$$(6) \begin{aligned} -870^\circ &= -720^\circ - 150^\circ \\ &= -4\pi - \frac{5}{6}\pi \\ &= -\frac{29}{6}\pi \end{aligned}$$

## 問3の解答

$$(1) \ell = 2\pi r$$

$$(2) S = \pi r^2$$

## &lt; 27 ページ. 弧度法 3 &gt;

## 問1の解答

度数法	$45^\circ$	$60^\circ$	$90^\circ$	$120^\circ$	$180^\circ$	$360^\circ$
弧度法 $\theta$	$\frac{\pi}{4}$	$\frac{\pi}{3}$	$\frac{\pi}{2}$	$\frac{2}{3}\pi$	$\pi$	$2\pi$
弧の長さ $\ell$	$\frac{1}{4}\pi r$	$\frac{\pi}{3}r$	$\frac{\pi}{2}r$	$\frac{2}{3}\pi r$	$\pi r$	$2\pi r$
面積 $S$	$\frac{\pi}{8}\pi r^2$	$\frac{\pi}{6}\pi r^2$	$\frac{1}{4}\pi r^2$	$\frac{\pi}{3}r^2$	$\frac{\pi}{2}r^2$	$\pi r^2$

## 問2の解答

$$\ell = \theta r$$

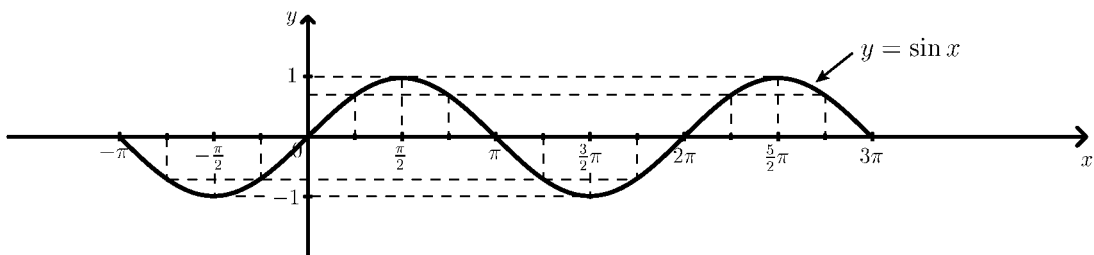
$$S = \frac{\theta}{2}r^2$$

## < 28 ページ. 三角関数のグラフ >

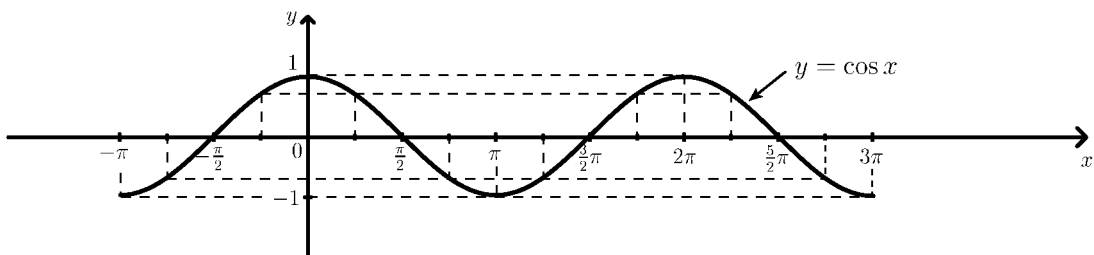
### 解答

$x$	度数法	$-180^\circ$	$-135^\circ$	$-90^\circ$	$-45^\circ$	$0^\circ$	$45^\circ$	$90^\circ$	$135^\circ$	$180^\circ$	$225^\circ$	$270^\circ$	$315^\circ$	$360^\circ$	$405^\circ$	$450^\circ$	$495^\circ$	$540^\circ$
	弧度法	$-\pi$	$-\frac{3}{4}\pi$	$-\frac{\pi}{2}$	$-\frac{\pi}{4}$	$0$	$\frac{\pi}{4}$	$\frac{\pi}{2}$	$\frac{3}{4}\pi$	$\pi$	$\frac{5}{4}\pi$	$\frac{3}{2}\pi$	$\frac{7}{4}\pi$	$2\pi$	$\frac{9}{4}\pi$	$\frac{5}{2}\pi$	$\frac{11}{4}\pi$	$3\pi$
$\sin x$		$0$	$-\frac{\sqrt{2}}{2}$	$-1$	$-\frac{\sqrt{2}}{2}$	$0$	$\frac{\sqrt{2}}{2}$	$1$	$\frac{\sqrt{2}}{2}$	$0$	$-\frac{\sqrt{2}}{2}$	$-1$	$-\frac{\sqrt{2}}{2}$	$0$	$\frac{\sqrt{2}}{2}$	$1$	$\frac{\sqrt{2}}{2}$	$0$
$\cos x$		$-1$	$-\frac{\sqrt{2}}{2}$	$0$	$\frac{\sqrt{2}}{2}$	$1$	$\frac{\sqrt{2}}{2}$	$0$	$-\frac{\sqrt{2}}{2}$	$-1$	$-\frac{\sqrt{2}}{2}$	$0$	$\frac{\sqrt{2}}{2}$	$1$	$\frac{\sqrt{2}}{2}$	$0$	$-\frac{\sqrt{2}}{2}$	$-1$

(1)  $y = \sin x$

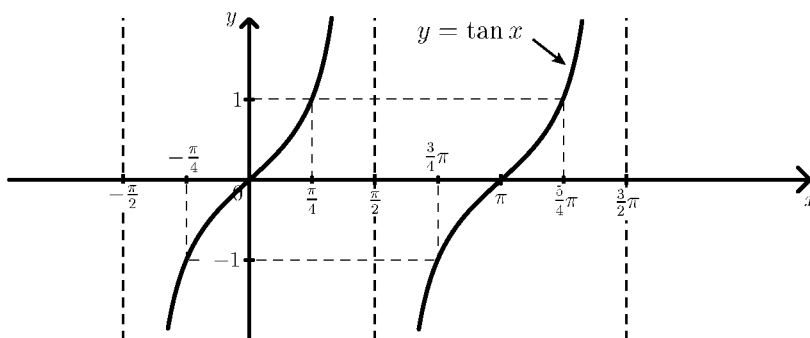


(2)  $y = \cos x$



$x$	度数法	$-90^\circ$	$-60^\circ$	$-45^\circ$	$-30^\circ$	$0^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$90^\circ$	$120^\circ$	$135^\circ$	$150^\circ$	$180^\circ$	$210^\circ$	$225^\circ$	$240^\circ$	$270^\circ$
	弧度法	$-\frac{\pi}{2}$	$-\frac{\pi}{3}$	$-\frac{\pi}{4}$	$-\frac{\pi}{6}$	$0$	$\frac{\pi}{6}$	$\frac{\pi}{4}$	$\frac{\pi}{3}$	$\frac{\pi}{2}$	$\frac{2}{3}\pi$	$\frac{3}{4}\pi$	$\frac{5}{6}\pi$	$\pi$	$\frac{7}{6}\pi$	$\frac{5}{4}\pi$	$\frac{4}{3}\pi$	$\frac{3}{2}\pi$
$\tan x$		$\times$	$-\sqrt{3}$	$-1$	$-\frac{\sqrt{3}}{3}$	$0$	$\frac{\sqrt{3}}{3}$	$1$	$\sqrt{3}$	$\times$	$-\sqrt{3}$	$-1$	$-\frac{\sqrt{3}}{3}$	$0$	$\frac{\sqrt{3}}{3}$	$1$	$\sqrt{3}$	$\times$

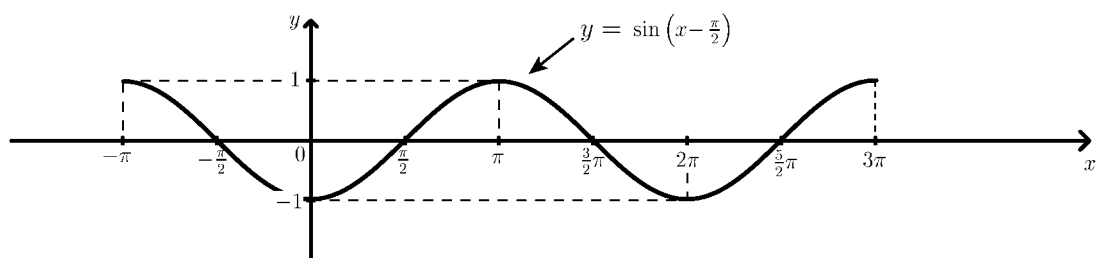
(3)  $y = \tan x$



## &lt; 29 ページ. 正弦波 1 &gt;

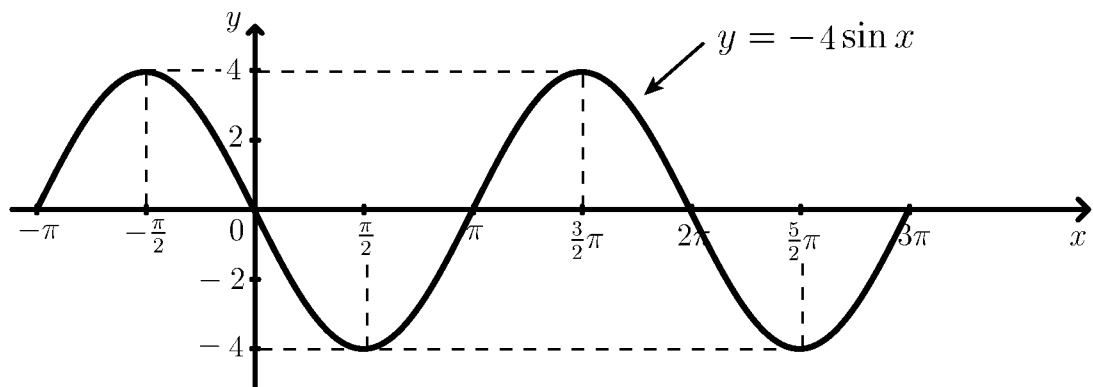
解答

$x$	$-\pi$	$-\frac{\pi}{2}$	$0$	$\frac{\pi}{2}$	$\pi$	$\frac{3}{2}\pi$	$2\pi$	$\frac{5}{2}\pi$	$3\pi$
$\sin x$	$0$	$-1$	$0$	$1$	$0$	$-1$	$0$	$1$	$0$
$\sin\left(x - \frac{\pi}{2}\right)$	$1$	$0$	$-1$	$0$	$1$	$0$	$-1$	$0$	$1$



## &lt; 30 ページ. 正弦波 2 &gt;

解答

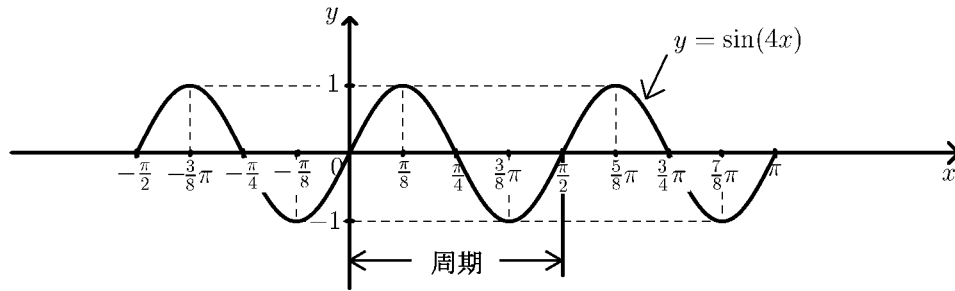


$y = \sin x$  のグラフを  $y$  軸方向に  $-4$  倍したもの

## &lt; 31 ページ. 正弦波 3 &gt;

## 解答

$x$	$-\frac{\pi}{2}$	$-\frac{3}{8}\pi$	$-\frac{\pi}{4}$	$-\frac{\pi}{8}$	$0$	$\frac{\pi}{8}$	$\frac{\pi}{4}$	$\frac{3}{8}\pi$	$\frac{\pi}{2}$	$\frac{5}{8}\pi$	$\frac{3}{4}\pi$	$\frac{7}{8}\pi$	$\pi$
$4x$	$-2\pi$	$-\frac{3}{2}\pi$	$-\pi$	$-\frac{\pi}{2}$	$0$	$\frac{\pi}{2}$	$\pi$	$\frac{3}{2}\pi$	$2\pi$	$\frac{5}{2}\pi$	$3\pi$	$\frac{7}{2}\pi$	$4\pi$
$\sin(4x)$	$0$	$1$	$0$	$-1$	$0$	$1$	$0$	$-1$	$0$	$1$	$0$	$-1$	$0$

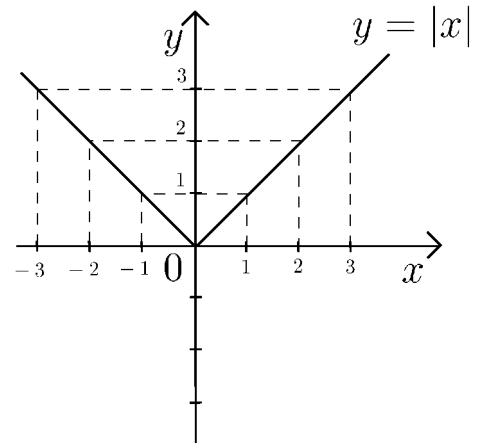


周期  $\frac{\pi}{2}$

## &lt; 32 ページ. 絶対値 &gt;

## 問1の解答

$x$	-3	-2	-1	0	1	2	3
$y$	3	2	1	0	1	2	3

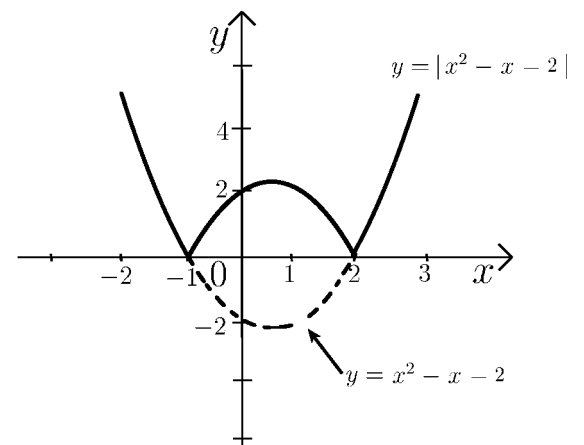


$x \geq 0$  の範囲では、直線  $y = \boxed{x}$  であり  
 $x < 0$  の範囲では、直線  $y = \boxed{-x}$  であることから、

$$y = |x| = \begin{cases} \boxed{x} & (x \geq 0) \\ \boxed{-x} & (x < 0) \end{cases} \text{ 分かる。}$$

## 問2の解答

$x$	-3	-2	-1	0	1	2	3
$y$	10	4	0	2	2	0	4



$$y = |x^2 - x - 2| = \begin{cases} \boxed{x^2 - x - 2} & (\boxed{2} \leq x) \\ \boxed{-x^2 + x + 2} & (\boxed{-1} < x < \boxed{2}) \\ \boxed{x^2 - x - 2} & (x \leq \boxed{-1}) \end{cases}$$

$$y = \boxed{x^2 - x - 2}$$

## &lt; 33 ページ. ガウス記号 &gt;

## 問1の解答

(1)  $[3] = 3$

(2)  $[2.1] = 2$

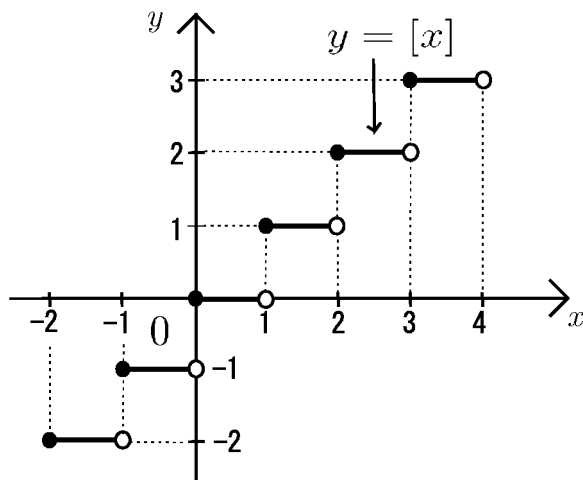
(3)  $[9.87] = 9$

(4)  $[-1] = -1$

(5)  $[-1.99] = -2$

(6)  $[-2.1] = -3$

## 問2の解答



## &lt; 34 ページ. 左極限・右極限 1 &gt;

解答

(1)  $\lim_{x \rightarrow 3-0} [x] = 2$

(2)  $\lim_{x \rightarrow 3+0} [x] = 3$

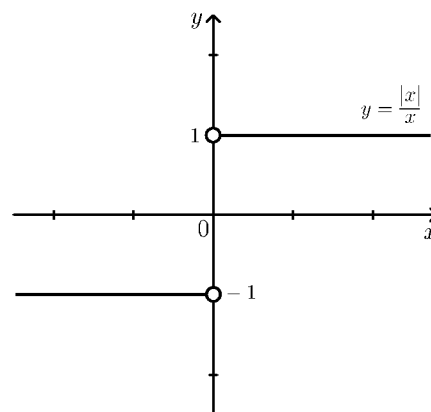
(3)  $\lim_{x \rightarrow -0} [x] = -1$

(4)  $\lim_{x \rightarrow +0} [x] = 0$

## &lt; 35 ページ. 左極限・右極限 2 &gt;

解答

$$(1) \lim_{x \rightarrow -0} \frac{|x|}{x} = -1 \quad (2) \lim_{x \rightarrow +0} \frac{|x|}{x} = 1$$



## < 36 ページ. 三角関数の極限 1 >

### 問 1 の解答

$$l_1 = \sin \theta \quad , \quad l_3 = \tan \theta$$

### 問 2 の解答

$$l_2 = \theta r = \theta \quad (r = 1)$$

### 問 3 の解答

$$\sin \theta < \theta < \tan \theta$$

### 問 4 の解答

$$\sin \theta < \theta < \frac{\sin \theta}{\cos \theta}$$

## < 37 ページ. 三角関数の極限 2 >

### 問1の解答

$$\cos \theta < \frac{\sin \theta}{\theta} < 1$$

### 問2の解答

$$\lim_{\theta \rightarrow +0} \frac{\sin \theta}{\theta} = 1$$

### 問3の解答

$$\lim_{\theta \rightarrow -0} \frac{\sin \theta}{\theta} = \lim_{\theta_1 \rightarrow +0} \frac{\sin(-\theta_1)}{-\theta_1} = \lim_{\theta_1 \rightarrow +0} \frac{-\sin \theta_1}{-\theta_1} = \lim_{\theta_1 \rightarrow +0} \frac{\sin \theta_1}{\theta_1} = 1$$

## &lt; 38 ページ. 三角関数の極限 3 &gt;

解答

$$\begin{aligned}\lim_{\theta \rightarrow 0} \frac{\cos(x + \theta) - \cos x}{\theta} &= \lim_{\theta \rightarrow 0} \frac{\cos x \cos \theta - \sin x \sin \theta - \cos x}{\theta} \\ &= \lim_{\theta \rightarrow 0} \left\{ (\cos x) \times \left( \frac{\cos \theta - 1}{\theta} \right) - (\sin x) \times \left( \frac{\sin \theta}{\theta} \right) \right\} \\ &= (\cos x) \times 0 - (\sin x) \times 1 \\ &= -\sin x\end{aligned}$$

## < 39 ページ. 三角関数の導関数 >

### 問1の解答

$$(\cos x)' = \lim_{h \rightarrow 0} \frac{\cos(x+h) - \cos x}{h} = \lim_{\theta \rightarrow 0} \frac{\cos(x+\theta) - \cos x}{\theta} = -\sin x$$

### 問2の解答

$$x = 0 \text{ のとき } \quad y = \cos x \text{ の傾き} = -\sin 0 = 0$$

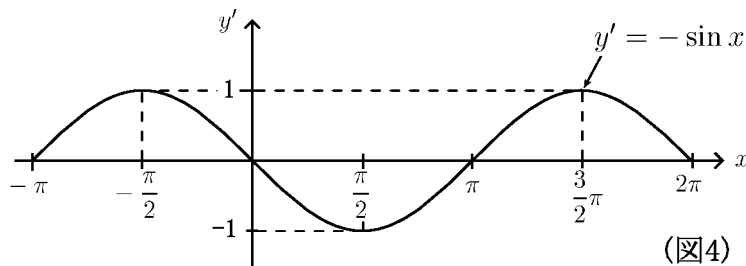
$$x = \frac{\pi}{2} \text{ のとき } \quad y = \cos x \text{ の傾き} = -\sin \frac{\pi}{2} = -1$$

$$x = \pi \text{ のとき } \quad y = \cos x \text{ の傾き} = -\sin \pi = 0$$

$$x = \frac{3}{2}\pi \text{ のとき } \quad y = \cos x \text{ の傾き} = -\sin \frac{3}{2}\pi = 1$$

$$x = 2\pi \text{ のとき } \quad y = \cos x \text{ の傾き} = -\sin 2\pi = 0$$

### 問3の解答



## &lt; 40 ページ. 三角関数の微分・積分 &gt;

## 問1の解答

$$(1) (3 \sin x + 2 \cos x)' = 3 \cos x - 2 \sin x$$

$$(2) (7 - 2 \sin x + 5 \cos x)' = -2 \cos x - 5 \sin x$$

## 問2の解答

$$(1) \int (\sin x + \cos x) dx = -\cos x + \sin x + C$$

$$(2) \int (2 \sin x - 7 \cos x) dx = -2 \cos x - 7 \sin x + C$$

## 問3の解答

$$(1) \int_0^{\pi} \cos x dx = [\sin x]_0^{\pi} = \sin \pi - \sin 0 = 0$$

$$(2) \int_0^{\pi} \frac{1}{2} \sin x dx = \left[ -\frac{1}{2} \cos x \right]_0^{\pi} = -\frac{1}{2} \cos \pi + \frac{1}{2} \cos 0 = 1$$

$$\begin{aligned} (3) \int_0^{\pi} (\sin x + \cos x) dx &= [-\cos x + \sin x]_0^{\pi} \\ &= (-\cos \pi + \sin \pi) - (-\cos 0 + \sin 0) \\ &= +1 + 1 = 2 \end{aligned}$$

$$\begin{aligned} (4) \int_{\frac{\pi}{2}}^0 (3 \sin x - 2 \cos x) dx &= [-3 \cos x - 2 \sin x]_{\frac{\pi}{2}}^0 \\ &= \left( -3 \cos 0 - 2 \sin 0 \right) - \left( -3 \cos \frac{\pi}{2} - 2 \sin \frac{\pi}{2} \right) \\ &= -3 - (-2) = -1 \end{aligned}$$