2002年度 基礎数学ワークブック

高知工科大学

基礎数学ワークブック

(2002年度版)

Series A

No. 2

解答

＜ 1 ページ. 分数指数 1 ＞

問の解答

(1) $121^{\frac{1}{2}} = 11$

(2) $27^{\frac{1}{3}} = 3$

(3) $25^{\frac{3}{2}} = 125$

(4) $343^{\frac{2}{3}} = 49$

(5) $81^{\frac{5}{4}} = 243$

(6) $32^{\frac{4}{5}} = 16$

(7) $16^{-\frac{1}{2}} = \dfrac{1}{4}$

(8) $27^{-\frac{4}{3}} = \dfrac{1}{81}$

(9) $64^{-\frac{2}{3}} = \dfrac{1}{16}$

＜ 2 ページ. 分数指数 2 ＞

問 1 の解答

(1) $\sqrt[6]{4^3} = 2$

(2) $\sqrt[12]{7^4} = \sqrt[3]{7}$

(3) $\sqrt[3]{5^9} = 125$

(4) $\sqrt[6]{27^4} = 9$

問 2 の解答

(1) $\sqrt[2]{10} \times \sqrt[4]{100} = \sqrt[4]{10000} = 10$

(2) $\dfrac{\sqrt[3]{9}}{\sqrt[6]{9}} = \sqrt[6]{\dfrac{9^2}{9}} = \sqrt[3]{3}$

(3) $\sqrt{\sqrt[3]{9}} = \sqrt[6]{9} = \sqrt[3]{3}$

(4) $\left(\sqrt[3]{\sqrt{27}}\right)^2 = \sqrt[3]{27} = 3$

< 3ページ. 指数法則 >

問 1 の解答

正の数 a と b、および有理数 p と q に対して

$1^\circ : a^p \times a^p = a^{\boxed{p+q}}$, $2^\circ : a^p \div a^q = a^{\boxed{p-q}}$

$3^\circ : (a^p)^q = a^{\boxed{pq}}$, $4^\circ : (ab)^p = a^p b^q$

問 2 の解答

(1) $\sqrt[4]{a} \times \sqrt[4]{a^3} = a$

(2) $\sqrt[3]{a^4} \div \sqrt[3]{a} = a$

(3) $\left(\sqrt[3]{a}\right)^4 \times \sqrt[3]{a^2} = a^2$

(4) $\sqrt[3]{a^7} \div \left(\sqrt[3]{a}\right)^4 = a$

(5) $\left(\sqrt[4]{a}\right)^{\frac{8}{3}} = \sqrt[3]{a^2}$

(6) $\left(\sqrt[5]{\sqrt[4]{a^{-3}}}\right)^{-2} = \sqrt[10]{a^3}$

問 3 の解答

(1) $(3^3 \times 5^2)^{\frac{1}{7}} \times (3^4 \times 5^5)^{\frac{1}{7}} = 3 \times 5 = 15$

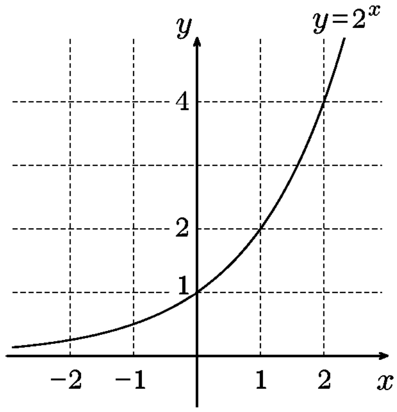
(2) $\sqrt[4]{18} \times \sqrt[4]{72} = \sqrt[4]{2^4 \times 3^4} = 6$

＜ 4 ページ. 指数関数 ＞

問の解答

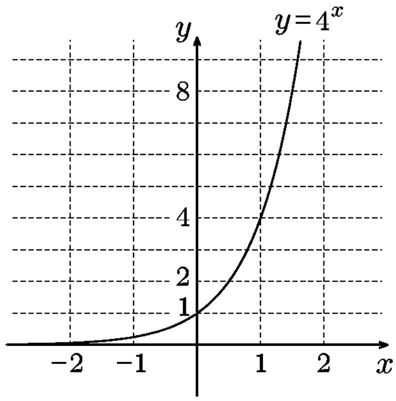
(1) $y = 2^x$

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



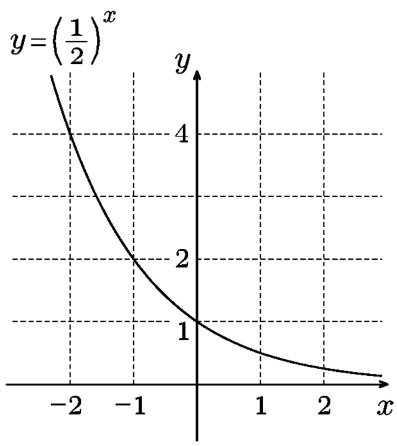
(2) $y = 4^x$

x	-1	$-\frac{1}{2}$	0	$\frac{1}{2}$	1	$\frac{3}{2}$
y	$\frac{1}{4}$	$\frac{1}{2}$	1	2	4	8



(3) $y = \left(\dfrac{1}{2}\right)^x$

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



< 5ページ. 指数方程式 >

問の解答

(1)	$x = 0$	(2)	$x = 1$	(3)	$x = 2$	(4)	$x = -1$
(5)	$x = \dfrac{1}{2}$	(6)	$x = 0$	(7)	$x = 2$	(8)	$x = \dfrac{1}{3}$
(9)	$x = -1$	(10)	$x = -2$	(11)	$x = 0$	(12)	$x = 2$
(13)	$x = 5$	(14)	$x = \dfrac{1}{4}$	(15)	$x = \dfrac{3}{2}$	(16)	$x = -1$
(17)	$x = -3$	(18)	$x = -2$	(19)	$x = -\dfrac{1}{2}$	(20)	$x = 0$
(21)	$x = 1$	(22)	$x = 3$	(23)	$x = 2$	(24)	$x = -1$
(25)	$x = -2$	(26)	$x = -\dfrac{1}{2}$	(27)	$x = 0$	(28)	$x = 2$
(29)	$x = \dfrac{1}{2}$	(30)	$x = \dfrac{3}{2}$	(31)	$x = -1$	(32)	$x = \dfrac{1}{4}$

＜ 6 ページ. 対数 1 ＞

問 1 の解答

(1) $\dfrac{1}{2} = \log_2 \sqrt{2}$

(2) $-1 = \log_5 \dfrac{1}{5}$

(3) $3^3 = 27$

(4) $9^{\frac{3}{2}} = 27$

問 2 の解答

(1) $\log_2 64 = 6$

(2) $\log_3 243 = 5$

(3) $\log_{10} 1000 = 3$

(4) $\log_5 625 = 4$

＜ 7 ページ. 対数 2 ＞

問 1 の解答

(1) $\log_2 64 = 6$

(2) $\log_2 \sqrt{2} = \dfrac{1}{2}$

(3) $\log_2 0.5 = -1$

(4) $\log_2 \left(2\sqrt{2}\right) = \dfrac{3}{2}$

(5) $\log_4 64 = 3$

(6) $\log_4 1 = 0$

(7) $\log_6 \sqrt[3]{6} = \dfrac{1}{3}$

(8) $\log_5 0.2 = -1$

(9) $\log_{10} 0.01 = -2$

(10) $\log_7 \sqrt[3]{49} = \dfrac{2}{3}$

(11) $\log_2 \left(\dfrac{1}{\sqrt{2}}\right) = -\dfrac{1}{2}$

(12) $\log_4 8 = \dfrac{3}{2}$

問 2 の解答

(証明)
$$\begin{aligned}
\log_2(M \times N) &= \log_2(2^\alpha \times 2^\beta) \\
&= \log_2(2^{\alpha+\beta}) \\
&= \alpha + \beta \\
&= \log_2(2^\alpha) + \log_2(2^\beta) \\
&= \log_2 M + \log_2 N
\end{aligned}$$

よって $\log_2(M \times N) = \log_2 M + \log_2 N$ が成り立つ

＜ 8 ページ. 対数 3 ＞

問 1 の解答

(証明) $\log_2\left(\dfrac{M}{N}\right) = \log_2(2^{\alpha-\beta})$

$$= \alpha - \beta$$

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

$$= \log_2 M - \log_2 N$$

よって $\log_2\left(\dfrac{M}{N}\right) = \log_2 M - \log_2 N$ が成り立つ

問 2 の解答

(証明) $\log_2(M^r) = \log_2(2^{\alpha\times r})$

$$= \alpha \times r$$

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

$$= r \times \log_2 M$$

よって $\log_2(M^r) = r \times \log_2 M$ が成り立つ

$<$ 9ページ. 対数 4 $>$

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) $\log_2 12 + \log_2 \dfrac{1}{3} = \log_2 4 = 2$

(2) $\log_3 108 - \log_3 4 = \log_3(27) = 3$

(3) $\log_6 12 + \log_6 2 + 2\log_6 3 = \log_6 6^3 = 3$

(4) $\log_{10} 4 + \log_{10} 25 - \log_{10} 0.1 = \log_{10} = 3$

＜ 10 ページ. 底の変換 ＞

問 1 の解答

$c = b$ とおくと、底の変換より

$$\log_a b = \frac{\log_c b}{\log_c a} = \frac{\log_b b}{\log_b a} = \frac{1}{\log_b a}$$

よって $\log_a b = \dfrac{1}{\log_b a}$ が成り立つ。

問 2 の解答

(1) $\log_4 32 + \log_{16} 64 = \dfrac{5}{2} + \dfrac{3}{2} = 4$

(2) $(\log_3 4) \times (\log_4 9) = \log_3 9 = 2$

(3) $(\log_2 3) \times (\log_3 4) \times (\log_4 2) = \log_2 2 = 1$

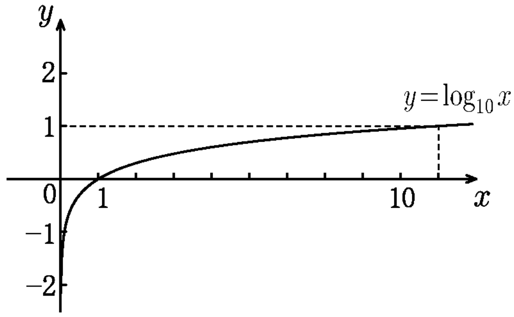
＜ 11 ページ. 対数関数 ＞

問の解答

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

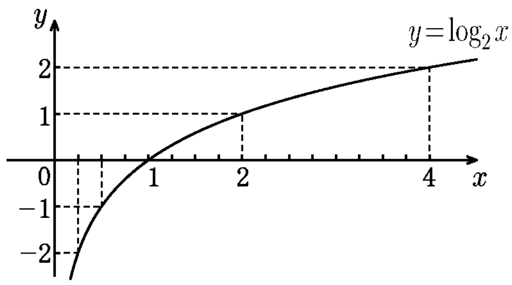
x	0.1	1	$\sqrt{10}$	10
y	-1	0	$\frac{1}{2}$	1

注) $\sqrt{10} \fallingdotseq 3.16$



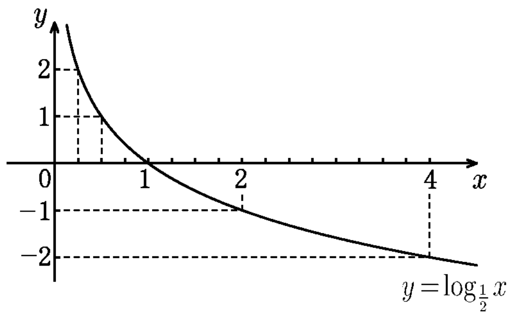
(2) $y = \log_2 x \quad (x > 0)$

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



＜ 12 ページ. 平面上の距離 ＞

問 1 の解答

(1) $\mathrm{A}(2,3)$, $\mathrm{B}(6,1)$

$\mathrm{AB} = \sqrt{4^2 + 2^2} = 2\sqrt{5}$

(2) $\mathrm{A}(1,2)$, $\mathrm{B}(-1,0)$

$\mathrm{AB} = \sqrt{2^2 + 2^2} = 2\sqrt{2}$

(3) $\mathrm{A}(2,-1)$, $\mathrm{B}(-1,-3)$

$\mathrm{AB} = \sqrt{3^2 + 2^2} = \sqrt{13}$

問 2 の解答

$\mathrm{A}(x_1, y_1)$, $\mathrm{B}(x_2, y_2)$

$\mathrm{AB} = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

＜ 13 ページ. 円の方程式 ＞

問 1 の解答

$$\left(x - \boxed{a}\right)^2 + \left(y - \boxed{b}\right)^2 = \boxed{r^2}$$

問 2 の解答

(1) $(x-1)^2 + (y-2)^2 = 16$: 中心 (1 , 2) , 半径 $= 4$

(2) $(x+2)^2 + (y+3)^2 = 4$: 中心 (-2 , -3) , 半径 $= 2$

(3) $x^2 + y^2 = 1$: 中心 (0 , 0) , 半径 $= 1$

＜ 14 ページ. 直角三角形 ＞

問 1 の解答

$c = \sqrt{a^2 + b^2}$

問 2 の解答

$\mathrm{AD} = \sqrt{3}$

問 3 の解答

$\mathrm{AB} = \dfrac{\sqrt{3}}{2}$ $\qquad$ $\mathrm{BC} = \dfrac{1}{2}$

問 4 の解答

$\mathrm{AD} = \mathrm{BC} = \dfrac{\sqrt{2}}{2}$

＜ 15 ページ. 円周上の点 ＞

問 1 の解答

A $(\ 1\ ,\ 0\ )$, B $(\ 0\ ,\ 1\ )$

C $(\ -1\ ,\ 0\ )$, D $(\ 0\ ,\ -1\ )$

問 2 の解答

A $\left(\dfrac{\sqrt{2}}{2}\ ,\ \dfrac{\sqrt{2}}{2}\right)$, B $\left(-\dfrac{\sqrt{2}}{2}\ ,\ \dfrac{\sqrt{2}}{2}\right)$

C $\left(-\dfrac{\sqrt{2}}{2}\ ,\ -\dfrac{\sqrt{2}}{2}\right)$, D $\left(\dfrac{\sqrt{2}}{2}\ ,\ -\dfrac{\sqrt{2}}{2}\right)$

問 3 の解答

A $\left(\dfrac{\sqrt{3}}{2}\ ,\ \dfrac{1}{2}\right)$, B $\left(-\dfrac{\sqrt{3}}{2}\ ,\ \dfrac{1}{2}\right)$

C $\left(-\dfrac{\sqrt{3}}{2}\ ,\ -\dfrac{1}{2}\right)$, D $\left(\dfrac{\sqrt{3}}{2}\ ,\ -\dfrac{1}{2}\right)$

問 4 の解答

A $\left(\dfrac{1}{2}\ ,\ \dfrac{\sqrt{3}}{2}\right)$, B $\left(-\dfrac{1}{2}\ ,\ \dfrac{\sqrt{3}}{2}\right)$

C $\left(-\dfrac{1}{2}\ ,\ -\dfrac{\sqrt{3}}{2}\right)$, D $\left(\dfrac{1}{2}\ ,\ -\dfrac{\sqrt{3}}{2}\right)$

< 16 ページ. 三角法 >

問の解答

$$1.5 + 10 \times \frac{1}{\sqrt{3}} = 1.5 + 5.774 = 7.274$$

(答) 7.274(m)

＜ 17 ページ. 三角比 1 ＞

問の解答

$$\sin 30^\circ = \frac{\mathrm{B'C'}}{\mathrm{A'B'}} = \frac{1}{2}$$

$$\cos 30^\circ = \frac{\mathrm{A'C'}}{\mathrm{A'B'}} = \frac{\sqrt{3}}{2}$$

$$\tan 30^\circ = \frac{\mathrm{B'C'}}{\mathrm{A'C'}} = \frac{\sqrt{3}}{3}$$

＜ 18 ページ. 三角比 2 ＞

問 1 の解答

(1) $\dfrac{\mathrm{BC}}{\mathrm{AB}} = \dfrac{\sqrt{2}}{2}$, $\dfrac{\mathrm{AC}}{\mathrm{AB}} = \dfrac{\sqrt{2}}{2}$, $\dfrac{\mathrm{BC}}{\mathrm{AC}} = 1$

(2) $\dfrac{\mathrm{B'C'}}{\mathrm{A'B'}} = \dfrac{\sqrt{2}}{2}$, $\dfrac{\mathrm{A'C'}}{\mathrm{A'B'}} = \dfrac{\sqrt{2}}{2}$, $\dfrac{\mathrm{B'C'}}{\mathrm{A'C'}} = 1$

(3) $\sin 45^\circ = \dfrac{\sqrt{2}}{2}$, $\cos 45^\circ = \dfrac{\sqrt{2}}{2}$, $\tan 45^\circ = 1$, $\dfrac{\sin 45^\circ}{\cos 45^\circ} = 1$

問 2 の解答

(1) $\dfrac{\mathrm{BC}}{\mathrm{AB}} = \dfrac{\sqrt{3}}{2}$, $\dfrac{\mathrm{AC}}{\mathrm{AB}} = \dfrac{1}{2}$, $\dfrac{\mathrm{BC}}{\mathrm{AC}} = \sqrt{3}$

(2) $\dfrac{\mathrm{B'C'}}{\mathrm{A'B'}} = \dfrac{\sqrt{3}}{2}$, $\dfrac{\mathrm{A'C'}}{\mathrm{A'B'}} = \dfrac{1}{2}$, $\dfrac{\mathrm{B'C'}}{\mathrm{A'C'}} = \sqrt{3}$

(3) $\sin 60^\circ = \dfrac{\sqrt{3}}{2}$, $\cos 60^\circ = \dfrac{1}{2}$, $\tan 60^\circ = \sqrt{3}$, $\dfrac{\sin 60^\circ}{\cos 60^\circ} = \sqrt{3}$

＜ 19 ページ. 三角関数の定義 ＞

問の解答

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

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

＜ 20 ページ. 文字式の展開 1 ＞

問 1 の解答

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

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

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

問 2 の解答

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

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

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

問 3 の解答

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

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

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

問 4 の解答

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

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

(3) $\cos 315^\circ = \dfrac{\sqrt{2}}{2}$, $\sin 315^\circ = -\dfrac{\sqrt{2}}{2}$, $\tan 315^\circ = -1$

＜ 21 ページ. 三角関数の値 2 ＞

問 1 の解答

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

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

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

問 2 の解答

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

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

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

問 3 の解答

角度 θ	0°	30°	45°	60°	90°	120°	135°	150°	180°	210°	225°	240°	270°	300°	315°	330°	360°
$\sin\theta$	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	$-\frac{1}{2}$	$-\frac{\sqrt{2}}{2}$	$-\frac{\sqrt{3}}{2}$	-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	$-\frac{\sqrt{3}}{2}$	$-\frac{\sqrt{2}}{2}$	$-\frac{1}{2}$	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	$\frac{\sqrt{3}}{3}$	1	$\sqrt{3}$		$-\sqrt{3}$	-1	$-\frac{\sqrt{3}}{3}$	0

＜ 22 ページ. 極座標表示 ＞

問の解答

(1) $(1\ ,\ \sqrt{3}) = (2\cos 60^\circ\ ,\ 2\sin 60^\circ)$

検算 $(2\cos 60^\circ\ ,\ 2\sin 60^\circ) = \left(2\times\dfrac{1}{2}\ ,\ 2\times\dfrac{\sqrt{3}}{2}\right) = (1\ ,\ \sqrt{3})$

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

検算 $$(2\sqrt{2}\cos 135^\circ\ ,\ 2\sqrt{2}\sin 135^\circ) = \left(2\sqrt{2}\times\left(-\frac{1}{\sqrt{2}}\right)\ ,\ 2\sqrt{2}\times\frac{1}{\sqrt{2}}\right) = (-2\ ,\ 2)$$

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

検算 $$(2\sqrt{3}\cos 210^\circ\ ,\ 2\sqrt{3}\sin 210^\circ) = \left(2\sqrt{3}\times\left(-\frac{\sqrt{3}}{2}\right)\ ,\ 2\sqrt{3}\times\left(-\frac{1}{2}\right)\right) = (-3\ ,\ -\sqrt{3})$$

(4) $(3\ ,\ -3) = (3\sqrt{2}\cos 315^\circ\ ,\ 3\sqrt{2}\sin 315^\circ)$

検算 $$(3\sqrt{2}\cos 315^\circ\ ,\ 3\sqrt{2}\sin 315^\circ) = \left(3\sqrt{2}\times\frac{1}{\sqrt{2}}\ ,\ 3\sqrt{2}\times\left(-\frac{1}{\sqrt{2}}\right)\right) = (3\ ,\ -3)$$

＜ 23 ページ. 余弦定理 1 ＞

問の解答

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

Q (a , 0)

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

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

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

＜ 24 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) $c^2 = 2 + 9 - 6\sqrt{2} \times \dfrac{1}{\sqrt{2}} = 2 + 9 - 6 = 5$

$\underline{c = \sqrt{5}}$

(2) $c^2 = 9 + 12 - 12\sqrt{3} \times \left(-\dfrac{\sqrt{3}}{2}\right) = 9 + 12 + 18 = 39$

$\underline{c = \sqrt{39}}$

＜ 25 ページ. 一般角 ＞

問の解答

(1) $\sin 460^\circ = \sin 100^\circ$

(2) $\cos(-70^\circ) = \cos 290^\circ$

(3) $\tan 500^\circ = \tan 140^\circ$

(4) $\sin(-200^\circ) = \sin 160^\circ$

(5) $\cos 650^\circ = \cos 290^\circ$

(6) $\tan 860^\circ = \tan 140^\circ$

< 26 ページ. 三角関数の性質 1 >

問の解答

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

＜ 27 ページ. 三角関数の性質 2 ＞

問 1 の解答

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

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

問 2 の解答

(1) $\sin 200^\circ = -\sin 20^\circ = -0.342$

$\cos 200^\circ = -\cos 20^\circ = -0.9397$

$\tan 200^\circ = \tan 20^\circ = 0.364$

(2) $\sin -(20^\circ) = -\sin 20^\circ = -0.342$

$\cos(-20^\circ) = \cos 20^\circ = 0.9397$

$\tan(-20^\circ) = -\tan 20^\circ = -0.364$

(3) $\sin 70^\circ = \cos 20^\circ = 0.9397$

$\cos 70^\circ = \sin 20^\circ = 0.342$

＜ 28 ページ. 三角関数の性質 1 ＞

問 1 の解答

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

問 2 の解答

θ	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

$$\begin{aligned}\sin\theta &= \sqrt{1-\cos^2\theta}\\ &= \sqrt{1-\left(\frac{12}{13}\right)^2}\\ &= \sqrt{\frac{25}{169}}\\ &= \frac{5}{13}\end{aligned}$$

＜ 29 ページ. 三角関数表 ＞

問の解答

(1) $\sin 100^\circ = \sin 80^\circ = 0.9848$

(2) $\tan 220^\circ = \tan 40^\circ = 0.8391$

(3) $\cos 320^\circ = \cos 40^\circ = 0.7660$

(4) $\sin(-40^\circ) = -\sin 40^\circ = -0.6428$

(5) $\cos(-160^\circ) = -\cos 20^\circ = -0.9397$

(6) $\tan 500^\circ = -\tan 40^\circ = -0.8391$

＜ 30 ページ. 三角方程式 1 ＞

問の解答

(1) $\sin\theta = \dfrac{\sqrt{2}}{2} \qquad (0^\circ \leqq \theta \leqq 360^\circ)$

(答) $\theta = 45^\circ$ または $\theta = 135^\circ$

(2) $\sin\theta = -\dfrac{\sqrt{3}}{2} \qquad (-180^\circ \leqq \theta \leqq 180^\circ)$

(答) $\theta = -60^\circ$ または $\theta = -120^\circ$

(3) $\sin\theta = -\dfrac{1}{2} \qquad (0^\circ \leqq \theta \leqq 360^\circ)$

(答) $\theta = 210^\circ$ または $\theta = 330^\circ$

＜ 31 ページ. 三角方程式 2 ＞

問の解答

(1) $\cos\theta = \dfrac{\sqrt{3}}{2} \qquad (-180^\circ \leqq \theta \leqq 180^\circ)$

(答) $\theta = 30^\circ$ または $\theta = -30^\circ$

(2) $\cos\theta = -\dfrac{1}{2} \qquad (-180^\circ \leqq \theta \leqq 180^\circ)$

(答) $\theta = 120^\circ$ または $\theta = -120^\circ$

(3) $\cos\theta = \dfrac{\sqrt{2}}{2} \qquad (0^\circ \leqq \theta \leqq 360^\circ)$

(答) $\theta = 45^\circ$ または $\theta = 315^\circ$

＜ 32 ページ. 三角方程式 3 ＞

問の解答

(1) $\tan\theta = 1 \qquad (-90^\circ \leqq \theta \leqq 270^\circ)$

(答) $\theta = 45^\circ$ または $\theta = 225^\circ$

(2) $\tan\theta = \dfrac{1}{\sqrt{3}} \qquad (-90^\circ \leqq \theta \leqq 270^\circ)$

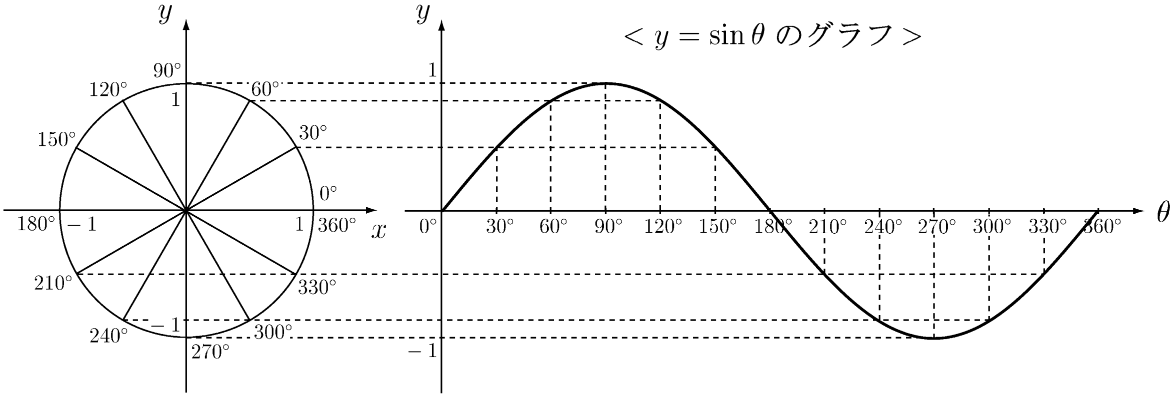
(答) $\theta = 30^\circ$ または $\theta = 210^\circ$

(3) $\tan\theta = -\sqrt{3} \qquad (-90^\circ \leqq \theta \leqq 270^\circ)$

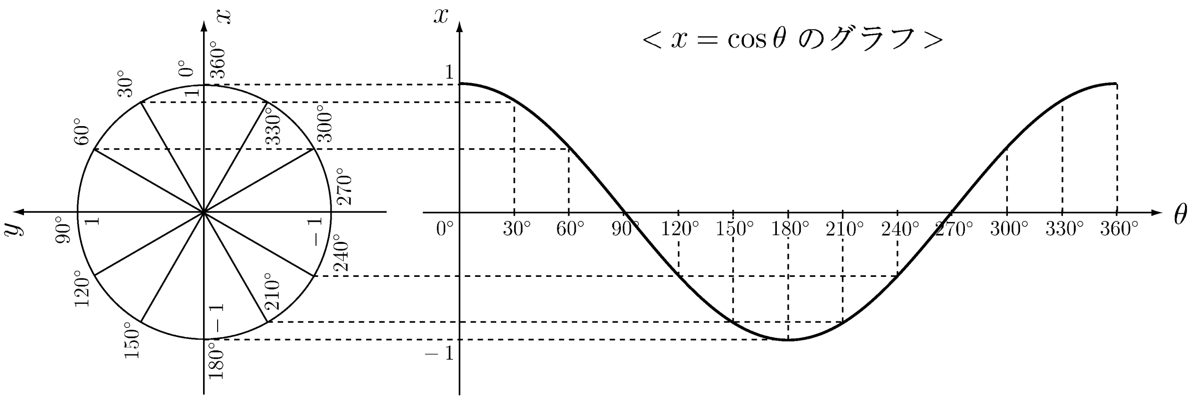
(答) $\theta = -60^\circ$ または $\theta = 120^\circ$

＜ 33 ページ. 三角関数のグラフ 1 ＞

問 1 の解答

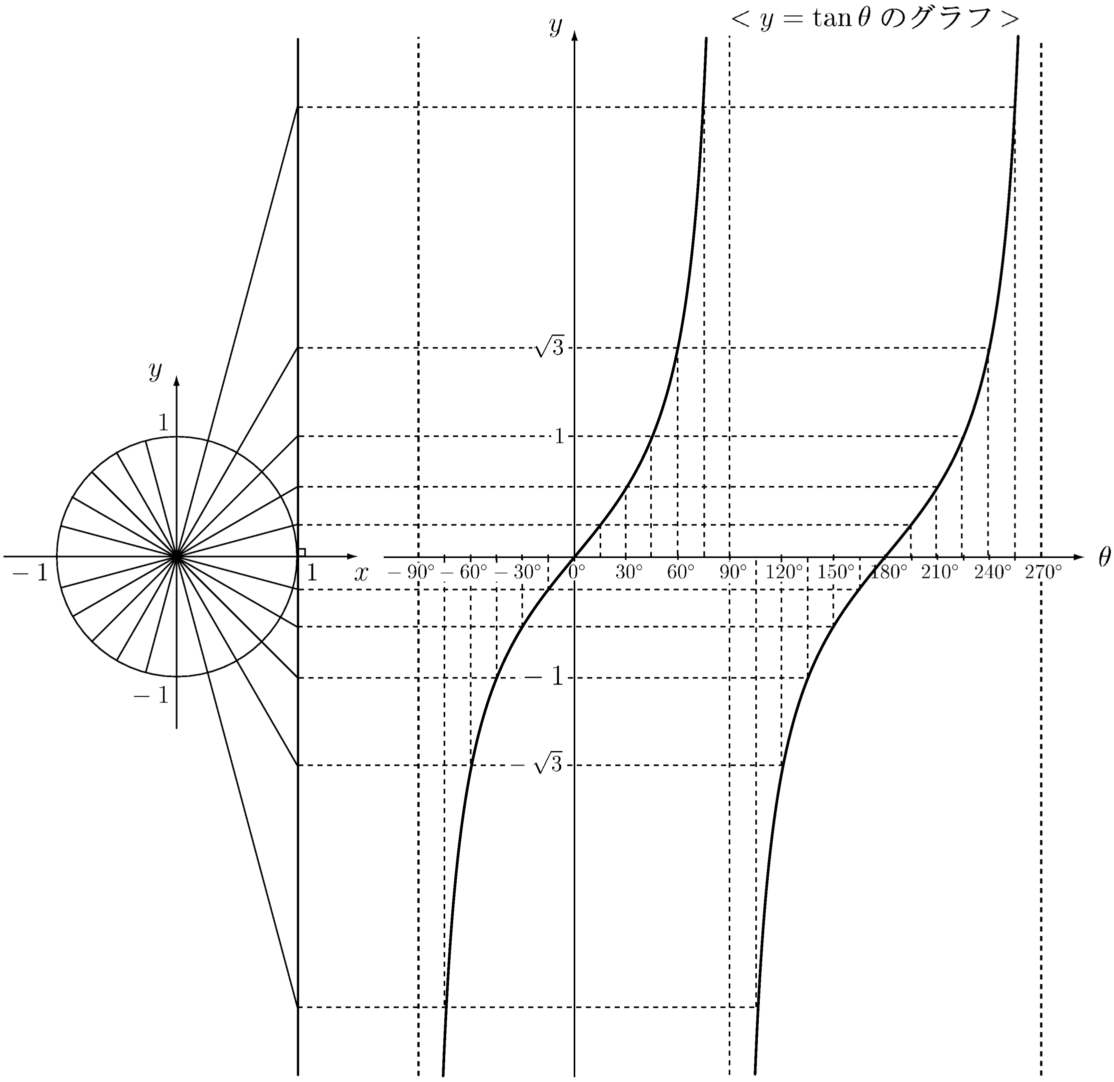


問 2 の解答



＜ 34 ページ. 三角関数のグラフ 2 ＞

問の解答



＜ 35 ページ. 加法定理 1 ＞

問の解答

(1) $\mathrm{P}(\cos\beta\ ,\ \sin\beta)$

(2) $\mathrm{Q}(\cos\alpha\ ,\ -\sin\alpha)$

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

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

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

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

＜ 36 ページ. 加法定理 2 ＞

問の解答

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

$$\begin{aligned}\sin 105^\circ &= \sin(60^\circ + 45^\circ) = \cos(90^\circ - 60^\circ - 45^\circ) = \cos(30^\circ - 45^\circ) \\ &= \cos 30^\circ \cos(-45^\circ) - \sin 30^\circ \sin(-45^\circ) \\ &= \frac{\sqrt{3}}{2} \times \frac{\sqrt{2}}{2} - \frac{1}{2} \times \left(-\frac{\sqrt{2}}{2}\right) = \frac{\sqrt{2} + \sqrt{6}}{4}\end{aligned}$$

< 37 ページ. 加法定理 3 >

問 1 の解答

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

問 2 の解答

(1) $\cos 165^\circ = \cos 105^\circ \cos 60^\circ - \sin 105^\circ \sin 60^\circ$

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

(2) $\sin 165^\circ = \sin 105^\circ \cos 60^\circ + \cos 105^\circ \sin 60^\circ$

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

問 3 の解答

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

(2) $\sin(\alpha-\beta) = \sin\alpha\cos\beta - \cos\alpha\sin\beta$

＜ 38 ページ. 加法定理 4 ＞

問 1 の解答

$$\tan 105^\circ = \frac{\tan 60^\circ + \tan 45^\circ}{1 - \tan 60^\circ \tan 45^\circ} = \frac{\sqrt{3}+1}{1-3}$$

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

問 2 の解答

$$\tan(\alpha+\beta) = \frac{\tan\alpha + \tan\beta}{1 - \tan\alpha\tan\beta}$$

＜ 39 ページ. 円周率 ＞

問 1 の解答

(1) $\ell = 4\pi$ (cm)　　(2) $\ell = 2\pi r$

問 2 の解答

(1) πr　　(2) $\dfrac{\pi}{2}r$　　(3) $\dfrac{\pi}{3}r$

< 40 ページ. 弧度法 1 >

問の解答

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