高知工科大学

基礎数学ワークブック

(2004年度版)

入門編

No. 2

解答

< 1ページ. 三角比 (1) >

問の解答

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

$\sin B = \dfrac{3}{4}$, $\cos B = \dfrac{\sqrt{7}}{4}$, $\tan B = \dfrac{3}{\sqrt{7}} = \dfrac{3\sqrt{7}}{7}$

(2)$\sin A = \dfrac{3\sqrt{13}}{13}$, $\cos A = \dfrac{2\sqrt{13}}{13}$, $\tan A = \dfrac{3}{2}$

$\sin B = \dfrac{2\sqrt{13}}{13}$, $\cos B = \dfrac{3\sqrt{13}}{13}$, $\tan B = \dfrac{2}{3}$

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

$\sin B = \dfrac{\sqrt{2}}{2}$, $\cos B = \dfrac{\sqrt{2}}{2}$, $\tan B = 1$

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

$\sin B = \dfrac{\sqrt{3}}{2}$, $\cos B = \dfrac{1}{2}$, $\tan B = \sqrt{3}$

< 2ページ. 三角比 (2) >

問の解答

$\tan A = \dfrac{BC}{AC}$ より,

$\mathrm{BC} = \mathrm{AC} \times \tan A = 10 \times \tan 35^\circ = 10 \times 0.7002 = 7.002$

木の高さは

$$7.002 + 1.5 = 8.502$$

(答) 8.502(m)

< 3ページ. 三角比 (3) >

問 1 の解答

$$\sin \mathrm{A} = \frac{\mathrm{BC}}{3} \Rightarrow \mathrm{BC} = 3 \times \sin \mathrm{A} = 3 \times \sin 56^\circ$$
$$= 3 \times 0.829 = 2.487 \fallingdotseq 2.5$$

$$\cos \mathrm{A} = \frac{\mathrm{AC}}{3} \Rightarrow \mathrm{AC} = 3 \times \cos \mathrm{A} = 3 \times \cos 56^\circ$$
$$= 3 \times 0.5592 = 1.6776 \fallingdotseq 1.7$$

$$\mathrm{BC} \fallingdotseq 2.5(\mathrm{m}), \qquad \mathrm{AC} \fallingdotseq 1.7(\mathrm{m})$$

問 2 の解答

(1) $40 \times \sin 18^\circ = 40 \times 0.309 = 12.36 \fallingdotseq 12.4$

(答)12.4(m)

(2) $40 \times \cos 18^\circ = 40 \times 0.9511 = 38.044 \fallingdotseq 38.0$

(答)38.0(m)

問 3 の解答

$X = r \cos \theta, \qquad Y = r \sin \theta$

< 4ページ. 三角比 (4) >

問の解答

(1) $\mathrm{P}(\sqrt{3},\ 1)$

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

$$\cos 30^\circ = \frac{\sqrt{2}}{2}$$

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

(2) $\mathrm{P}(1,\ 1)$

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

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

$$\tan 45^\circ = 1$$

(3) $\mathrm{P}(1,\ \sqrt{3})$

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

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

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

< 5ページ. 鈍角の三角比 (1) >

問の解答

(1) $r = 1$ のとき　$\mathrm{P}\left(-\dfrac{1}{2},\ \dfrac{\sqrt{3}}{2}\right)$

$$\sin 120^\circ = \frac{\sqrt{3}}{2} \qquad \cos 120^\circ = -\frac{1}{2} \qquad \tan 120^\circ = -\sqrt{3}$$

(2) $r = 2$ のとき　$\mathrm{P}(-1,\ \sqrt{3})$

$$\sin 120^\circ = \frac{\sqrt{3}}{2} \qquad \cos 120^\circ = -\frac{1}{2} \qquad \tan 120^\circ = -\sqrt{3}$$

< 6ページ. 鈍角の三角比 (2) >

問 1 の解答

(1) $r = 1$ のとき　　$\mathrm{P}\left(-\frac{\sqrt{3}}{2}\,,\,\frac{1}{2}\right)$

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

(2) $r = 2$ のとき　　$\mathrm{P}\left(-\sqrt{3}\,,\,1\right)$

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

問 2 の解答

$\sin\theta = Y$

$\cos\theta = X$

$\tan\theta = \dfrac{Y}{X}$

問 3 の解答

(1)　$\mathrm{P}\left(-\frac{1}{\sqrt{2}}\,,\,\frac{1}{\sqrt{2}}\right)$

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

(2)　$\mathrm{Q}\left(\frac{\sqrt{2}}{2},\frac{\sqrt{2}}{2}\right)$

$$\sin 45^\circ = \frac{\sqrt{2}}{2} \quad \cos 45^\circ = \frac{\sqrt{2}}{2} \quad \tan 45^\circ = 1$$

(3)　$\mathrm{R}\left(\,0\,,\,1\,\right)$

$$\sin 90^\circ = 1 \qquad \cos 90^\circ = 0$$

< 7ページ. 鈍角の三角比 (3) >

問 1 の解答

$$\mathrm{P}\left(\frac{1}{2}, \frac{\sqrt{3}}{2}\right) \ , \ \mathrm{Q}\left(-\frac{1}{2}, \frac{\sqrt{3}}{2}\right)$$

$$\sin 60^\circ = \frac{\sqrt{3}}{2} \qquad \cos 60^\circ = \frac{1}{2} \qquad \tan 60^\circ = \sqrt{3}$$

$$\sin 120^\circ = \frac{\sqrt{3}}{2} \qquad \cos 120^\circ = -\frac{1}{2} \qquad \tan 120^\circ = -\sqrt{3}$$

問 2 の解答

$$\mathrm{P}\left(\frac{\sqrt{3}}{2}, \frac{1}{2}\right) \ , \ \mathrm{Q}\left(-\frac{\sqrt{3}}{2}, \frac{1}{2}\right)$$

$$\sin 30^\circ = \frac{1}{2} \qquad \cos 30^\circ = \frac{\sqrt{3}}{2} \qquad \tan 30^\circ = \frac{1}{\sqrt{3}}$$

$$\sin 150^\circ = \frac{1}{2} \qquad \cos 150^\circ = -\frac{\sqrt{3}}{2} \qquad \tan 150^\circ = -\frac{1}{\sqrt{3}}$$

問 3 の解答

(1) $\sin 110^\circ = 0.9397$ $\cos 110^\circ = -0.3420$ $\tan 110^\circ = -2.7475$

(2) $\sin 140^\circ = 0.6428$ $\cos 140^\circ = -0.7660$ $\tan 140^\circ = -0.8391$

(3) $\sin 165^\circ = 0.2588$ $\cos 165^\circ = -0.9659$ $\tan 165^\circ = -0.2679$

< 8ページ. 三角関数表 >

問の解答

(1) $\sin 95^\circ = 0.9962$ $\cos 95^\circ = -0.0872$ $\tan 95^\circ = -11.4301$

(2) $\sin 127^\circ = 0.7986$ $\cos 127^\circ = -0.6018$ $\tan 127^\circ = -1.3270$

(3) $\sin 143^\circ = 0.6018$ $\cos 143^\circ = -0.7986$ $\tan 143^\circ = -0.7536$

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

< 9ページ. 三角比と辺の長さ >

問 1 の解答

(1)AB$= 20\cos 25^\circ = 20 \times 0.9063 = 18.126$

BC$= 20\sin 25^\circ = 20 \times 0.4226 = 8.452$

(2)DH$= 10\cos 40^\circ = 10 \times 0.7660 = 7.660$

EH$= 10\sin 40^\circ = 10 \times 0.6428 = 6.428$

問 2 の解答

AB$= r\cos\theta$
BC$= r\sin\theta$

問 3 の解答

EH$= r\sin(180^\circ - \theta) = r\sin\theta$
DH$= r\cos(180^\circ - \theta) = -r\cos\theta$

< 10ページ. 正弦定理 (1) >

問の解答

(1) $A = 70^\circ$

$$\frac{a}{\sin 70^\circ} = 2R$$

$$a = 2R \sin 70^\circ = 1.8794R$$

(2) $A = 70^\circ$

$$\frac{a}{\sin 90^\circ} = 2R$$

$$a = 2R$$

(3) $A = 120^\circ$

$$\frac{a}{\sin 120^\circ} = 2R$$

$$a = 2R \times \sin 120^\circ = 2R \times \frac{\sqrt{3}}{2} = \sqrt{3}R$$

< 11 ページ. 正弦定理 (2) >

問 1 の解答

$$\frac{b}{\sin 60^\circ} = \frac{8}{\sin 45^\circ} \Rightarrow b = \frac{\sin 60^\circ}{\sin 45^\circ} \times 8 = \frac{\frac{\sqrt{3}}{2}}{\frac{1}{\sqrt{2}}} \times 8 = 4\sqrt{6}$$

問 2 の解答

$$\frac{c}{\sin 120^\circ} = \frac{2}{\sin 45^\circ} \Rightarrow c = \frac{2\sin 120^\circ}{\sin 45^\circ} = \frac{\frac{2\times\sqrt{3}}{2}}{\frac{1}{\sqrt{2}}} = \sqrt{6}$$

問 3 の解答

(1) $\dfrac{a}{\sin 60^\circ} = \dfrac{10}{\sin 45^\circ} \Rightarrow a = \dfrac{2\sin 60^\circ}{\sin 45^\circ} \times 10 = \dfrac{\frac{\sqrt{3}}{2}}{\frac{1}{\sqrt{2}}} \times 10 = 5\sqrt{6}$

(2) $2R = \dfrac{5\sqrt{6}}{\sin 60^\circ} = \dfrac{5\sqrt{6}}{\frac{\sqrt{3}}{2}} = 10\sqrt{2} \Rightarrow R = 5\sqrt{2}$

< 12ページ. 正弦定理の応用 >

問 1 の解答

$\mathrm{A}+\mathrm{B}+\mathrm{C}=180^\circ$ より $\mathrm{C}=54^\circ$

$$\frac{\mathrm{AC}}{\sin 70^\circ}=\frac{100}{\sin 54^\circ}\Rightarrow \mathrm{AC}=\frac{100\sin 70^\circ}{\sin 54^\circ}=\frac{100\times 0.94}{0.8}=117.5(\mathrm{m})$$

問 2 の解答

(1) 60°

(2) $\dfrac{\mathrm{BH}}{\sin 45^\circ}=\dfrac{200}{\sin 60^\circ}\Rightarrow \mathrm{BH}=\dfrac{200\sin 45^\circ}{\sin 60^\circ}=\dfrac{200\sqrt{6}}{3}$

(3) $\tan 30^\circ=\dfrac{\mathrm{CH}}{\mathrm{BH}}\Rightarrow \mathrm{CH}=\mathrm{BH}\times\tan 30^\circ=\dfrac{200\sqrt{2}}{3}$

< 13ページ. 余弦定理 (1) >

問の解答

HC$= a\sin B$

BH$= a\cos B$

HA$= b\cos(180^\circ - A) = -b\cos A$

より △ACH に三平方の定理を適用すると

AC^2 =CH^2+AH^2

$b^2 = (a\sin B)^2 + (a\cos B - c)^2 = a^2 - 2ac\cos B + c^2$

$b^2 = a^2 + c^2 - 2ac\cos B$

< 14ページ. 余弦定理 (2) >

問 1 の解答

$b^2 = c^2 + a^2 - 2ca\cos B$

問 2 の解答

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

問 3 の解答

(1) $a^2 = \left(\sqrt{6}\right)^2 + \left(\sqrt{2}\right)^2 - 2 \times \sqrt{6} \times \sqrt{2} \times \cos 30^\circ = 2 \quad a = \sqrt{2}$

(2) $b^2 = \left(\sqrt{2}\right)^2 + 3^2 - 2 \times \sqrt{2} \times 3\cos 45^\circ = 5 \quad b = \sqrt{5}$

(3) $c^2 = \left(\sqrt{3}\right)^2 + 1^2 - 2 \times \sqrt{3} \times 1\cos 150^\circ = 7 \quad c = \sqrt{7}$

(4) $b^2 = \left(\sqrt{3}\right)^2 + \left(\sqrt{6}\right)^2 - 2 \times \sqrt{3} \times \sqrt{6}\cos 135^\circ = 15 \quad b = \sqrt{15}$

< 15ページ. 余弦定理 (3) >

問 1 の解答

$$\mathrm{BC}^2 = 9^2 + 10^2 - 2 \times 9 \times 10 \times \cos 63^\circ = 100$$

$$\underline{(\text{答})\mathrm{BC} = 10(\mathrm{m})}$$

問 2 の解答

$$\cos A = \frac{b^2 + c^2 - a^2}{2bc} \quad , \quad \cos B = \frac{a^2 + c^2 - b^2}{2ac}$$

問 3 の解答

(1) $$\cos A = \frac{b^2 + c^2 - a^2}{2bc} = \frac{9 + 2 - 5}{2 \times 3 \times \sqrt{2}} = \frac{1}{\sqrt{2}}$$

$$\underline{(\text{答})A = 45^\circ}$$

(2) $$\cos B = \frac{a^2 + c^2 - b^2}{2ac} = \frac{9 + 12 - 39}{2 \times 3 \times 2\sqrt{3}} = -\frac{\sqrt{3}}{2}$$

$$\underline{(\text{答})B = 150^\circ}$$

< 16 ページ. 三角関数 (1) >

問の解答

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

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

$\sin 360^\circ = 0$, $\cos 360^\circ = 1$, $\tan 360^\circ = 0$

< 17ページ. 三角関数 (2) >

問 1 の解答

$\cos 45^\circ = \dfrac{\sqrt{2}}{2}$ $\sin 45^\circ = \dfrac{\sqrt{2}}{2}$ $\tan 45^\circ = 1$

$\mathrm{P}\left(\dfrac{\sqrt{2}}{2},\ \dfrac{\sqrt{2}}{2}\right)$

$\mathrm{P}'\left(-\dfrac{\sqrt{2}}{2},\ \dfrac{\sqrt{2}}{2}\right)$ $\cos 135^\circ = -\dfrac{\sqrt{2}}{2}$ $\sin 135^\circ = \dfrac{\sqrt{2}}{2}$ $\tan 135^\circ = -1$

$\mathrm{P}''\left(-\dfrac{\sqrt{2}}{2},\ -\dfrac{\sqrt{2}}{2}\right)$ $\cos 225^\circ = -\dfrac{\sqrt{2}}{2}$ $\sin 225^\circ = -\dfrac{\sqrt{2}}{2}$ $\tan 225^\circ = 1$

$\mathrm{P}'''\left(\dfrac{\sqrt{2}}{2},\ -\dfrac{\sqrt{2}}{2}\right)$

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

問 2 の解答

$\cos 30^\circ = \dfrac{\sqrt{3}}{2}$ $\sin 30^\circ = \dfrac{1}{2}$ $\tan 30^\circ = \dfrac{\sqrt{3}}{3}$

$\mathrm{P}\left(\dfrac{\sqrt{3}}{2},\ \dfrac{1}{2}\right)$

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

$\mathrm{P}'\left(-\dfrac{\sqrt{3}}{2},\ \dfrac{1}{2}\right)$

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

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

< 18ページ. 三角関数 (3) >

問 1 の解答

$\mathrm{P}\left(\frac{1}{2},\ \frac{\sqrt{3}}{2}\right)$ $\quad \cos 60^\circ = \frac{1}{2}$ $\quad \sin 60^\circ = \frac{\sqrt{3}}{2}$ $\quad \tan 60^\circ = \sqrt{3}$

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

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

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

問 2 の解答

(1) $\mathrm{P}'(\ -0.6428\ ,\ 0.766\ )$

$\mathrm{P}''(\ -0.6428\ ,\ -0.766\ )$

$\mathrm{P}'''(\ 0.6428\ ,\ -0.766\ )$

(2) $\cos 130^\circ = -0.6428$ $\quad \sin 130^\circ = 0.766$

$\cos 230^\circ = -0.6428$ $\quad \sin 230^\circ = -0.766$

$\cos 310^\circ = 0.6428$ $\quad \sin 310^\circ = -0.766$

(3) $\tan 130^\circ = -1.1918$ $\quad \tan 230^\circ = 1.1918$ $\quad \tan 310^\circ = -1.1918$

< 19ページ. 三角関数 (4) >

問 1 の解答

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

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

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

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

$\sin(360^\circ - \theta) = -\sin\theta$

$\cos(360^\circ - \theta) = \cos\theta$

(2) $\tan(180^\circ - \theta) = -\tan\theta$

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

$\tan(360^\circ - \theta) = -\tan\theta$

問 2 の解答

$\cos 20^\circ = 0.9397$ $\sin 20^\circ = 0.3420$ $\tan 20^\circ = 0.3640$

$\cos 160^\circ = -0.9397$ $\sin 160^\circ = 0.3420$ $\tan 160^\circ = -0.3640$

$\cos 200^\circ = -0.9397$ $\sin 200^\circ = -0.3420$ $\tan 200^\circ = 0.3640$

$\cos 340^\circ = 0.9397$ $\sin 340^\circ = -0.3420$ $\tan 340^\circ = -0.3640$

< 20ページ. 三角関数の相互関係 >

問 1 の解答

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

問 2 の解答

$$1 + \tan^2\theta = 1 + \frac{\sin^2\theta}{\cos^2\theta} = \frac{\cos^2\theta + \sin^2\theta}{\cos^2\theta} = \frac{1}{\cos^2\theta}$$

問 3 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 4 の解答

$$\sin^2\theta = 1 - \cos^2\theta = 1 - \left(\frac{12}{13}\right)^2 = 1 - \frac{144}{169} = \frac{25}{169} = \left(\frac{5}{13}\right)^2$$

$0^\circ < \theta < 180^\circ$ より $\sin\theta > 0$ よって $\sin\theta = \dfrac{5}{13}$

< 21 ページ. 平面座標の三角表示 >

問の解答

(1) $\mathrm{P}(-\sqrt{3},\ 1)$

(2) $\mathrm{P}(-2\sqrt{2},\ -2\sqrt{2})$

(3) $\mathrm{P}(3,\ -3\sqrt{3})$

(4) $\mathrm{P}(-6.428,\ 7.660)$

< 22 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) $\tan 860^\circ = \tan 140^\circ$

< 23ページ. 一般角の三角関数 >

問 1 の解答

$\cos(\theta + 360^\circ) = \cos\theta$ $\sin(\theta + 360^\circ) = \sin\theta$ $\tan(\theta + 360^\circ) = \tan\theta$

$\cos(\theta - 360^\circ) = \cos\theta$ $\sin(\theta - 360^\circ) = \sin\theta$ $\tan(\theta - 360^\circ) = \tan\theta$

$\cos(180^\circ - \theta) = -\cos\theta$ $\sin(180^\circ - \theta) = \sin\theta$ $\tan(180^\circ - \theta) = -\tan\theta$

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

$\cos(360^\circ - \theta) = \cos\theta$ $\sin(360^\circ - \theta) = -\sin\theta$ $\tan(360^\circ - \theta) = -\tan\theta$

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

問 2 の解答

$\sin 420^\circ = \dfrac{\sqrt{3}}{2}$ $\cos 450^\circ = 0$ $\tan 495^\circ = -1$

$\sin(-45^\circ) = -\dfrac{\sqrt{2}}{2}$ $\cos(-90^\circ) = 0$ $\tan(-120^\circ) = \sqrt{3}$

問 3 の解答

$\sin 380^\circ = 0.3420$ $\cos 400^\circ = 0.7760$ $\tan 510^\circ = -0.5774$

$\sin(-40^\circ) = -0.6428$ $\cos(-100^\circ) = -0.1736$ $\tan(-50^\circ) = -1.1918$

< 24ページ. 三角関数の値 >

問 1 の解答

角度 θ	-90°	-60°	-45°	-30°	0	30°	45°	60°	90°	120°	135°	150°	180°
$\sin\theta$	-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
$\cos\theta$	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
$\tan\theta$		$-\sqrt{3}$	-1	$-\frac{\sqrt{3}}{3}$	0	$\frac{\sqrt{3}}{3}$	1	$\sqrt{3}$		$-\sqrt{3}$	-1	$-\frac{\sqrt{3}}{3}$	0

角度 θ	180°	210°	225°	240°	270°	300°	315°	330°	360°	390°	405°	420°	450°
$\sin\theta$	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
$\cos\theta$	-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
$\tan\theta$	0	$\frac{\sqrt{3}}{3}$	1	$\sqrt{3}$		$-\sqrt{3}$	-1	$-\frac{\sqrt{3}}{3}$	0	$\frac{\sqrt{3}}{3}$	1	$\sqrt{3}$	

問 2 の解答

$\sin(-50^\circ) = -0.7660$ $\cos(-40^\circ) = 0.7660$ $\tan(-20^\circ) = -0.3640$

$\sin 130^\circ = 0.7660$ $\cos 140^\circ = -0.7660$ $\tan 160^\circ = -0.3640$

$\sin 200^\circ = -0.3420$ $\cos 190^\circ = -0.9848$ $\tan 220^\circ = 0.8391$

$\sin 280^\circ = -0.9848$ $\cos 290^\circ = 0.3420$ $\tan 310^\circ = -1.1918$

$\sin 370^\circ = 0.1736$ $\cos 380^\circ = 0.9397$ $\tan 410^\circ = 1.1918$

< 25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) $\theta = 45^\circ,\ \theta = 135^\circ$

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

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

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

(答) $\theta = 210^\circ,\ \theta = 330^\circ$

< 26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) $\theta = -30^\circ,\ \theta = 30^\circ$

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

(答) $\theta = -120^\circ,\ \theta = 120^\circ$

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

(答) $\theta = 45^\circ,\ \theta = 315^\circ$

< 27ページ. 三角方程式 (3) >

問 1 の解答

三角形の相似より

$Y : X = T : 1$

$\dfrac{Y}{X} = \dfrac{T}{1} = T$

よって $\tan\theta = \dfrac{Y}{X} = T$

問 2 の解答

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

(答) $\theta = 45^\circ,\ \theta = 225^\circ$

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

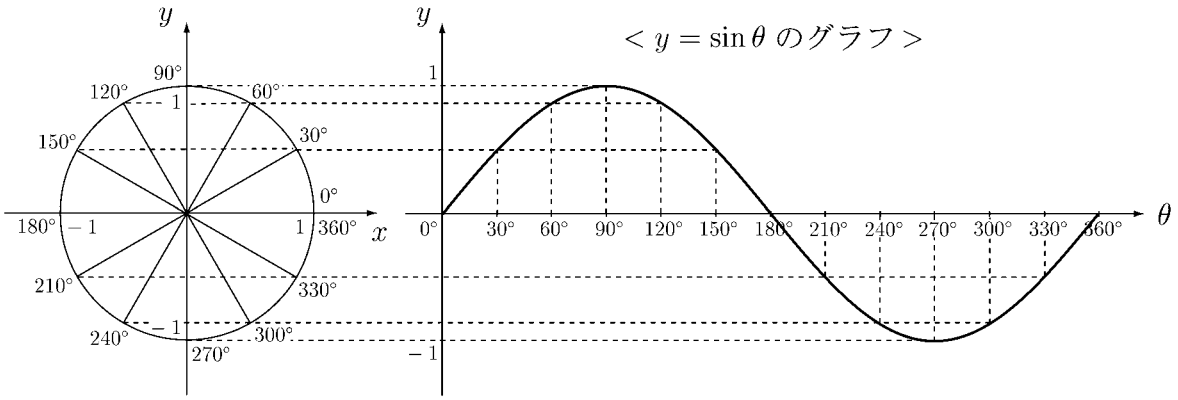
(答) $\theta = 30^\circ,\ \theta = 210^\circ$

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

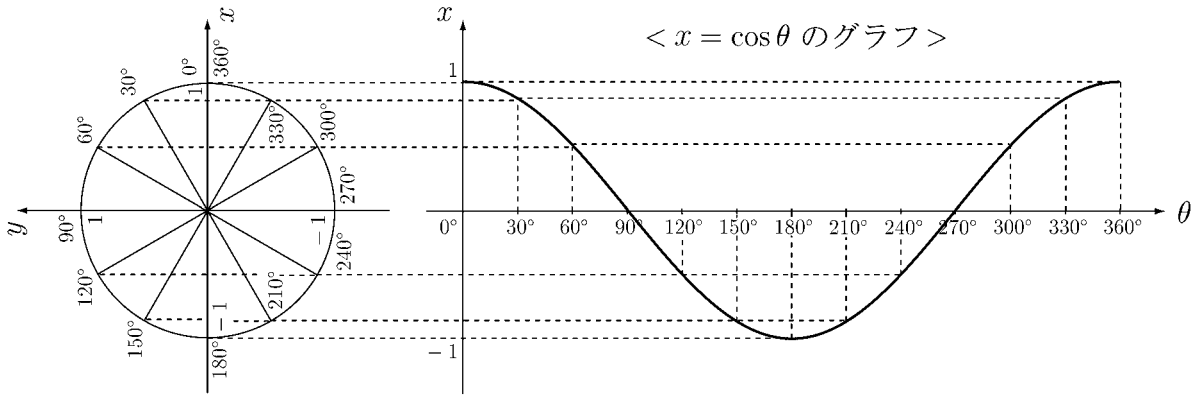
(答) $\theta = -60^\circ,\ \theta = 120^\circ$

< 28ページ. 三角関数のグラフ (1) >

問 1 の解答

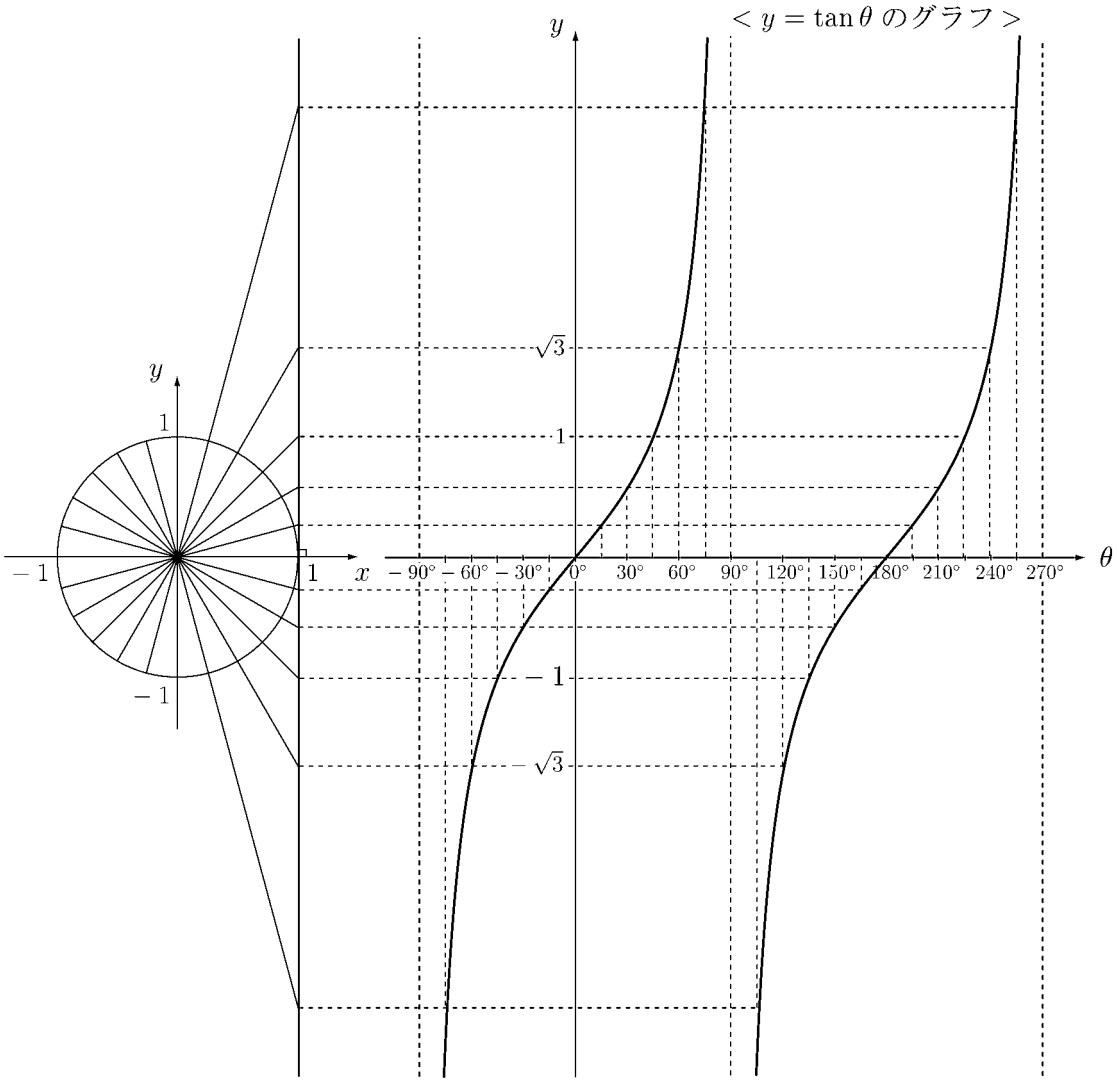


問 2 の解答



< 29ページ. 三角関数のグラフ (2) >

問の解答



< 30ページ. スカラーとベクトル >

問 1 の解答

① 北東の風 3m/s　　② 南東の風 6m/s

問 2 の解答

(1) スカラー　(2) スカラー　(3) スカラー

(4) スカラー　(5) ベクトル　(6) ベクトル

< 31 ページ. 速度の合成 >

問の解答

$$\sin\theta = \frac{3}{5}$$

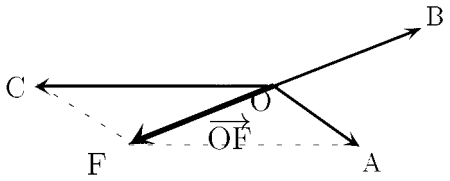
< 32 ページ. ベクトルの表記 >

問の解答

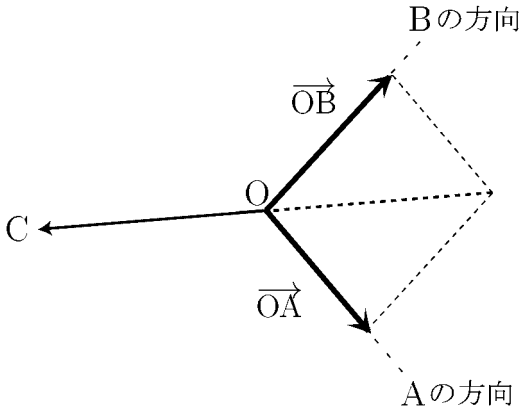
$$\overrightarrow{\mathrm{BO}} = \overrightarrow{\mathrm{AF}} = \overrightarrow{\mathrm{CD}} = \overrightarrow{\mathrm{OE}}$$

< 33ページ. 力の合成 >

問 1 の解答

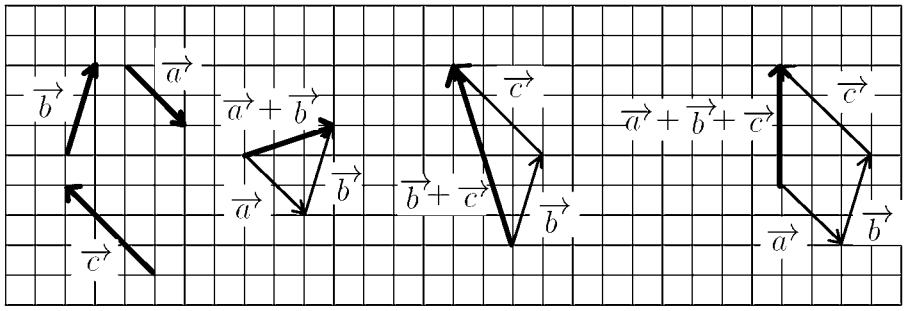


問 2 の解答



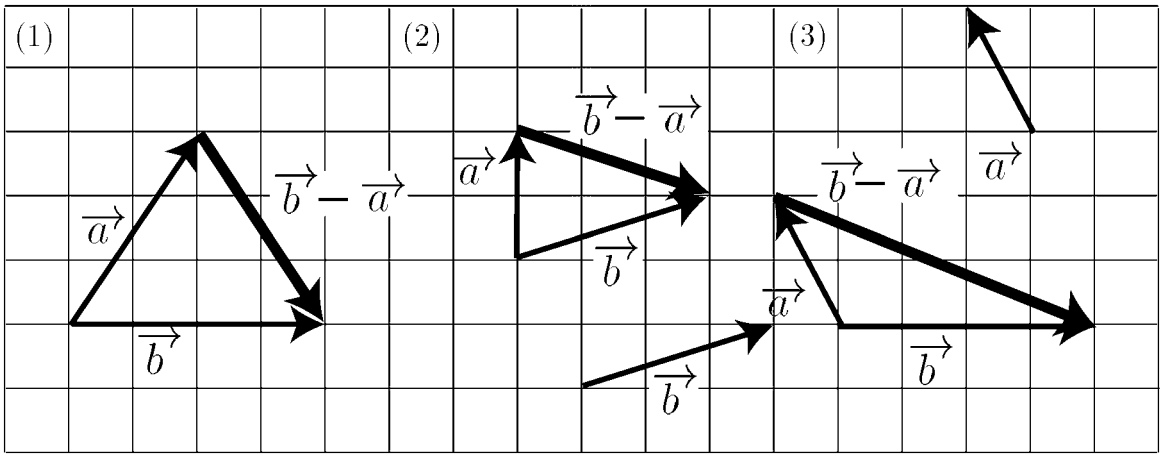
< 34 ページ. 平面のベクトル (1) >

問の解答



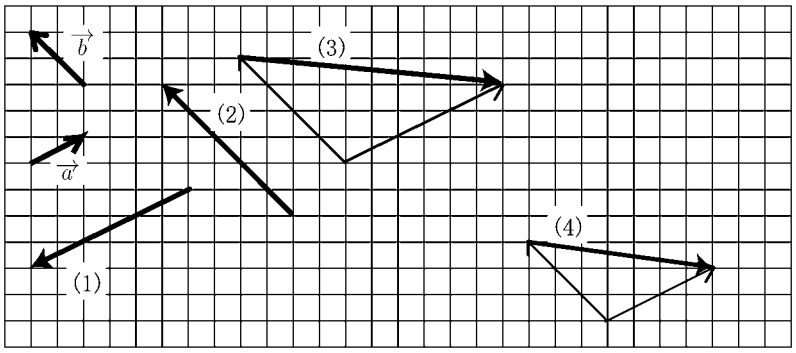
< 35 ページ. 平面のベクトル (2) >

問の解答



< 36 ページ. 平面のベクトル (3) >

問の解答



< 37ページ. 平面ベクトルの成分 (1) >

問の解答

$\overrightarrow{a} = (\ 1\ ,\ 3\ )$

$\overrightarrow{b} = (-2\ ,\ 1\ )$

$\overrightarrow{c} = (\ 4\ , -3\ )$

< 38 ページ. 平面ベクトルの成分 (2) >

問の解答

(1) $\overrightarrow{\mathrm{AB}} = (\ 2\ ,\ 1\ )$

$|\overrightarrow{\mathrm{AB}}| = \sqrt{5}$

(2) $\overrightarrow{\mathrm{AB}} = (-1\ ,\ 2\ )$

$|\overrightarrow{\mathrm{AB}}| = \sqrt{5}$

< 39ページ. 平面ベクトルの成分 (3) >

問 1 の解答

(1) $\overrightarrow{a} + \overrightarrow{b} = (\ a_1\ ,\ a_2\ ) + (\ b_1\ ,\ b_2\ ) = (\ a_1 + b_1\ ,\ a_2 + b_2\ )$

(2) $\overrightarrow{a} - \overrightarrow{b} = (\ a_1\ ,\ a_2\ ) - (\ b_1\ ,\ b_2\ ) = (\ a_1 - b_1\ ,\ a_2 - b_2\ )$

(3) $k\overrightarrow{a} = k(\ a_1\ ,\ a_2\ ) = (\ ka_1\ ,\ ka_2\ )$

問 2 の解答

(1) $\dfrac{1}{2}\overrightarrow{a} = (\ 1\ ,\ 3\ )$

(2) $-\overrightarrow{b} = (\ 1\ ,\ 3\ )$

(3) $\overrightarrow{a} - \overrightarrow{b} = (\ 3\ ,\ 9\ )$

(4) $\overrightarrow{a} + 2\overrightarrow{b} = (\ 2\ ,\ 6\ ) + 2(\ -1\ ,\ -3\ ) = (\ 0\ ,\ 0\ )$

< 40 ページ. ベクトルの内積 (1) >

問の解答

$$\overrightarrow{\boldsymbol{a}} \cdot \overrightarrow{\boldsymbol{b}} = 3 \times 2 \times \cos 60^\circ = 3$$

$$\overrightarrow{\boldsymbol{c}} \cdot \overrightarrow{\boldsymbol{d}} = 4 \times 2 \times \cos 150^\circ = -4\sqrt{3}$$

< 41 ページ. ベクトルの内積 (2) >

問の解答

(1) $\overrightarrow{\mathrm{AB}} \cdot \overrightarrow{\mathrm{AC}} = 2 \times 2 \times \cos 60^\circ = 2$,

(2) $\overrightarrow{\mathrm{AB}} \cdot \overrightarrow{\mathrm{AM}} = 2 \times \sqrt{3} \times \cos 30^\circ = 2 \times \sqrt{3} \times \dfrac{\sqrt{3}}{2} = 3$,

(3) $\overrightarrow{\mathrm{BC}} \cdot \overrightarrow{\mathrm{AM}} = 2 \times \sqrt{3} \times \cos 90^\circ = 0$

(4) $\overrightarrow{\mathrm{AB}} \cdot \overrightarrow{\mathrm{BC}} = 2 \times 2 \times \cos 120^\circ = -2$,

(5) $\overrightarrow{\mathrm{MB}} \cdot \overrightarrow{\mathrm{MC}} = 1 \times 1 \times \cos 180^\circ = -1$

< 42 ページ. 内積の成分表示 (1) >

問 1 の解答

$$\mathrm{OA}^2 = {a_1}^2 + {a_2}^2 \qquad \mathrm{OB}^2 = {b_1}^2 + {b_2}^2$$

問 2 の解答

$$\frac{1}{2}\left\{\mathrm{OA}^2 + \mathrm{OB}^2 - \mathrm{AB}^2\right\} = \frac{1}{2}\left\{({a_1}^2 + {a_2}^2) + ({b_1}^2 + {b_2}^2) - (b_1 - a_1)^2 - (b_2 - a_2)^2\right\}$$

$$= \frac{1}{2}\left\{{a_1}^2 + {a_2}^2 + {b_1}^2 + {b_2}^2 - ({b_1}^2 - 2b_1a_1 + {a_1}^2) - ({b_2}^2 - 2b_2a_2 + {a_2}^2)\right\}$$

$$= \frac{1}{2}\left\{2a_1b_1 + 2a_2b_2\right\} = a_1b_1 + a_2b_2$$

問 3 の解答

$$\vec{\boldsymbol{a}} \cdot \vec{\boldsymbol{b}} = a_1b_1 + a_2b_2$$

< 43ページ. 内積の成分表示 (2) >

問 1 の解答

(1) $\overrightarrow{\boldsymbol{a}} \cdot \overrightarrow{\boldsymbol{b}} = 23$

(2) $\overrightarrow{\boldsymbol{a}} \cdot \overrightarrow{\boldsymbol{b}} = 0 \ \Rightarrow \ \overrightarrow{\boldsymbol{a}} \perp \overrightarrow{\boldsymbol{b}}$

(3) $\overrightarrow{\boldsymbol{a}} \cdot \overrightarrow{\boldsymbol{b}} = 0 \ \Rightarrow \ \overrightarrow{\boldsymbol{a}} \perp \overrightarrow{\boldsymbol{b}}$

問 2 の解答

$\overrightarrow{\boldsymbol{b}} = (\ 1,\ 1\ )\ , \quad \overrightarrow{\boldsymbol{c}} = (\ -1,\ -1\ )$ など

< 44 ページ. 平面ベクトルのなす角 >

問 1 の解答

$$\cos\theta = \frac{\overrightarrow{a} \cdot \overrightarrow{b}}{|\overrightarrow{a}||\overrightarrow{b}|} = \frac{a_1 b_1 + a_2 b_2}{\sqrt{{a_1}^2 + {a_2}^2}\ \sqrt{{b_1}^2 + {b_2}^2}}$$

問 2 の解答

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

(2) $\cos\theta = -\dfrac{1}{\sqrt{2}}$ (答) $\theta = 135^\circ$

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

< 45ページ. まとめの問題 >

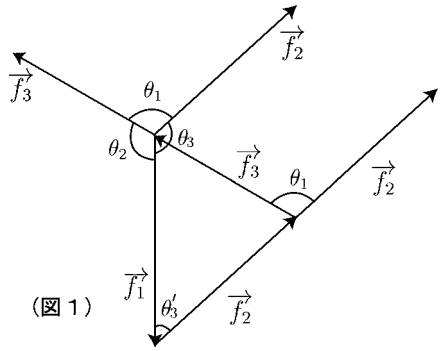
問 1 の解答

(1) $b = 2$ (2) $c = \sqrt{61}$ (3) $A = 150^\circ$

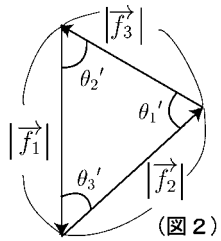
問 2 の解答

(1) $\theta = 30^\circ,\ \theta = 150^\circ$ (2) $\theta = 135^\circ,\ \theta = 225^\circ$ (3) $\theta = 60^\circ,\ \theta = 240^\circ$

問 3 の解答



(図 1)



(図 2)

$\theta_3' = 180^\circ - \theta_3$

$\theta_1' = 180^\circ - \theta_1$

$\theta_2' = 180^\circ - \theta_2$

正弦定理より $\dfrac{|\overrightarrow{f_1}|}{\sin\theta_1'} = \dfrac{|\overrightarrow{f_2}|}{\sin\theta_2'} = \dfrac{|\overrightarrow{f_3}|}{\sin\theta_3'}$

一方 $\sin\theta_1' = \sin(180^\circ - \theta_1) = \sin\theta_1$

$\sin\theta_2' = \sin(180^\circ - \theta_2) = \sin\theta_2$

$\sin\theta_3' = \sin(180^\circ - \theta_3) = \sin\theta_3$

よって $\dfrac{|\overrightarrow{f_1}|}{\sin\theta_1} = \dfrac{|\overrightarrow{f_2}|}{\sin\theta_2} = \dfrac{|\overrightarrow{f_3}|}{\sin\theta_3}$ (証明終)

問 4 の解答

(1) $\overrightarrow{\mathrm{AB}} = (\ -5,\ 0\ )$, $|\overrightarrow{\mathrm{AB}}| = 5$

(2) $\mathrm{C}(\ 1,\ 2\ )$

(3) $|\overrightarrow{\mathrm{OA}}| = \sqrt{10}$, $|\overrightarrow{\mathrm{OB}}| = \sqrt{5}$

(4) $\overrightarrow{\mathrm{OA}} \cdot \overrightarrow{\mathrm{OB}} = -5$

(5) $\cos\theta = -\dfrac{1}{\sqrt{2}}$ より $\theta = 135^\circ$