高知工科大学

基礎数学ワークブック

(2003年度版)

入門編

No. 2

解答

＜1ページ.比例・反比例 1＞

問 1 の解答

小さいダイヤの重さを x カラットとする。大きいダイヤの重さは $1.5x$ カラットである。小さいダイヤの値段を $y = kx^2$ とすると大きいダイヤの値段は $k \times (1.5x)^2 = 2.25kx^2$

(答)2.25 倍

問 2 の解答

一辺の長さ x(cm) の立方体の重さ y(g) は x の 3 乗に比例するので $y = kx^3$(k は定数) と表される。

$x = 2$ のとき $y = 120$ より $120 = k \times 2^3$ よって $k = \dfrac{120}{8} = 15$ である。従って $x = 3$(cm) のときの重さは $y = 15x^3 = 15 \times 3^3 = 405$

(答)405g

問 3 の解答

(1) $y = \dfrac{k}{x^2}$

$12.5 = \dfrac{k}{2^2}$ より $k = 12.5 \times 2^2 = 50$ (答)$y = \dfrac{50}{x^2}$

(2) $y = \dfrac{50}{5^2} = 2$

(答)2 ルクス

< 2ページ. 比例・反比例 2 >

問の解答

(1) $z = \dfrac{kx}{y}$, $\quad 50 = \dfrac{k \times 100}{4} \Rightarrow k = 2$ $\quad$ (答)$z = \underline{\dfrac{2x}{y}}$

(2) $z = \dfrac{kx}{y^2}$, $\quad 5 = \dfrac{k \times 24}{6^2} \Rightarrow k = \dfrac{15}{2}$ $\quad$ (答)$z = \underline{\dfrac{15x}{2y^2}}$

＜ 3ページ. 比例・反比例 3 ＞

問 1 の解答

(1) $z = \dfrac{kx}{y^2}$ とおく。 $x = 1,\ y = 1$ のとき $z = 1$ より $k = 1$ $\qquad$ (答)$z = \dfrac{x}{y^2}$

(2) $z = \dfrac{50}{2^2} = 12.5$ $\qquad$ (答)12.5 ルクス

問 2 の解答

(1) $V = \dfrac{kT}{P} \qquad 35 = \dfrac{k \times 280}{2} \Rightarrow k = \dfrac{1}{4}$

(答)$V = \dfrac{T}{4P}$

(2) $V = \dfrac{300}{4 \times 5} = 15$

(答)$V = 15(\ell)$

問 3 の解答

(1) 切り口の面積を S とすると $S = \pi y^2$。 よって z と x, y の関係は

$$z = \frac{kx}{S} = \frac{kx}{\pi y^2}$$

である。

$x = 1,\ y = 2$ のとき $z = 0.0014$ より $k = 0.0056\pi$

(答)$z = \dfrac{0.0056x}{y^2}$

(2) $x = 6, y = 1$ のとき $z = \dfrac{0.0056x}{y^2} = 0.0056 \times 6 = 0.0336$

(答)0.0336 オーム

＜4ページ.2次関数のグラフ 1＞

問の解答

(1) $y = -(x-3)^2 + 2$

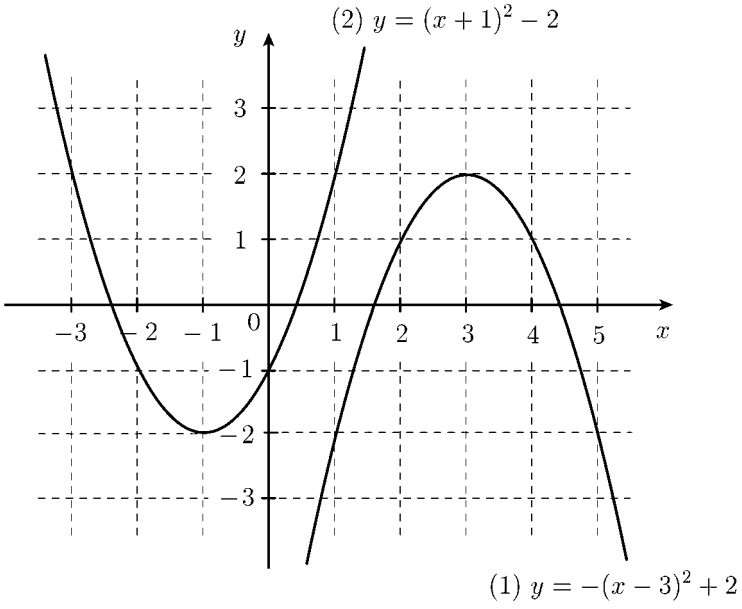
頂点 $(3,\ 2)$, 軸 $x = 3$

x	1	2	3	4	5
y	−2	1	2	1	−2

(2) $y = (x+1)^2 - 2$

頂点 $(-1,\ -2)$, 軸 $x = -1$

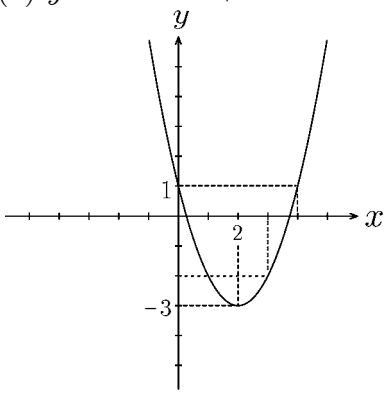
x	−3	−2	−1	0	1
y	2	−1	−2	−1	2



＜5ページ.2次関数のグラフ 2＞

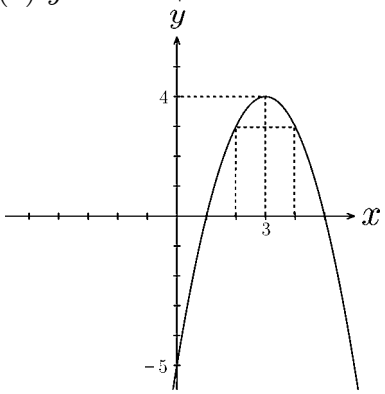
問の解答

(1) $y = x^2 - 4x + 1$



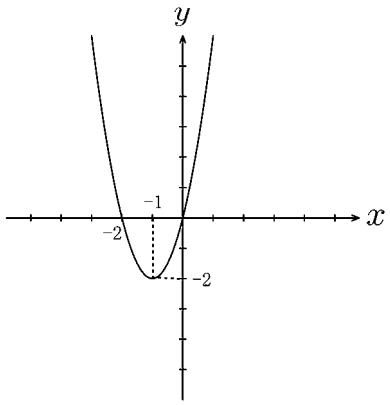
$y = (x-2)^2 - 3$　頂点 $(2,\ -3)$

(2) $y = -x^2 + 6x - 5$



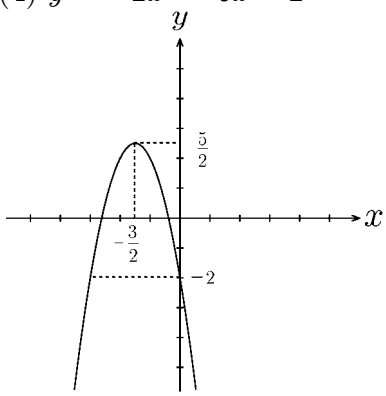
$y = -(x-3)^2 + 4$　頂点 $(3,\ 4)$

(3) $y = 2x^2 + 4x$



$y = 2(x+1)^2 - 2$　頂点 $(-1,\ -2)$

(4) $y = -2x^2 - 6x - 2$



$y = -2\left(x + \dfrac{3}{2}\right)^2 + \dfrac{5}{2}$

頂点 $\left(-\dfrac{3}{2},\ \dfrac{5}{2}\right)$

< 6ページ.2次関数のグラフ 3 >

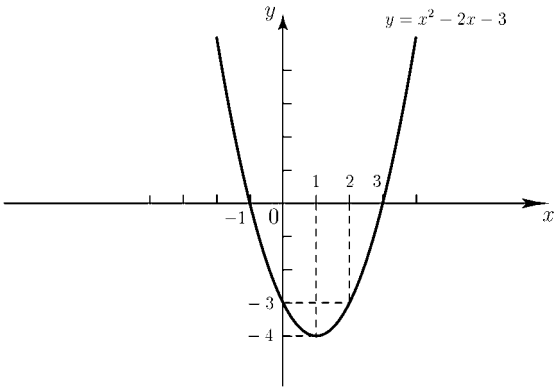
問 1 の解答

(1) $x^2 - 2x - 3$

$= (x-1)^2 - 4$

頂点 $(1, -4)$

x 切片 $(-1,\ 0)$ と $(3,\ 0)$

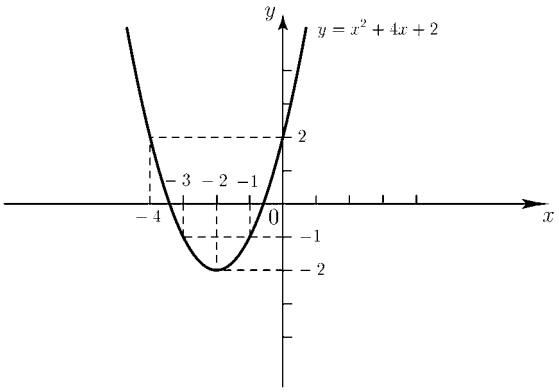


(2) $x^2 + 4x + 2$

$= (x-2)^2 - 2$

頂点 $(-2, -2)$

x 切片 $(-2-\sqrt{2},\ 0)$ と $(-2+\sqrt{2},\ 0)$



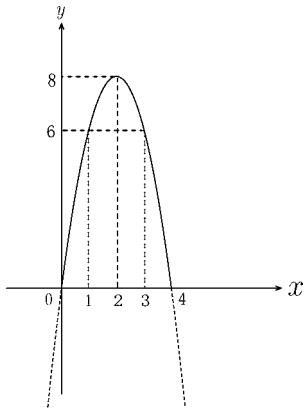
問 2 の解答

(1) $\underline{x < -1 \text{ か又は } 3 < x}$

(2) $\underline{-2-\sqrt{2} \leqq x \leqq -2+\sqrt{2}}$

＜ 7ページ.2 次関数の最大・最小 1 ＞

問 1 の解答



(1) $y = 2x(4-x) \qquad (0 \leqq x \leqq 4)$

$= -8x - 2x^2 = -2(x^2 - 4x)$

$= -2\{(x-2)^2 - 4\} = -2(x-2)^2 + 8$

$x = 2$ のとき最大値 $y = 8$

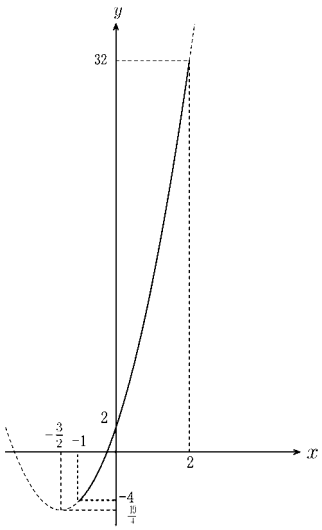
$x = 0$ または $x = 4$ のとき最小値 $y = 0$

(2) $y = 3x^2 + 9x + 2 \qquad (-1 \leqq x \leqq 2)$

$= 3(x^2 + 3x) + 2 = 3\left\{\left(x + \dfrac{3}{2}\right)^2 - \dfrac{9}{4}\right\} + 2$

$= 3\left(x + \dfrac{3}{2}\right)^2 - \dfrac{27}{4} + 2$

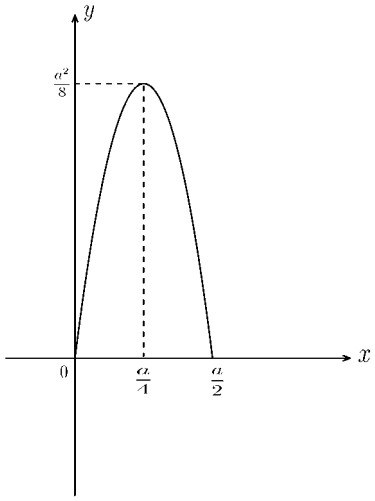
$= 3\left(x + \dfrac{3}{2}\right)^2 - \dfrac{19}{4}$



$x = 2$ のとき最大値 $y = 32$

$x = -1$ のとき最小値 $y = -4$

問 2 の解答



$a - 2x > 0 \;\Rightarrow\; 0 < x < \dfrac{a}{2}$

$y = x(a-2x) = -2x^2 + ax = -2\left(x^2 - \dfrac{a}{2}x\right)$

$= -2\left\{(x - \dfrac{a}{4})^2 - \dfrac{a^2}{16}\right\} = -2\left(x - \dfrac{a}{4}\right)^2 + \dfrac{a^2}{8}$

(答) $x = \dfrac{a}{4}(\mathrm{cm})$

＜ 8ページ.2 次関数の最大・最小 2 ＞

問 1 の解答

(1) $y = -4.9(t^2 - 4t) = -4.9\{(t-2)^2 - 4\} = -4.9(t-2)^2 + 19.6$

(答) $t = 2$ のとき最大値 $y = 19.6$

(2) 2 秒後

(3) 19.6m

(4) $y = 0 \Rightarrow -4.9(t^2 - 4t) = 0 \Rightarrow t = 0,\ 4$

(答) 4 秒後

問 2 の解答

(1)$y = -4.9(t^2 - 6t - 7) = -4.9\{(t-3)^2 - 16\} = -4.9(t-3)^2 + 78.4$

(答) 3 秒後

(2) (答)78.4m

(3) $-4.9(t^2 - 6t - 7) = 0$

$(t-7)(t+1) = 0$

(答) 7 秒後

< 9ページ. 三角比 1 >

問の解答

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

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

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

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

< 10ページ. 三角比 2 >

問の解答

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

$$7.002 + 1.5 = 8.502$$

(答) $\underline{8.502(\mathrm{m})}$

< 11ページ. 三角比 3 >

問 1 の解答

$$\sin \mathrm{A} = \frac{\mathrm{BC}}{3} \Rightarrow \mathrm{BC} = 3 \times \sin \mathrm{A} = 3 \times \sin 56^\circ$$
$$= 3 \times 0.829 = 2.48 \fallingdotseq 2.5$$

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

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

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

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

< 12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) $\mathrm{P}(1,\ \sqrt{3})$

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

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

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

< 13ページ. 三角関数 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　$\mathrm{P}(-1,\ \sqrt{3})$

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

< 14ページ. 三角関数 2 >

問の解答

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

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

< 15ページ. 三角関数 3 >

問 1 の解答

$\cos 45^\circ = \dfrac{\sqrt{2}}{2}$ $\sin 45^\circ = \dfrac{\sqrt{2}}{2}$ $\tan 45^\circ = 1$ $\mathrm{P}\left(\dfrac{\sqrt{2}}{2}, \dfrac{\sqrt{2}}{2}\right)$

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

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

$\cos 315^\circ = \dfrac{\sqrt{2}}{2}$ $\sin 315^\circ = -\dfrac{\sqrt{2}}{2}$ $\tan 315^\circ = -1$ $\mathrm{P}'''\left(\dfrac{\sqrt{2}}{2}, -\dfrac{\sqrt{2}}{2}\right)$

問 2 の解答

$\cos 30^\circ = \dfrac{\sqrt{3}}{2}$ $\sin 30^\circ = \dfrac{1}{2}$ $\tan 30^\circ = \dfrac{\sqrt{3}}{3}$ $\mathrm{P}\left(\dfrac{\sqrt{3}}{2}, \dfrac{1}{2}\right)$

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

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

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

< 16ページ. 三角関数 4 >

問 1 の解答

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

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

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

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

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

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

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

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

< 17ページ. 三角関数 5 >

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

$\cos 20^\circ = 0.9397$	$\sin 20^\circ = 0.342$	$\tan 20^\circ = 0.364$
$\cos 160^\circ = -0.9397$	$\sin 160^\circ = 0.342$	$\tan 160^\circ = -0.364$
$\cos 200^\circ = -0.9397$	$\sin 200^\circ = -0.342$	$\tan 200^\circ = 0.364$
$\cos 340^\circ = 0.9397$	$\sin 340^\circ = -0.342$	$\tan 340^\circ = -0.364$

< 18ページ. 三角関数表 >

問の解答

(1) $\sin 155^\circ = \sin 25^\circ = 0.4226$

(2) $\tan 190^\circ = \tan 10^\circ = 0.1763$

(3) $\cos 320^\circ = \cos 40^\circ = 0.766$

(4) $\tan 140^\circ = -\tan 40^\circ = -0.8391$

(5) $\tan 250^\circ = -\cos 70^\circ = -0.342$

(6) $\sin 350^\circ = -\sin 10^\circ = -0.1736$

< 20 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

$$\frac{c}{\sin 120^\circ} = \frac{2}{\sin 45^\circ} \Rightarrow c = \frac{2\sin 120^\circ}{\sin 45^\circ} = \frac{\frac{2\times\sqrt{3}}{2}}{\frac{1}{\sqrt{2}}} \times 8 = \sqrt{6}$$

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

< 21 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) $\tan 30^\circ=\dfrac{\mathrm{CH}}{\mathrm{BH}}\Rightarrow \mathrm{CH}=\mathrm{BH}\times\tan 30^\circ=\dfrac{200\sqrt{2}}{3}$

< 22 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

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

$$\sin^2\theta = \frac{25}{169} = \left(\frac{5}{13}\right)^2 \Rightarrow \sin\theta = \frac{5}{13}$$

< 23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) $\mathrm{P}(-6.428,\ 7.66)$

< 24 ページ. 平面の距離 >

問 1 の解答

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

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

問 2 の解答

(1) AB$= \sqrt{(4-1)^2 + (1-3)^2} = \sqrt{13}$

(2) AB$= \sqrt{(-6)^2 + 2^2} = 2\sqrt{10}$

(3) AB$= \sqrt{4^2 + (-4)^2} = 4\sqrt{2}$

問 3 の解答

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

< 25ページ. 余弦定理 1 >

問の解答

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

(2) A($b\cos\theta,\ b\sin\theta$)

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

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

< 26 ページ. 余弦定理 2 >

問 1 の解答

$a^2 = b^2 + c^2 - 2bc\cos A$

問 2 の解答

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

問 3 の解答

(1) $a^2 = b^2 + c^2 - 2bc\cos A$

$= 6 + 2 - 2\sqrt{6} \times \sqrt{2} \times \dfrac{\sqrt{3}}{2} = 2$

$\underline{(答) a = \sqrt{2}}$

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

$= 2 + 9 - 2\sqrt{2} \times 3 \times \dfrac{1}{\sqrt{2}} = 5$

$\underline{(答) b = \sqrt{5}}$

(3) $c^2 = a^2 + b^2 - 2cb\cos C$

$= 3 + 1 - 2\sqrt{3} \times 1 \times \left(-\dfrac{\sqrt{3}}{2}\right) = 7$

$\underline{(答) c = \sqrt{7}}$

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

$= 6 + 3 - 2 \times \sqrt{6} \times \sqrt{3} \times \left(-\dfrac{\sqrt{2}}{2}\right) = 15$

$\underline{(答) b = \sqrt{15}}$

< 27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) $$\cos B = \frac{a^2 + c^2 - b^2}{2ac} = \frac{9 + 12 - 39}{2 \times 3 \times 2\sqrt{3}} = -\frac{\sqrt{3}}{2}$$

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

< 28 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) $\tan 860^\circ = \tan 140^\circ$

< 29 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

$\sin 380^\circ = 0.342$ $\cos 400^\circ = 0.776$ $\tan 510^\circ = -0.5774$

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

< 30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

$\sin(-50°) = -0.766$ $\quad$ $\cos(-40°) = 0.766$ $\quad$ $\tan(-20°) = -0.364$

$\sin 130° = 0.766$ $\quad$ $\cos 140° = -0.766$ $\quad$ $\tan 160° = -0.364$

$\sin 200° = -0.342$ $\quad$ $\cos 190° = -0.9848$ $\quad$ $\tan 220° = 0.8391$

$\sin 280° = -0.9848$ $\quad$ $\cos 290° = 0.342$ $\quad$ $\tan 310° = -1.1918$

$\sin 370° = 0.1736$ $\quad$ $\cos 380° = 0.9397$ $\quad$ $\tan 410° = 1.1918$

< 31 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) $\theta = 210^\circ,\ \theta = 330^\circ$

< 32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) $\theta = 45^\circ,\ \theta = 315^\circ$

< 33ページ. 三角方程式 3 >

問 1 の解答

三角形の相似より

$Y : X = T : 1$

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

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

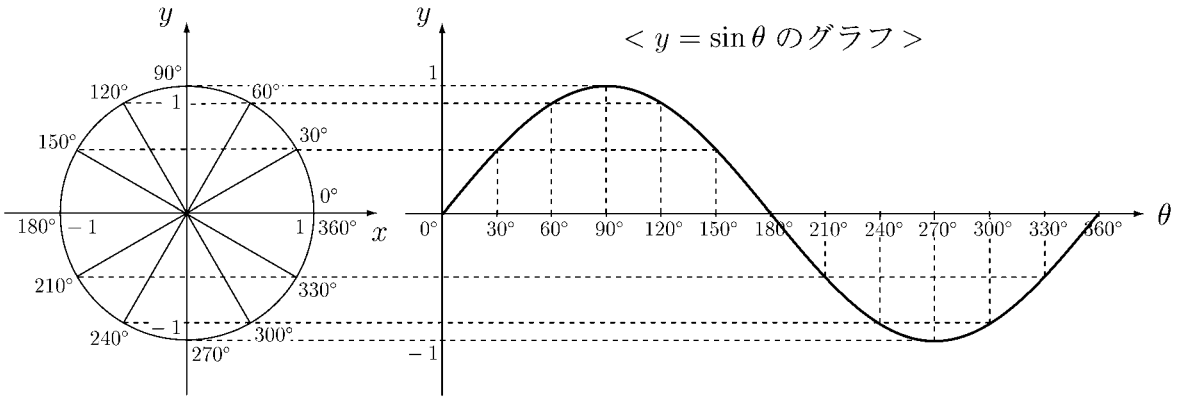
(答) $\theta = 30^\circ,\ \theta = 210^\circ$

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

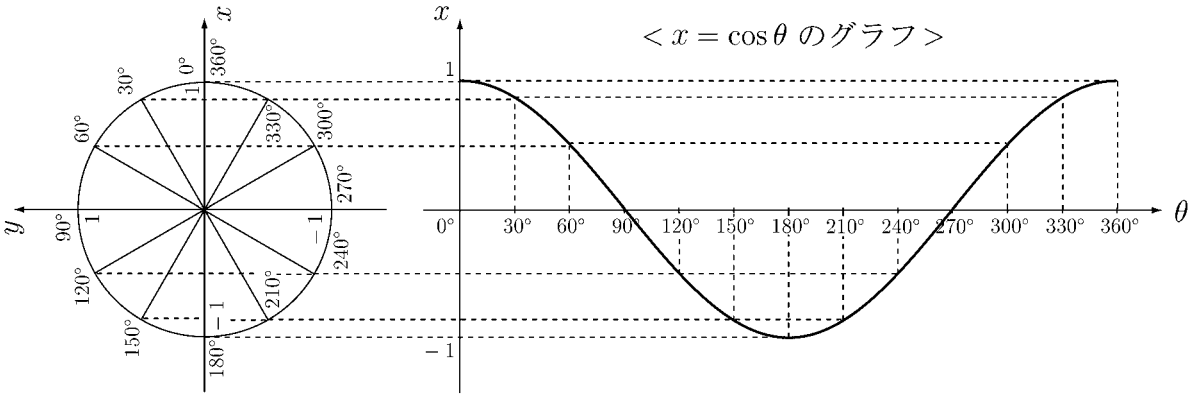
(答) $\theta = -60^\circ,\ \theta = 120^\circ$

< 34 ページ. 三角関数のグラフ 1 >

問 1 の解答

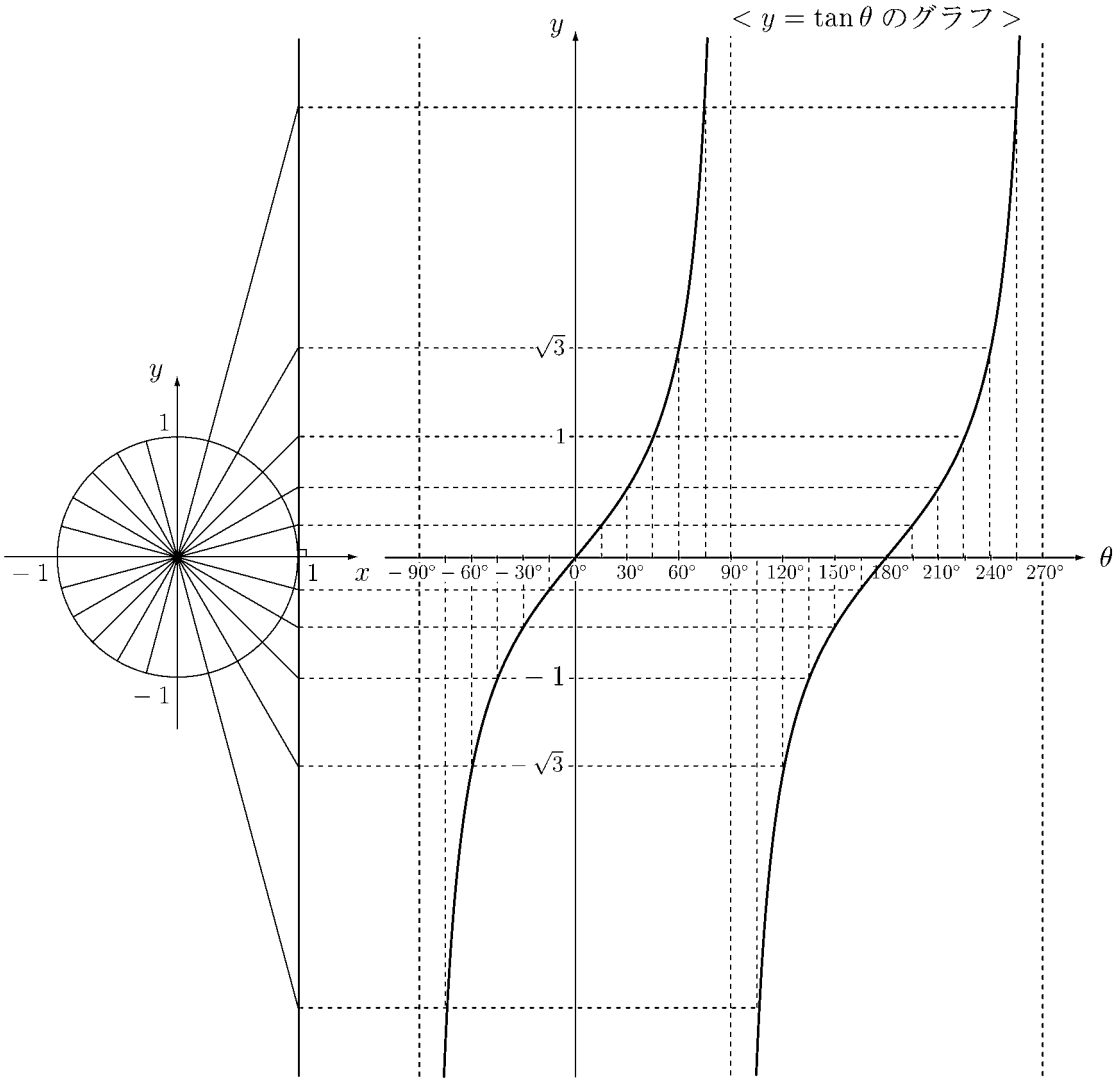


問 2 の解答



< 35ページ. 三角関数のグラフ 2 >

問の解答



< 36 ページ. 速度の合成 >

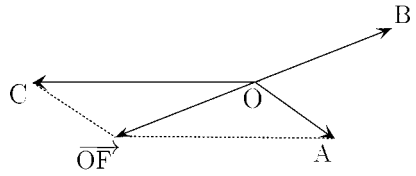
問の解答

$$\sin\theta = \frac{6}{10} = 0.6$$

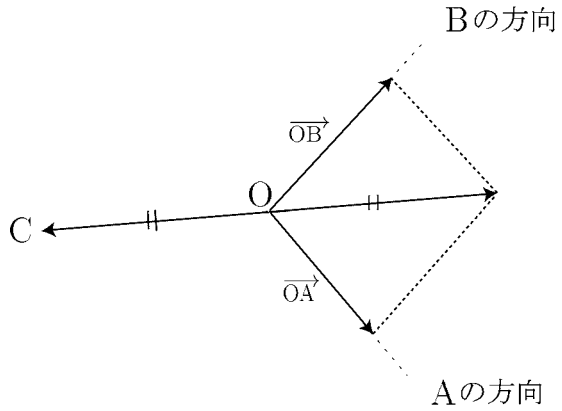
$$\theta \fallingdotseq 37^\circ$$

< 37ページ. 力の合成 >

問 1 の解答



問 2 の解答



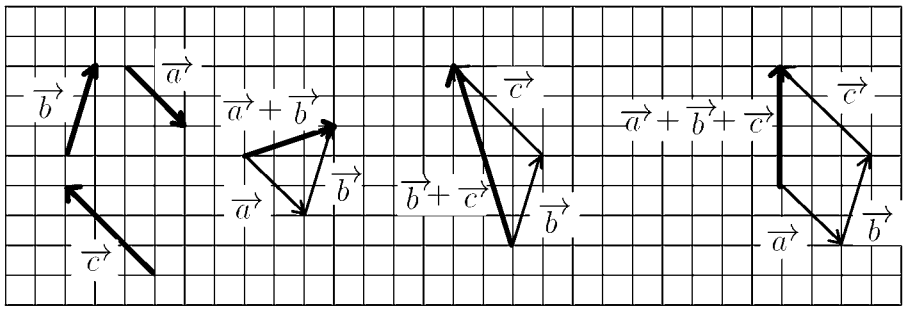
< 38ページ. 平面のベクトル 1 >

問の解答

$\overrightarrow{\mathrm{AO}} = \overrightarrow{\mathrm{BC}} = \overrightarrow{\mathrm{OD}} = \overrightarrow{\mathrm{FE}}$

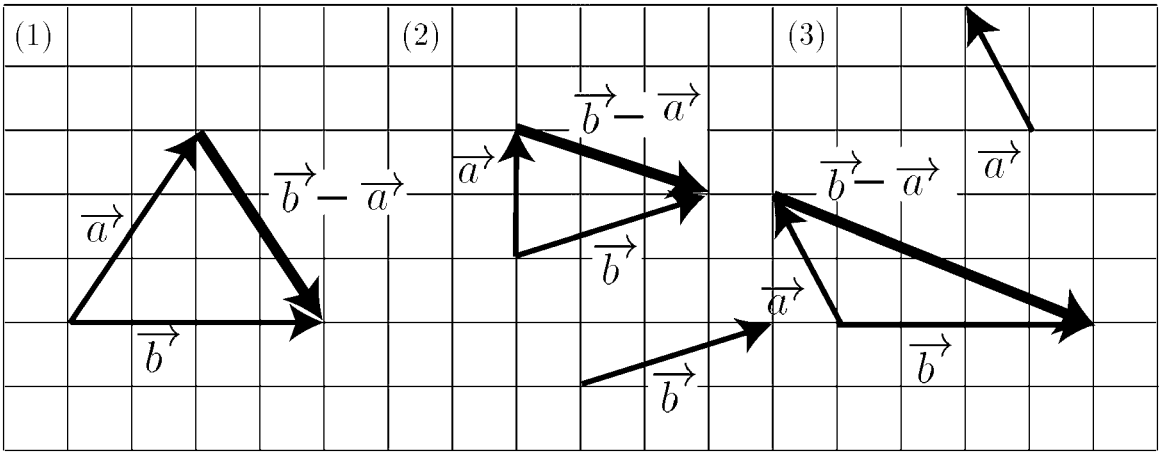
< 39 ページ. 平面のベクトル 2 >

問の解答



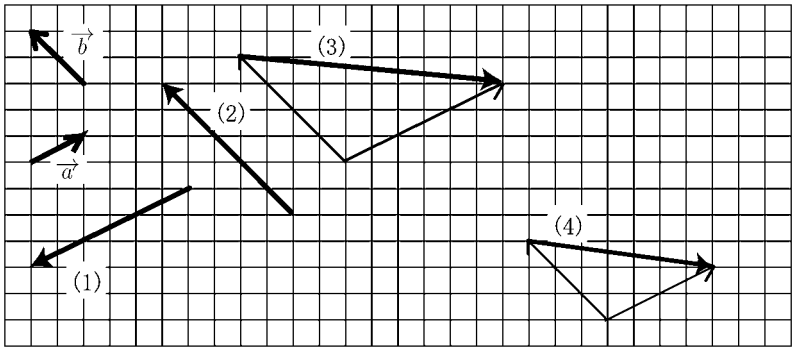
< 40 ページ. 平面のベクトル 3 >

問の解答



< 41 ページ. 平面のベクトル 4 >

問の解答



< 42ページ. 平面ベクトルの成分 1 >

問の解答

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

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

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

< 43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) $\overrightarrow{\mathrm{AB}} = (-1\ ,\ 2\ )$

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

< 44 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) $\overrightarrow{a} + 2\overrightarrow{b} = (\ 2\ ,\ 6\ ) + 2(\ -1\ ,\ -3\ ) = (\ 0\ ,\ 0\ )$

< 45ページ. ベクトルの内積 1 >

問の解答

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

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

< 46 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) $\overrightarrow{\mathrm{MB}} \cdot \overrightarrow{\mathrm{MC}} = 1 \times 1 \times \cos 180^\circ = -1$

< 47ページ. 内積の成分表示 1 >

問 1 の解答

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

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

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

< 48 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

< 49 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) $\theta = 30^\circ$

< 50ページ. まとめの問題 >

問 1 の解答

$$z = \frac{kx}{y^2}$$

問 2 の解答

(1) $x = 2$ のとき最大値 $y = 45$　　(2) $-1 \leqq x \leqq 5$

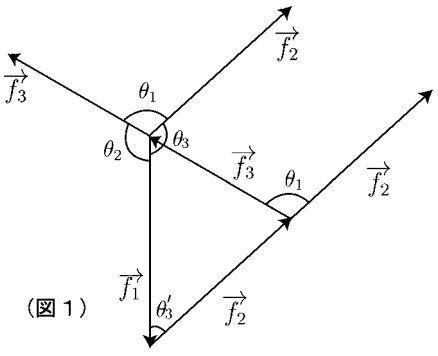
問 3 の解答

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

問 4 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 5 の解答



（図 1）

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

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

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

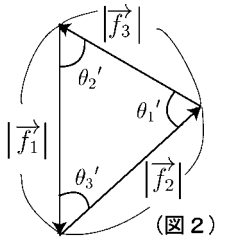
正弦定理より $\dfrac{|\overrightarrow{f_1}|}{\sin\theta_1'} = \dfrac{|\overrightarrow{f_2}|}{\sin\theta_2'} = \dfrac{|\overrightarrow{f_3}|}{\sin\theta_3'}$

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)



（図 2）

問 6 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) $\theta = 135^\circ$