数学 1

(i) $y = \dfrac{a-2}{2}x + \dfrac{a}{2}$.

(ii) $a = 2,\ -1$.

(iii) $a = 2$ のとき，$S = \dfrac{16}{3}$．　$a = -1$ のとき，$S = \dfrac{8}{3}$.

数学 2

(i) $f_1'(0) = 1, \quad \displaystyle\int_0^1 f_1(x)\,dx = \frac{1}{2}.$

$f_2'(0) = \dfrac{1}{4}, \quad \displaystyle\int_0^1 f_2(x)\,dx = -\frac{2}{3}\log(2).$

$f_3'(0) = 0, \quad \displaystyle\int_0^1 f_3(x)\,dx = 0.$

$f_4'(0) = 1, \quad \displaystyle\int_0^1 f_4(x)\,dx = 1.$

$f_5'(0) = 0, \quad \displaystyle\int_0^1 f_5(x)\,dx = \frac{\pi}{6}.$

$f_6'(0) = \pi, \quad \displaystyle\int_0^1 f_6(x)\,dx = \frac{2}{\pi}.$

(ii) $\dfrac{7}{16}$.

(iii) $\dfrac{253}{1728}$.

数学 3

(i) $\mathrm{AB} = 1$. $\quad \overrightarrow{a} \cdot \overrightarrow{b} = 1$.

(ii) $\overrightarrow{\mathrm{BA}} \cdot \overrightarrow{\mathrm{BC}} = \cos\theta$. $\quad S = \dfrac{1}{2}\sin\theta$.

(iii) $\overrightarrow{\mathrm{OH}} = \overrightarrow{\mathrm{OB}} + \dfrac{1}{1+\cos\theta}\overrightarrow{\mathrm{BA}} + \dfrac{1}{1+\cos\theta}\overrightarrow{\mathrm{BC}}$.

(iv) $\mathrm{OH} = \sqrt{\dfrac{2\cos\theta}{1+\cos\theta}}$.

(v) $V = \dfrac{\sqrt{2}}{6}\sqrt{\cos\theta - \cos^2\theta}$.

最大値は $\dfrac{1}{6\sqrt{2}} = \dfrac{\sqrt{2}}{12}$. そのときの θ の値は $\theta = \dfrac{\pi}{3}$.

数 学 4

(i) $\dfrac{1}{2} \pm \dfrac{\sqrt{3}}{2} i.$

(ii) 省略.

(iii) $(m, n) = (0, \pm 1),\ (\pm 1, 0),\ (1, -1),\ (-1, 1).$

(iv) $(a, b, c, d) = (0, -1, 1, 0),\ (0, -1, 1, -1),\ (1, -1, 1, 0).$