数 学 1

(i) $f\left(\dfrac{1}{\alpha}\right)=\dfrac{f(\alpha)}{\alpha^2}=0$

(ii) $(p,\ 1)$, $\left(\dfrac{1}{p},\ \dfrac{1}{p^2}\right)$

(iii) $\left(\dfrac{p}{2},\ \dfrac{1}{2}\right)$

(iv) $\dfrac{\pi}{6}\left(\alpha^2+\dfrac{1}{\alpha^2}\right)$

数 学 2

(i) $\log 2$

(ii) $\left(\sqrt{x(x+4)}\right)' = \dfrac{x+2}{\sqrt{x\,(x+4)}}$

$\left(\log\left(\sqrt{x}+\sqrt{x+4}\right)\right)' = \dfrac{1}{2\sqrt{x\,(x+4)}}$

(iii) $0 < x \leqq 2$ のとき，$f(x) > 0$, $g(x) = 1 - \frac{2}{x} \leqq 0$

$x > 2$ のとき，$f(x) > 0$, $g(x) > 0$，$(f(x))^2 - (g(x))^2 > 0$

(iv) $4 - 2\log 2$

数学 3

(i) $\overrightarrow{AP}=s\overrightarrow{AB}+t\overrightarrow{AC}$

$\overrightarrow{AP}\cdot\overrightarrow{AD}=(s\overrightarrow{AB}+t\overrightarrow{AC})\cdot\overrightarrow{AD}=s\overrightarrow{AB}\cdot\overrightarrow{AD}+\mathrm{t}\overrightarrow{AC}\cdot\overrightarrow{AD}$

$=\cdots=s\Big((b_1b_2c_3-b_1b_2c_3)+(b_1c_2b_3-b_1c_2b_3)+(c_1b_2b_3-c_1b_2b_3)\Big)$

$+t\Big((c_1c_2b_3-c_1c_2b_3)+(c_1b_2c_3-c_1b_2c_3)+(b_1c_2c_3-b_1c_2c_3)\Big)=0$

(ii) $6\sqrt{3}$

(iii) $(1,\ 3,\ 4)$

(iv) $\left(\frac{61}{15},\ \frac{43}{15},\ \frac{2}{3}\right),\ \left(\frac{-11}{15},\ \frac{7}{15},\ \frac{2}{3}\right)$

数 学 4

(i) $b_n = n^2 + 2n + \dfrac{5}{3}$, $\displaystyle\sum_{k=1}^{n} b_k = \frac{1}{3}n^3 + \frac{3}{2}n^2 + \frac{17}{6}n$

(ii) $\sin n\theta + \sin(n+1)\theta + \sin(n+2)\theta = 0$ $(n = 1, 2, \cdots,\ 0 < \theta < \pi)$ を解く

$\theta = \dfrac{2\pi}{3}$

(iii) (iii-1) $\displaystyle\lim_{n\to\infty} \frac{b_n}{a_{n+1}} = 1$

(iii-2) $\dfrac{b_n}{a_{n+1}} = \dfrac{\sqrt{n+2} + \sqrt{n+1}}{\sqrt{n+3} + \sqrt{n}}$ の分母，分子の平方の差を比較

$b_n > a_{n+1}$

(iv) (iv-1) $a_{n+1} = -2a_n + 6$

(iv-2) $b_n = 2 - (-2)^{n-1}$, $\displaystyle\sum_{k=1}^{n} b_k = 2n + \frac{(-2)^n - 1}{3}$