2021 国際医療福祉大(医)

第1問

(A) $|2x+3|=5$

$2x+3=\pm 5$

$2x=8,-2$ $\underline{x=-1,4}$ //

また

$|x+2|+|x-3|=7$

$$\begin{cases} 2x-1=7 & (x\geqq 3) \\ -5=7 & (2\leqq x<3) \\ -2x+1=7 & (x<2) \end{cases}$$

解くと $\underline{x=-3,4}$ //

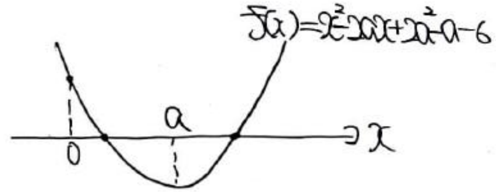
(B)

$\frac{D}{4}=a^2-(2a^2-a-6)$

$=-a^2+a+6>0$

$\Leftrightarrow a^2-a-6<0$

$\therefore \underline{-2<a<3}$ //



$$\begin{cases} 端\ f(0)=2a^2-a-6>0 \\ 軸\ a>0 \quad 判\ -2<a<3 \end{cases}$$

$\therefore \underline{2<a<3}$ //

(C)

$\left((x+3)^{10} の x^8 の係数\right)$

$={}_{10}C_2 3^2$

$=45\cdot 9=\underline{405}$ //

$\left(\left(x-\frac{2}{x}\right)^{12} の x^{10} の係数\right)$

$={}_{12}C_1(-2)=\underline{-24}$ //

(D)

$A(3,6)$ $P(t,t^2+4t-3)$

$X=\frac{2\cdot 3+1\cdot t}{1+2}=\underline{\frac{t+6}{3}}$ //

$Y=\frac{2\cdot 6+t^2+4t-3}{1+2}=\underline{\frac{t^2+4t+9}{3}}$ //

$3X-6=t$

Y

$=\frac{1}{3}\{9(X-2)^2+12X-24+9\}$

$=\frac{1}{3}(9X^2-24X+21)$

$=3X^2-8X+7$

$\therefore \underline{y=3x^2-8x+7}$ //

第2問

(1) $\left(\frac{1}{2}\right)^4=\underline{\frac{1}{16}}$ //

$P(\times 0000)=\left(\frac{1}{2}\right)^5=\underline{\frac{1}{32}}$ //

$P(?\times 0000)=\underline{\frac{1}{32}}$ //

(2)

$P(???\times 0000)=\underline{\frac{1}{32}}$ //

$P_{表5回}(???\times 0000)=\underline{\frac{3}{8}}$ //

(3)

$P(????\times 0000)$

$=\frac{1}{32}-P(0000\times 0000)$

$=\frac{1}{32}-\frac{1}{512}$

$=\underline{\frac{15}{512}}$ //

$P(コインを10回以上投げる)$

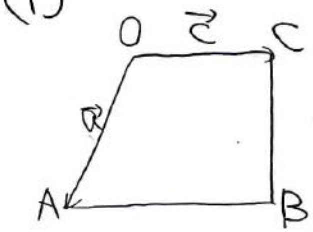
$=1-\frac{1}{16}-\frac{1}{32}\times 4-\frac{15}{512}$

$=\frac{512-32-16\times 4-15}{512}$

$=\underline{\frac{401}{512}}$ //

第3問

(1)



(i) $\vec{a}\cdot\vec{c}=5\cdot 4\left(-\frac{1}{4}\right)=\underline{-5}$ //

(ii)

$\triangle OAC$

$=\frac{1}{2}\sqrt{25\cdot 16-(-5)^2}$

$=\frac{1}{2}\sqrt{25\cdot 15}=\underline{\frac{5}{2}\sqrt{15}}$ //

(iii)

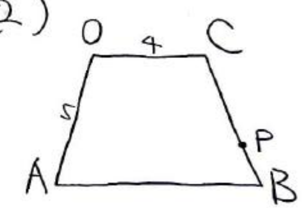
$\overrightarrow{OB}=\vec{a}+\underline{\frac{9}{4}}\vec{c}$ //

$\overrightarrow{OB}\cdot\overrightarrow{OC}=\left(\vec{a}+\frac{9}{4}\vec{c}\right)\cdot\vec{c}$

$=-5+\frac{9}{4}16$

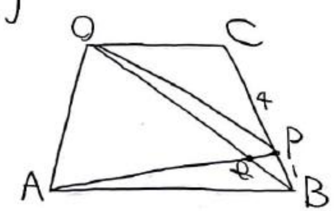
$=\underline{31}$ //

(2)



$|\overrightarrow{BC}|^2$
$= |\vec{c} - \vec{a} - \frac{9}{4}\vec{c}|^2$
$= |\vec{a} + \frac{5}{4}\vec{c}|^2$
$= |\vec{a}|^2 + \frac{5}{2}\vec{a}\cdot\vec{c} + \frac{25}{16}|\vec{c}|^2$
$= 25 + \frac{5}{2}(-4) + 25$
$= 40$
$\therefore |\overrightarrow{BC}| = \underline{2\sqrt{10}}$ //

(ii)



$\overrightarrow{AP} = \dfrac{4\overrightarrow{AB} + 1\cdot\overrightarrow{AC}}{1+4}$
$= \dfrac{9\overrightarrow{OC} + \overrightarrow{OC} - \overrightarrow{OA}}{5}$
$= 2\vec{c} - \frac{1}{5}\vec{a}$
$\overrightarrow{AQ} = k\overrightarrow{AP}$ とおく.
$= 2k\vec{c} - \frac{k}{5}\vec{a}$
$\overrightarrow{OQ} = \overrightarrow{OA} + \overrightarrow{AQ}$
$= (1 - \frac{k}{5})\vec{a} + 2k\vec{c}$

また
$\overrightarrow{OQ} = l\overrightarrow{OB}$ とおく
$= l\vec{a} + \frac{9l}{4}\vec{c}$

比較して
$\begin{cases} l = 1 - \frac{k}{5} \\ \frac{9l}{4} = 2k \end{cases} \rightarrow \frac{9}{4}(1 - \frac{k}{5}) = 2k$
$\Leftrightarrow 45 - 9k = 40k$
$\therefore k = \frac{45}{49}$
$l = 1 - \frac{9}{49} = \frac{40}{49}$

これより
$AQ : QP = 45 : 4$
$OQ : QB = 40 : 9$
$\Downarrow$
$AQ = 45\alpha,\ QP = 4\alpha$
$OQ = 40\beta,\ QB = 9\beta$
とおくと
$\triangle ABQ : \triangle OPQ$
$= 45\alpha\cdot 9\beta : 40\beta\cdot 4\alpha$
$= 81 : 32$

$\triangle OPQ = \underline{\frac{32}{81}\triangle ABQ}$ //

第4問 $\sin^2 x = t$ とおく.
$f(x) = 4t^2 - 2t + 1$
$= 4(t - \frac{1}{4})^2 + \frac{3}{4} \quad (0 \leqq t \leqq 1)$

$t = 1$ $x = \frac{\pi}{2}$ のとき極大値 3
$t = \frac{1}{4}$ $x = \frac{\pi}{6}, \frac{5}{6}\pi$ のとき極小値 $\frac{3}{4}$ //

(2)
$\int f(x)dx$
$= \int\{(1-\cos 2x)^2 - (1-\cos 2x) + 1\}dx$
$= \int\{-2\cos 2x + \frac{1+\cos 4x}{2} + \cos 2x + 1\}dx$
$= \int(\frac{1}{2}\cos 4x - \cos 2x + \frac{3}{2})dx$
$= \underline{\frac{1}{8}\sin 4x - \frac{1}{2}\sin 2x + \frac{3}{2}x + C}$ //

(3) $f(x) > 0$ より
$S(t)$
$= \int_{t-\frac{\pi}{8}}^{t+\frac{\pi}{8}} f(x)dx$
$= \left[\frac{1}{8}\sin 4x - \frac{1}{2}\sin 2x + \frac{3}{2}x\right]_{t-\frac{\pi}{8}}^{t+\frac{\pi}{8}}$
$= \frac{1}{8}\sin(4t + \frac{\pi}{2}) - \frac{1}{2}\sin(2t + \frac{\pi}{4})$
$- \frac{1}{8}\sin(4t - \frac{\pi}{2}) - \frac{1}{2}\sin(2t - \frac{\pi}{4}) + \frac{3}{8}\pi$
$= \underline{\frac{1}{4}\cos 4t - \frac{\sqrt{2}}{2}\cos 2t + \frac{3}{8}\pi}$ //
$= \frac{1}{4}(2\cos^2 2t - 1) - \frac{\sqrt{2}}{2}\cos 2t + \frac{3}{8}\pi$
$= \frac{1}{2}(\cos^2 2t - \sqrt{2}\cos 2t) + \frac{3}{8}\pi - \frac{1}{4}$
$= \frac{1}{2}(\cos 2t - \frac{\sqrt{2}}{2})^2 + \frac{3}{8}\pi - \frac{1}{2}$
$2t = \frac{\pi}{4}, \frac{7}{4}\pi$
$\Leftrightarrow t = \underline{\frac{\pi}{8}, \frac{7}{8}\pi}$ のとき //
最小値 $\underline{\frac{-1}{2} + \frac{3}{8}\pi}$ //