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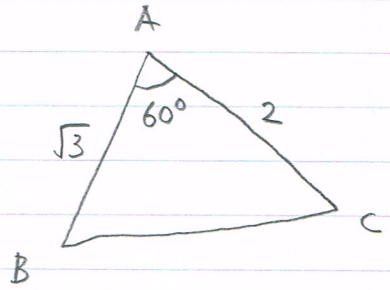
(1)



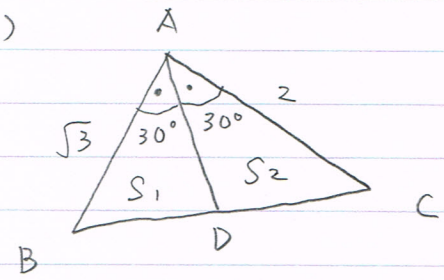
$S = \frac{1}{2} \cdot AB \cdot AC \cdot \sin A$

$= \frac{1}{2} \cdot \sqrt{3} \cdot 2 \cdot \sin 60°$

$= \sqrt{3} \times \frac{\sqrt{3}}{2}$

$\therefore S = \frac{3}{2}$

(2)



$S_1 = \frac{1}{2} \cdot AB \cdot AD \cdot \sin 30°$

$S_2 = \frac{1}{2} \cdot AC \cdot AD \cdot \sin 30°$ より

$S_1 = \frac{1}{2} \cdot \sqrt{3} \cdot x \cdot \frac{1}{2} = \frac{\sqrt{3}}{4}x$

$S_2 = \frac{1}{2} \cdot x \cdot 2 \cdot \frac{1}{2} = \frac{1}{2}x$

$S = S_1 + S_2$ より

$\frac{\sqrt{3}}{4}x + \frac{1}{2}x = \frac{3}{2}$

$\sqrt{3}x + 2x = 6$

$(\sqrt{3}+2)x = 6$

$x = \frac{6}{\sqrt{3}+2} = \frac{6(\sqrt{3}-2)}{(\sqrt{3}+2)(\sqrt{3}-2)}$

$= \frac{6(\sqrt{3}-2)}{3-4}$

$= -6(\sqrt{3}-2)$

$x = 6(2-\sqrt{3})$

$\therefore AD = 12 - 6\sqrt{3}$

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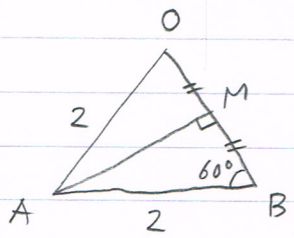
AMの長さを求めて
正三角形 OABから



$AM = AB \sin 60°$

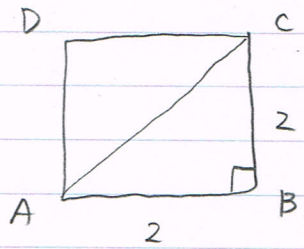
$= 2 \cdot \frac{\sqrt{3}}{2}$

$AM = \sqrt{3}$

MCの長さも同様に求めると

$MC = \sqrt{3}$

ACの長さを求めると
正方形 ABCD から



三平方の定理より

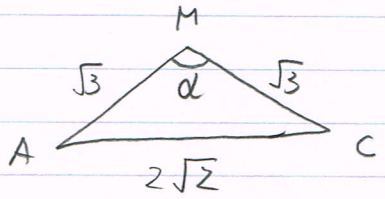
$AC^2 = AB^2 + CB^2$

$= 2^2 + 2^2$

$= 8$

$AC = \sqrt{8} = 2\sqrt{2}$

△MACについて



余弦定理（その2）より

$\cos\alpha = \frac{MA^2 + MC^2 - AC^2}{2 \cdot MA \cdot MC}$

$= \frac{(\sqrt{3})^2 + (\sqrt{3})^2 - (2\sqrt{2})^2}{2 \cdot \sqrt{3} \cdot \sqrt{3}}$

$= \frac{3+3-8}{6}$

$\therefore \cos\alpha = -\frac{1}{3}$