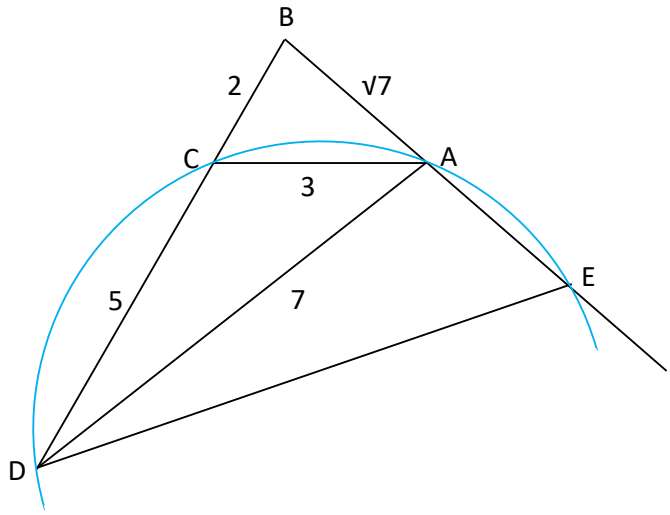
図 1



(1) 式

$$R = \frac{AD}{2\sin\angle ACD} = \frac{7}{2\times\sin 120^\circ} = \frac{7}{2\times(\sqrt{3}/2)} = \frac{7\sqrt{3}}{3}$$

(2) 式

$$\cos\angle BAD = \frac{AB^2+DA^2-BD^2}{2\cdot AB\cdot DA} = \frac{(\sqrt{7})^2+7^2-7^2}{2\times\sqrt{7}\times 7} = \frac{\sqrt{7}}{14}$$

(3) 式

$$\cos\angle DAE = \cos(180^\circ-\angle BAD) = -\cos\angle BAD = -\frac{\sqrt{7}}{14}$$

(4) 式

$$DE = 2R\sin\angle DAE = 2\times\frac{7\sqrt{3}}{3}\times(1-\cos^2\angle DAE)^{\frac{1}{2}} = \frac{14\sqrt{3}}{3}\times\left(1-\frac{1}{28}\right)^{\frac{1}{2}} = \frac{14\sqrt{3}}{3}\times\frac{3\sqrt{3}}{2\sqrt{7}} = \frac{21}{\sqrt{7}}$$
$$= 3\sqrt{7}$$

(5) 式

$$DE^2 = BD^2+EB^2-2\cdot BD\cdot EB\cdot\cos\angle ABC$$

$$\Rightarrow (3\sqrt{7})^2 = 7^2+EB^2-2\times 7\times EB\times\frac{\sqrt{7}}{14}$$

$$\Rightarrow EB^2-\sqrt{7}\cdot EB-14=0$$

$$\Rightarrow (EB+\sqrt{7})(EB-2\sqrt{7})=0$$

$$\Rightarrow EB=-\sqrt{7},2\sqrt{7}$$

(6) 式

$\mathbf{AB \cdot EB = \sqrt{7} \times 2\sqrt{7} = 14}$

$\mathbf{\therefore AE = EB - AB = 2\sqrt{7} - \sqrt{7} = \sqrt{7}}$