

(1) Reflection of $(y = -x) = \begin{bmatrix} 0 & -1 \\ -1 & 0 \end{bmatrix} \leftarrow Rot(z, 180^\circ) \begin{bmatrix} \cos 180^\circ & -\sin 180^\circ \\ \sin 180^\circ & \cos 180^\circ \end{bmatrix} = \begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix}$ 에 $\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$ 적용 (5점)

1. (2) $\begin{cases} \det(\text{rotation matrix}) = 1 \\ \det(\text{reflection matrix}) = -1 \end{cases}$ (5점)

(3) $R^{-1} = \begin{bmatrix} \cos \theta & -\sin \theta \\ \sin \theta & \cos \theta \end{bmatrix}^{-1} = \begin{bmatrix} \cos \theta & \sin \theta \\ -\sin \theta & \cos \theta \end{bmatrix} = R^T = \begin{bmatrix} \cos(-\theta) & -\sin(-\theta) \\ \sin(-\theta) & \cos(-\theta) \end{bmatrix}$ (5점, 전치 또는 반대회전)

$\begin{bmatrix} X \\ Y \\ Z \\ 1 \end{bmatrix} = Rot(y, 45^\circ) Rot(x, 30^\circ) Trans(-1, -1, -1) \begin{bmatrix} 3 \\ 2 \\ 1 \\ 1 \end{bmatrix}$ (정식화 3점)

$= \begin{bmatrix} \cos 45^\circ & 0 & \sin 45^\circ & 0 \\ 0 & 1 & 0 & 0 \\ -\sin 45^\circ & 0 & \cos 45^\circ & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & \cos 30^\circ & -\sin 30^\circ & 0 \\ 0 & \sin 30^\circ & \cos 30^\circ & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 & -1 \\ 0 & 1 & 0 & -1 \\ 0 & 0 & 1 & -1 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 3 \\ 2 \\ 1 \\ 1 \end{bmatrix}$ (변환행렬 3점)

$= \begin{bmatrix} 1/\sqrt{2} & 0 & 1/\sqrt{2} & 0 \\ 0 & 1 & 0 & 0 \\ -1/\sqrt{2} & 0 & 1/\sqrt{2} & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & \sqrt{3}/2 & -1/2 & 0 \\ 0 & 1/2 & \sqrt{3}/2 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 & -1 \\ 0 & 1 & 0 & -1 \\ 0 & 0 & 1 & -1 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 3 \\ 2 \\ 1 \\ 1 \end{bmatrix}$

$= \begin{bmatrix} 1/\sqrt{2} & 1/2\sqrt{2} & \sqrt{3}/2\sqrt{2} & -(3+\sqrt{3})/2\sqrt{2} \\ 0 & \sqrt{3}/2 & -1/2 & (1-\sqrt{3})/2 \\ -1/\sqrt{2} & 1/2\sqrt{2} & \sqrt{3}/2\sqrt{2} & (1-\sqrt{3})/2\sqrt{2} \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 3 \\ 2 \\ 1 \\ 1 \end{bmatrix} = \begin{bmatrix} 1.768 \\ 0.866 \\ -1.061 \\ 1 \end{bmatrix}$ (계산 4점)

3.

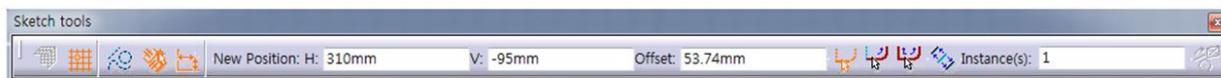
	(1) 제작순서(좌우길이) (5점)	(2) 제작방법 (5점)
(a)	$(25 \pm 0.2) + (85 \pm 0.3) = 110 \pm 0.5$	± 0.5 : 줄로 다듬질해서 손으로 제작
(b)	$(25 \pm 0.2) + (60 \pm 0.3) + (25 \pm 0.2) = 110 \pm 0.7$	± 0.05 : 공작기계를 사용하여 정밀가공

4. (1) parallel/평행 (2) perspective/투시 (3) orthographic/정 (4) oblique/사 (5) isometric/등각 (각 1 점)

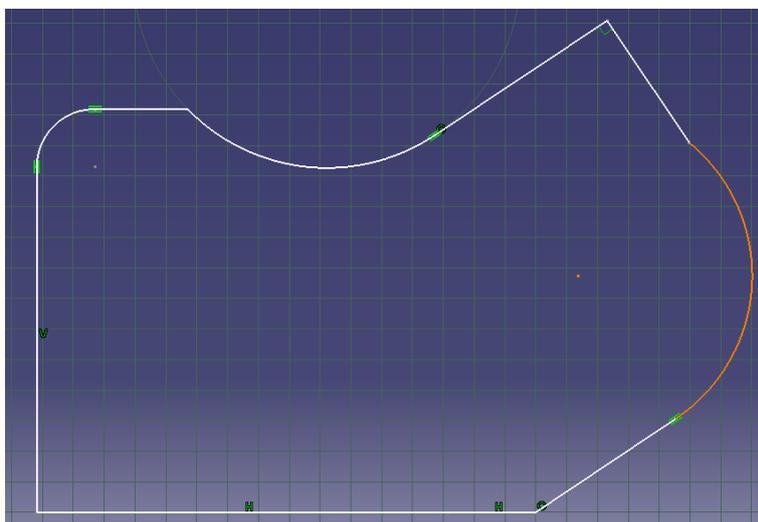
5. (각 항목 당 2 점)

비교 기준	CSG	B-Rep
용어	Constructive Solid Geometry	Boundary Representation
데이터 저장, 관리	간단, 쉬움	복잡한 자료구조
상호변환	B-Rep으로 변환 가능 (시간소요)	CSG로 변환 불가
파라메트릭 모델링 구현	용이	불가
모델링 기능	불리언 연산만 가능	불리언 연산포함 다양
디스플레이 등 반응	시간 소요	빠름 (경계정보 보관)
모델 유효성	항상 유효 (불리언 연산만 사용)	유효하지 않은 모델 가능

6. Sketcher 에서 Offset 기능을 적용 할 때 (a)~(e)의 기능을 설명하고, 아래 스케치에 적용한 결과를 각각 도시하시오. (2 pts each)

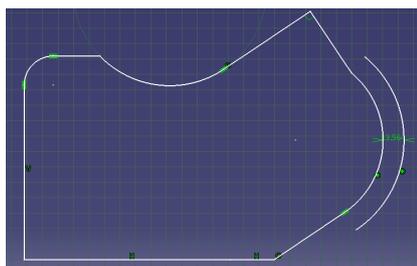


(a) (b) (c) (d) (e)

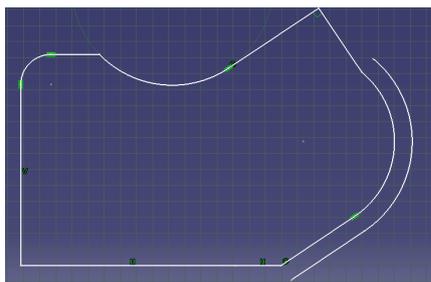


- (a) 선택한 스케치만 offset
- (b) 선택한 스케치에 접하는 부분까지 연장하여 offset
- (c) 선택한 스케치와 연결되는 부분 모두 offset
- (d) 선택한 스케치의 안쪽, 바깥쪽 모두 offset
- (e) 선택한 스케치의 offset 개수 조절

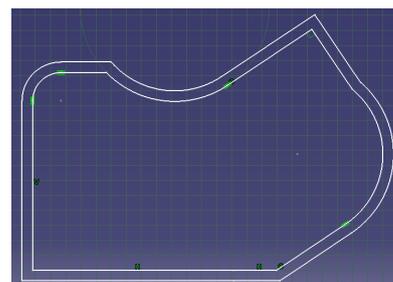
(a)



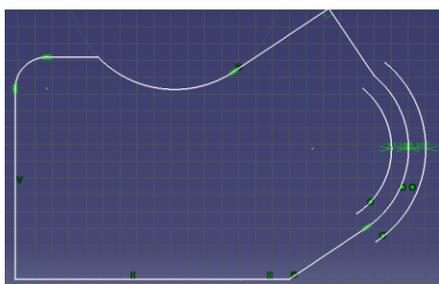
(b)



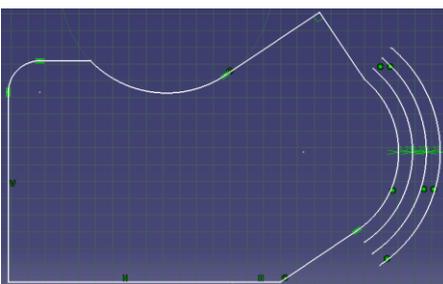
(c)



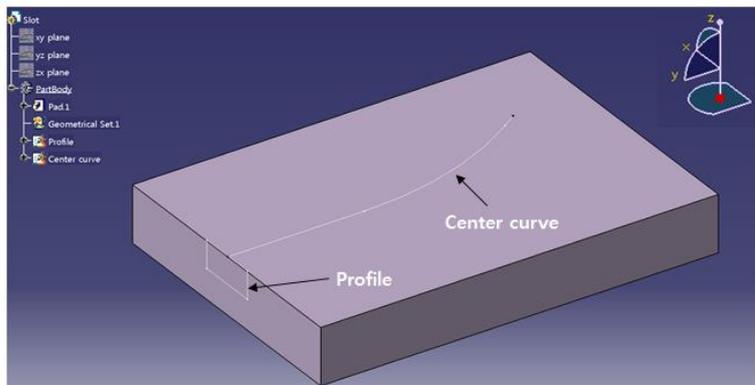
(d)



(e)



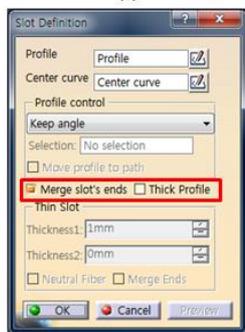
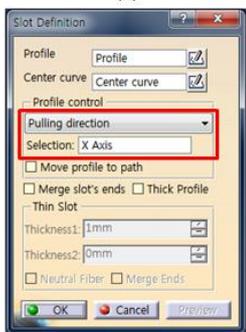
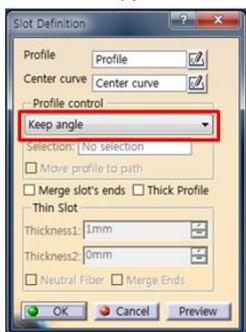
7. Part Design 에서 Slot 기능을 (a)~(c)와 같이 적용하였을 때 예상되는 결과를 각각 도시하고, 차이를 서술하시오. (2 pts each)



(a)

(b)

(c)

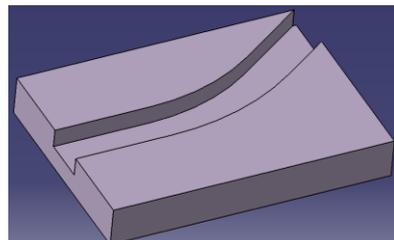
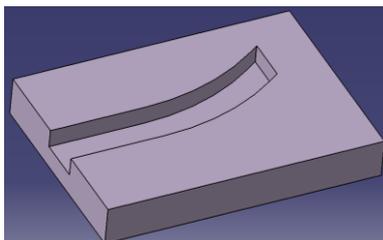
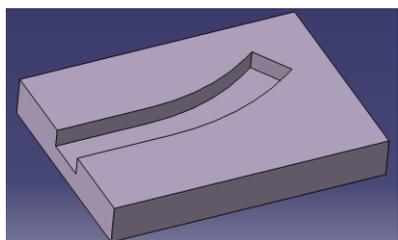


- (a) Profile이 Center curve과의 각도를 유지한채 Center curve를 따라가며 형상 제거
- (b) Profile이 x축과의 각도를 유지한채 Center curve를 따라가며 형상 제거
- (c) Profile이 Center curve를 따라가며 형상의 끝부분까지 연장하여 제거

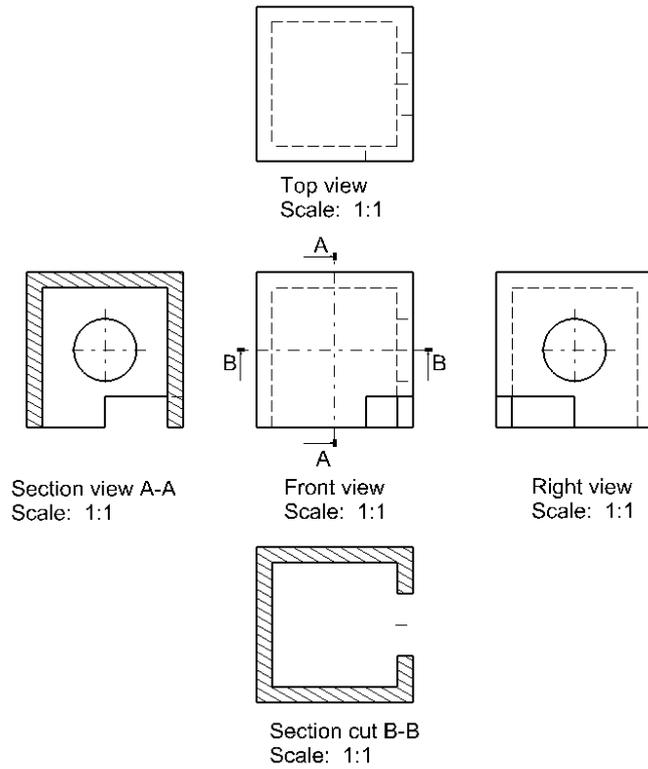
(a)

(b)

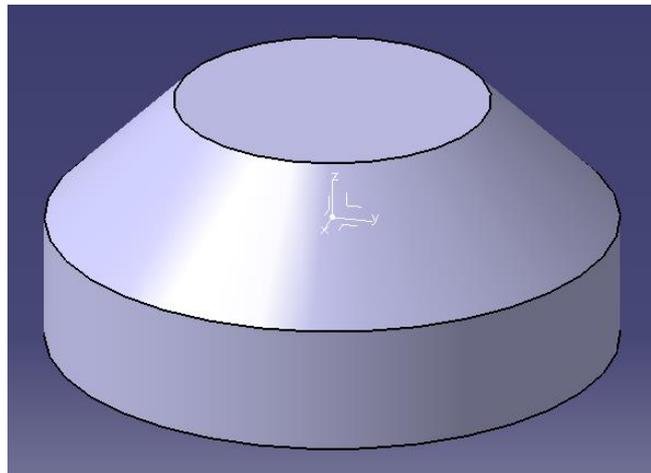
(c)



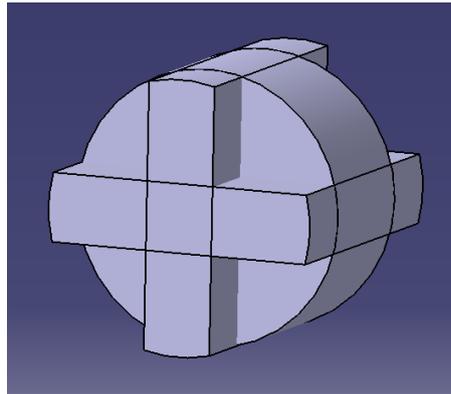
8. 아래의 3D 모델과 도면을 참고하여 (a)~(d)에 해당하는 결과를 도시하시오. (제 3 각법을 적용하고, hidden line, center line, axis 를 모두 표시할 것) (4 pts each)



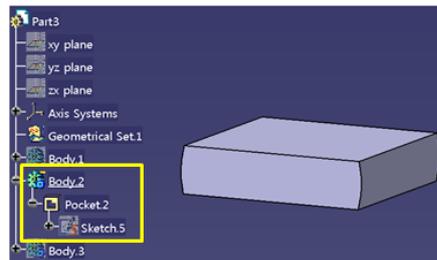
9. Part Design 에서 Draft Angle 기능을 아래와 같이 사용하였을 때 예상되는 결과를 도시하시오. (8 pts)



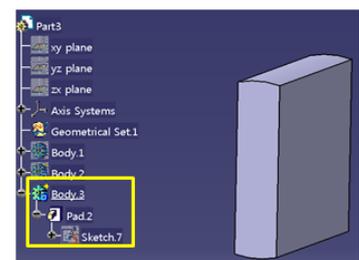
10. Part Design 에서 세 개의 Body 가 다음과 같이 구성되어 있을 때, 각 작업트리에 맞는 결과를 찾으시오. (2 pts each)



Body. 1



Body. 2



Body. 3



(a)



(b)



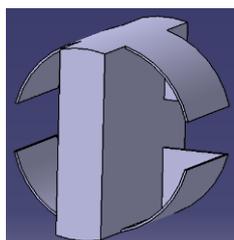
(c)



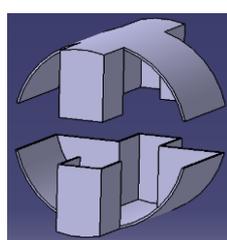
(d)



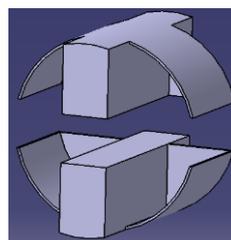
(e)



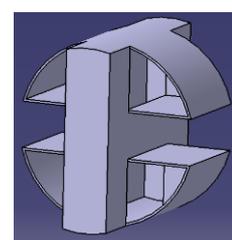
(1) – (d)



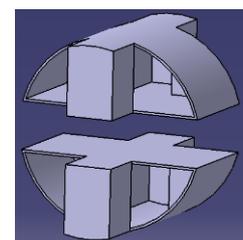
(2) – (c)



(3) – (b)



(4) – (a)



(5) – (e)