

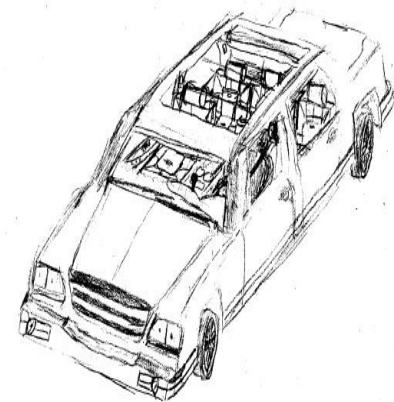
MELAKAR (SKETCHING)

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Good handwriting, good
Sketching technique will
reflects positively on
you and your ideas.



<http://www.pbs.org/wgbh/nova/mars/program.html>

HASIL PEMBELAJARAN

- Konsep lakaran
- Definisi lakaran
- Tujuan dan kegunaan
- Teknik lakaran
- Kategori lakaran



SKETCHING CONCEPT

- Sketching is the **oldest written** method of communication ever known
- Sketching in a pictorial drawing, can be viewed and **understood** by individuals with no background in engineering design
- One of **the technique to draw** an objek in fast track to show an idea or copy the existence objek
- Image/ graphic much **easy to understand, explain and memories** rather than word.



DEFINASI MELAKAR (SKETCHING)

- Lukisan menggunakan tangan bebas (*rough freehand drawing*)
- Untuk menzahirkan idea dalam bentuk grafik
- Dijadikan dokumentasi awal, maklumat pembuatan, berkomunikasi dan perbincangan.
- Sesuai dalam percambahan idea (*ideation phase*) dan proses reka bentuk
- Dalam bentuk lukisan bergambar 3D atau pelbagai gambar 2D.
- z1Perlu mematuhi amalan piawaian lukisan kejuruteraan



TECHNICAL SKETCHING PURPOSES

- Convey an ideation
- problem solving in fast track
- pictorial view
communication
- multiview specification

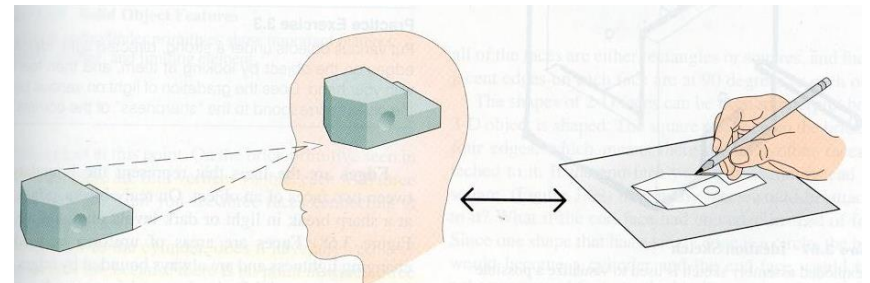
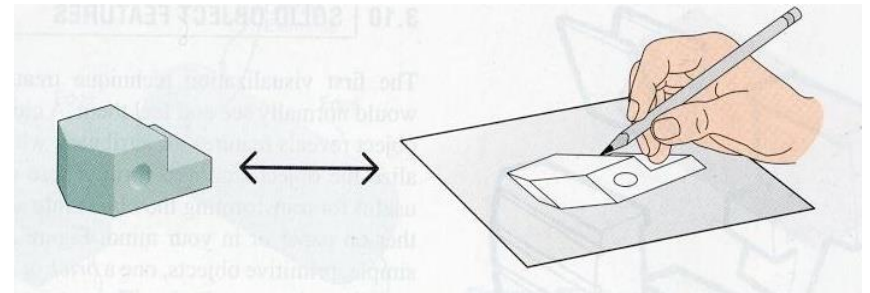


MENGAPA PERLU MELAKAR ?

1. Sebahagian dari proses reka bentuk – ‘ideation’
2. Menjana konsep2 pelesaikan masalah lebih pantas
3. Menyampaikan maklumat mengenai imej-imej mental secara perspektif,
4. Mempermudahkan konsep2 reka bentuk
5. Memperhalusi lukisan dengan lebih cepat

WHY SKETCHING ?

- Persediaan Dokumentasi
- Komunikasi
- Kreativiti



TUJUAN LAKARAN BEBAS

1. Dapat memberikan penerangan konsep dan idea BUKAN menunjukkan perincian.
2. Untuk tujuan berkomunikasi tentang konsep reka antara jabatan dengan cepat
3. Perlu dilukis dengan pantas dan jelas.



LATIHAN 1

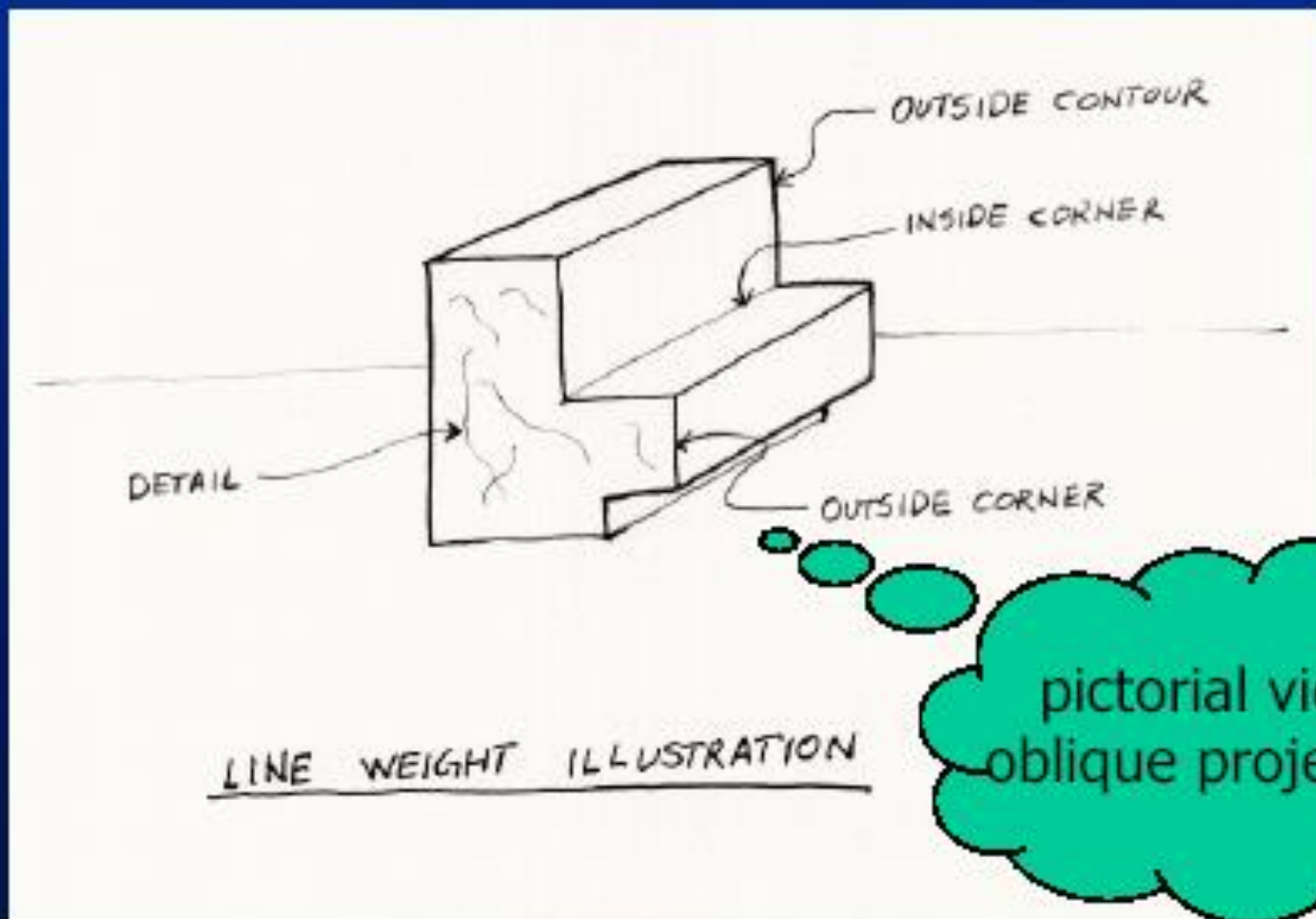
- Lakarkan dua kotak secara rupa
- Kotak ini mempunyai ukuran yang sama
- Tetapi satu menunjukkan ianya jauh dan satu lagi dekat
- Dalam rajah yang sama, bagaimana anda menunjukkan kotak itu mempunyai satu permukaan yang melengkung.
- Bagaimana anda menentukan saiz kotak itu tanpa memberi dimensi?



Some examples ...

Sketches (free-hand drawings)

Used to develop and communicate ideas



Parallel
projection

Perspective
projection

We will study
'orthographic' projection
systems in detail

SKETCHING

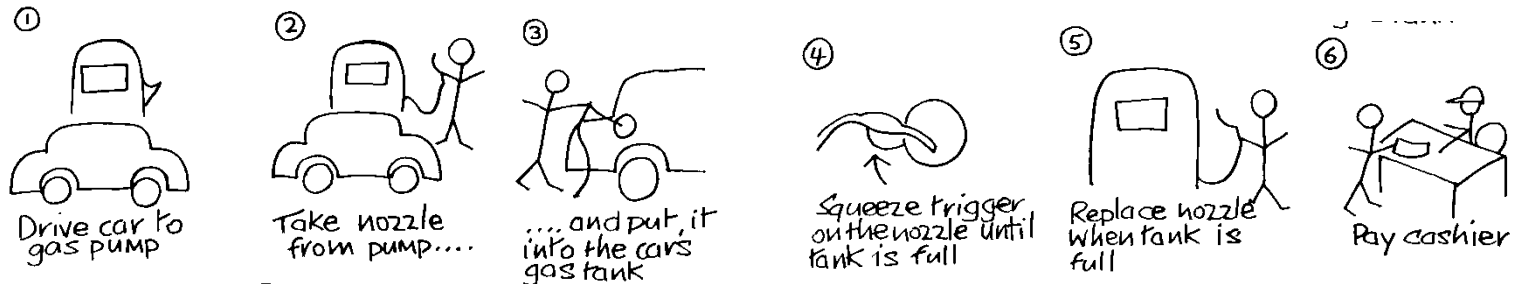
- Core skill for most low-fidelity prototyping
- *Not about drawing ability!* Simple symbols
- Cruder sketch will emphasize conceptual design over superficial, physical design



PICTURE CAN TELL US MANY THING

- Storyboards scenarios, bringing detail and a chance to role play

- Series of scene sketches showing user progression through a *task flow*

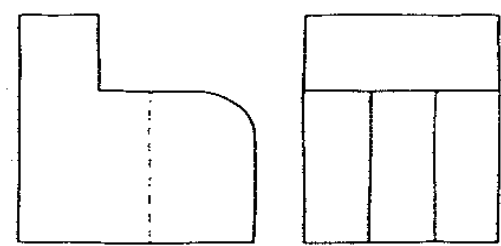
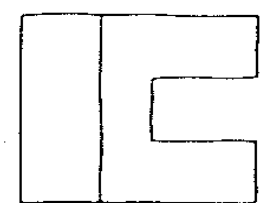
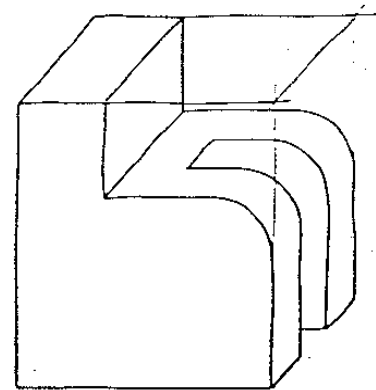
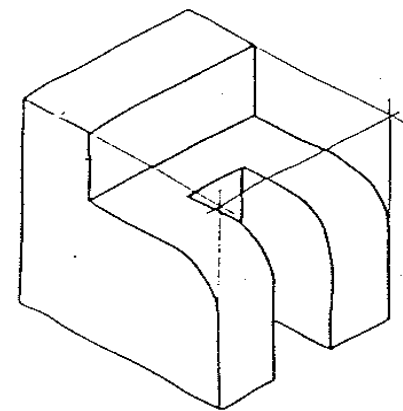
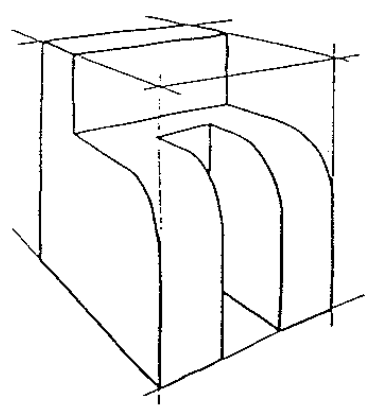


- Series of screenshots illustrating *use case*

Checkout: Product List, Shipping, Payment, Confirmation



EXAMPLE OF SKETCHING PROJECTIONS



Latihan 2

1. Anda menyaksikan satu kejadian kemalangan
2. Satu daripada kereta itu tersangkut di atas pokok.
3. Lakarkan kereta dan pokok itu dalam bentuk 3D?



SKETCHING TECHNIQUES

- line types
- line precedence's
- straight lines
- circles
- ellipses
- blocking
- grid paper
- shape primitives



SKILL NEEDED

- Stroke –line and round
- Pencil type – hard and soft
- Technique – measure, size and *Proportions*
- Shading – light
- Angle projection



LANKAH LAKARAN BEBAS

Secara amnya ada 3 langkah asas;

1. Lakaran dirancang dgn visualisasi

- Orientasi lakaran
- Saiz lakaran
- Perincian yg diperlukan

2. 'Outline' lakaran dibuat menggunakan garisan2 halus (light lines)

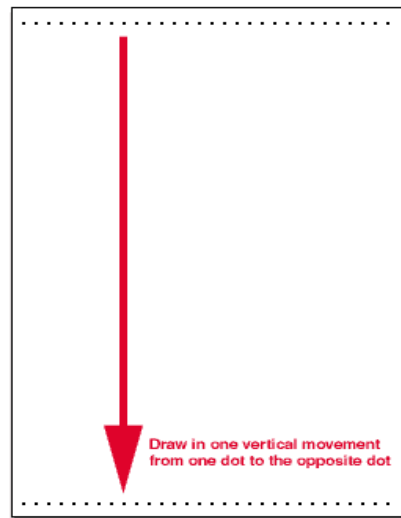
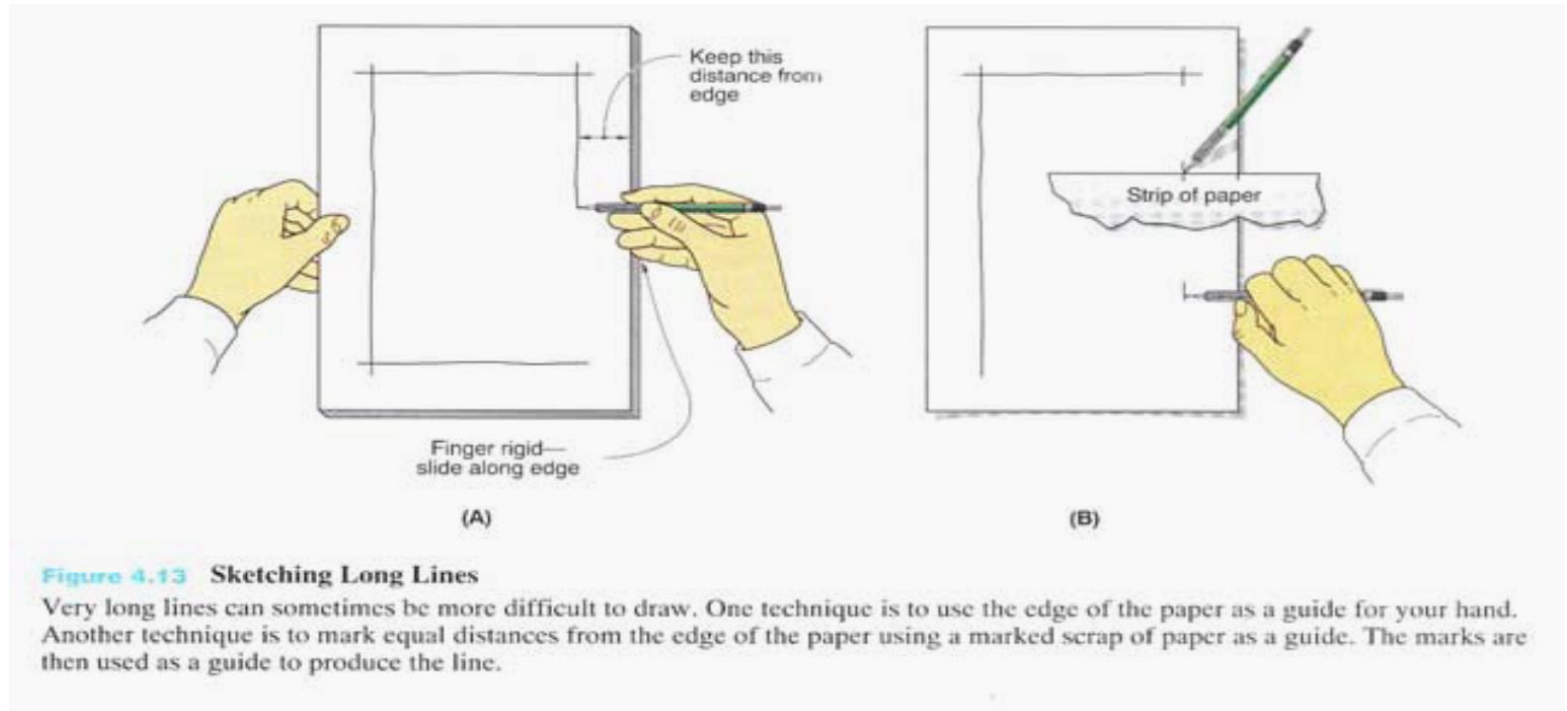
- Tentukan orientasi, saiz, proportion, ciri2 umum.

3. Garisan2 ditajamkan serta dihitamkan.

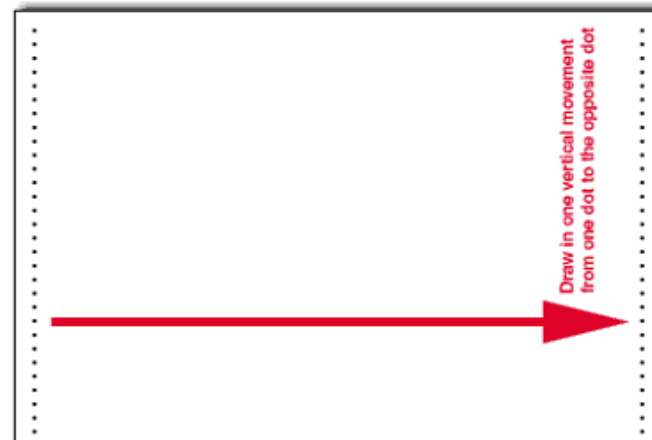
- Bina perincian lakaran berkenaan.



SKILL : STROKE TO DRAW A STARLIGHT LINE V AND H



Vertical
line

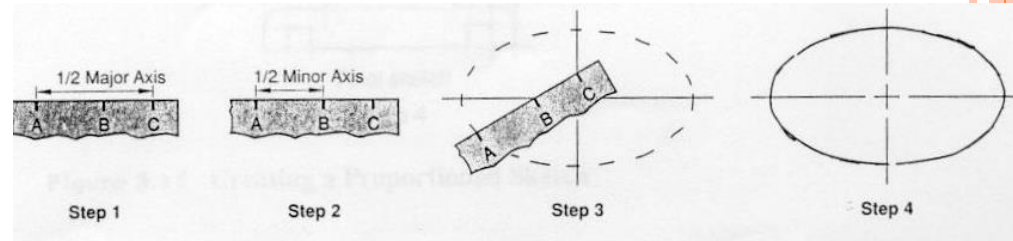
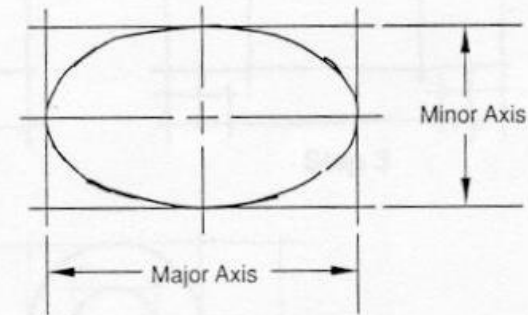
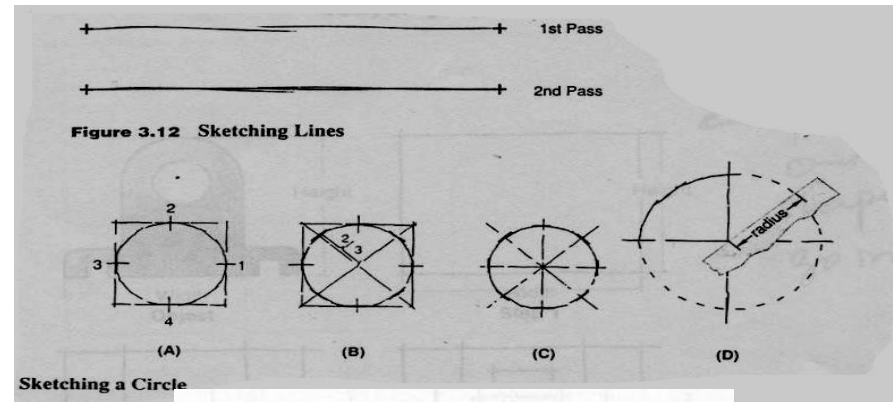


Horizontal
line



TEKNIK MELAKAR BULATAN DAN ELIP

Garis lurus	Garisan-garisan lakaran selalunya dilukis dgn satu urutan terdiri dari dua atau tiga laluan (passes) dgn pensil.
Garisan lengkok	Menggunakan titik-titik panduan (multiple guide points).
Elips	Boleh menggunakan satu cebisan dgn kaedah 'trammel method'.

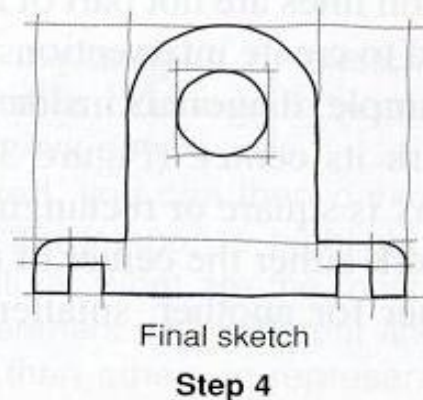
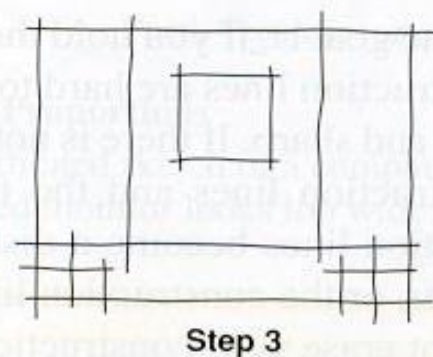
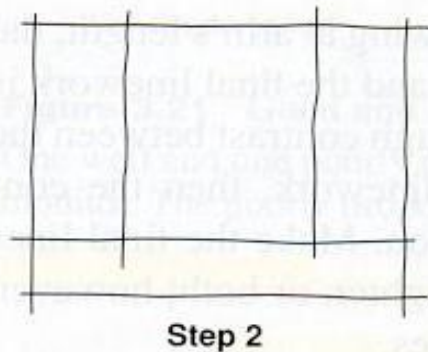
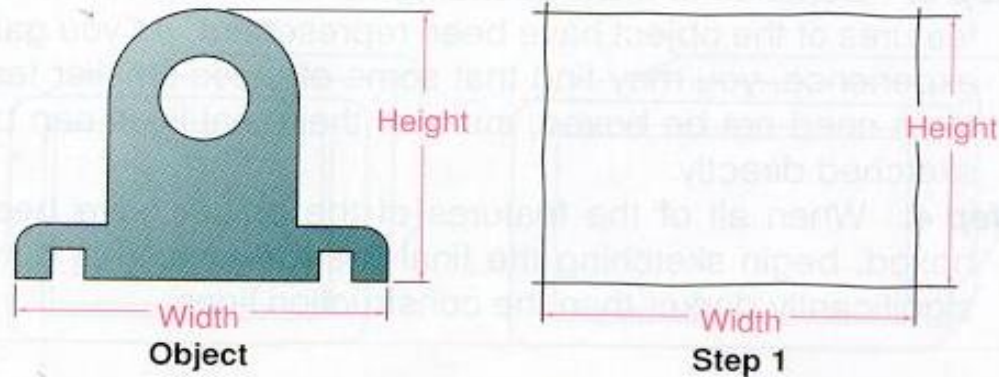


KESEPADAN DAN PEMBINAAN. (PROPORTIONS AND CONSTRUCTION LINES)

Kesesuaian

dimensi-dimensi
asas sesuatu
object adalah lebih
penting dari saiz
fizikal sebenarnya.

Kesesuaian adalah
nisbah antara dua
dimensi sesuatu
objek.



Bagaimana anda menentukan
saiz tanpa menunjukkan
dimensi?

Sketching

Engineering drawing

Pictorial

Perspective
(converging lines of sight)

One-point
(parallel)

Two-point
(angular)

Three-point
(oblique)

Orthographic projection
(parallel lines of sight)

Orthogonal

3rd-angle

1st-angle

Axonometric

Isometric

Dimetric

Trimetric

Oblique

Cavalier

Cabinet

General

Diagrams, charts, graphical computations

Wiring & circuit diagrams

Flow & organisation charts

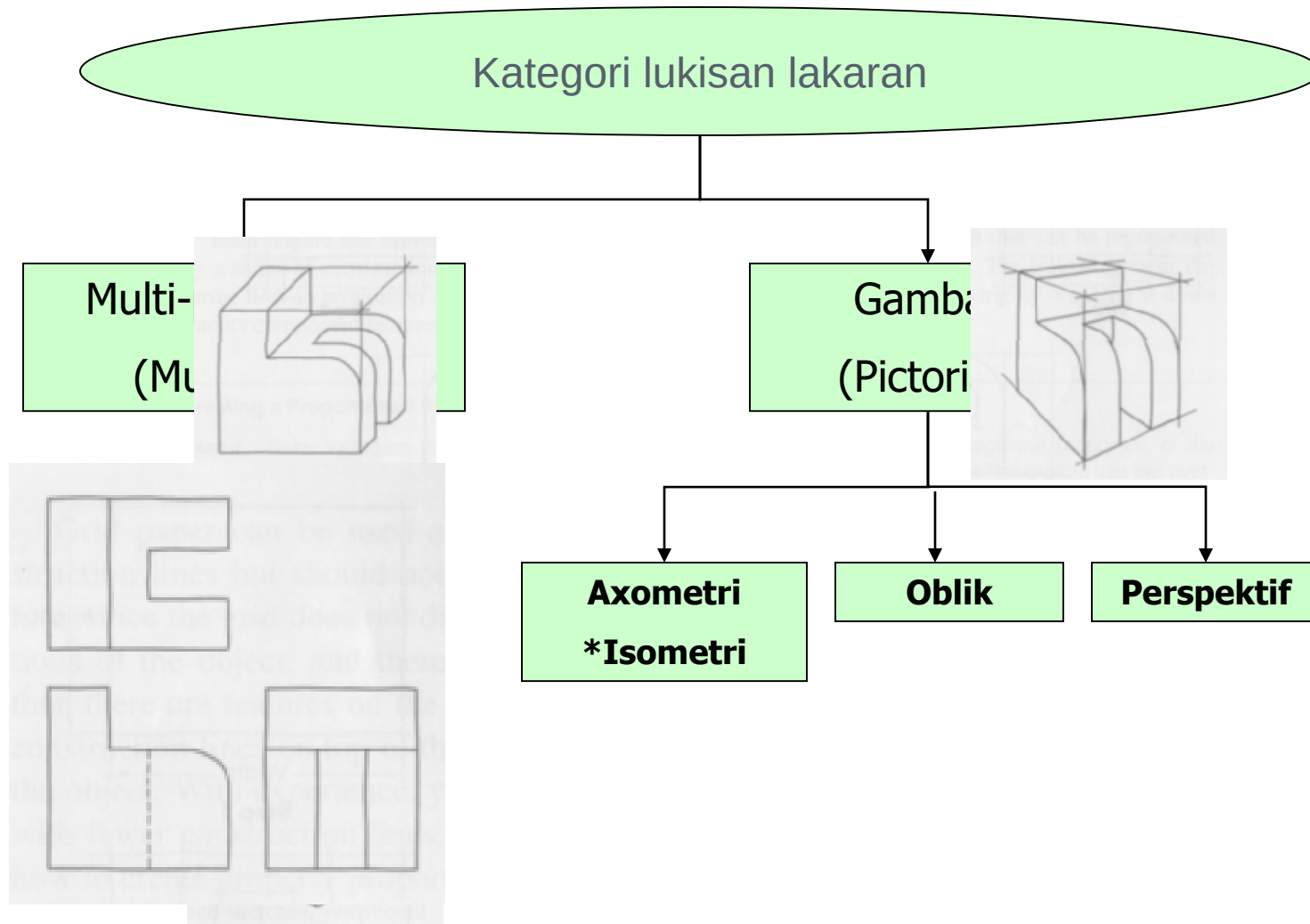
Graphs

Graphical mathematics

Vector analysis

Nomographs

**Classification
of engineering
drawings (EDH)**



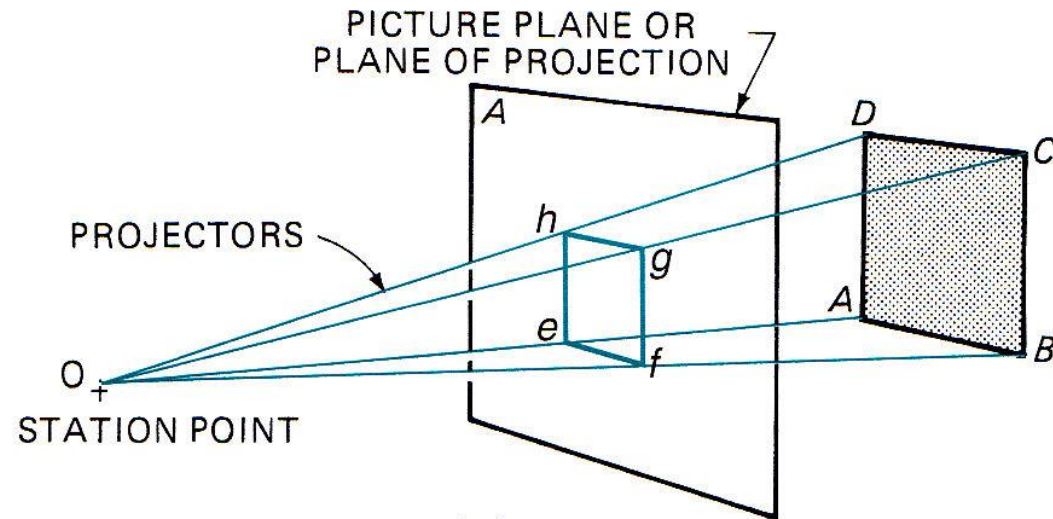
Pictorial drawings show the shape of an object viewed by the human eye. 

Pictorial sketches are sketches that show height, width, and depth all in one view

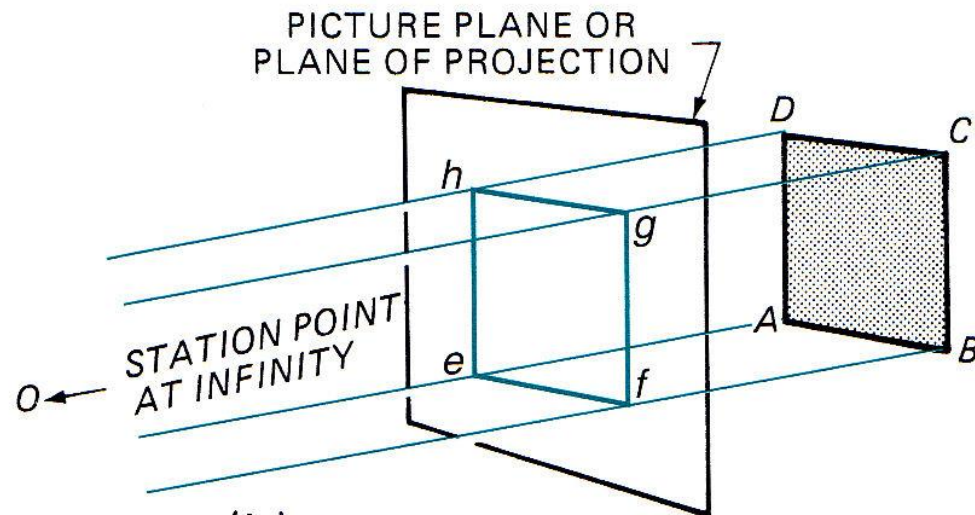
Sistem Unjuran (*Projection Systems*)

Setiap lukisan sesuatu objek melibatkan pertalian ruang antara;

1. Mata pemerhati, atau titik *station*.
2. Objek.
3. Satah unjuran.
4. Projektor (visual rays or line of sight)

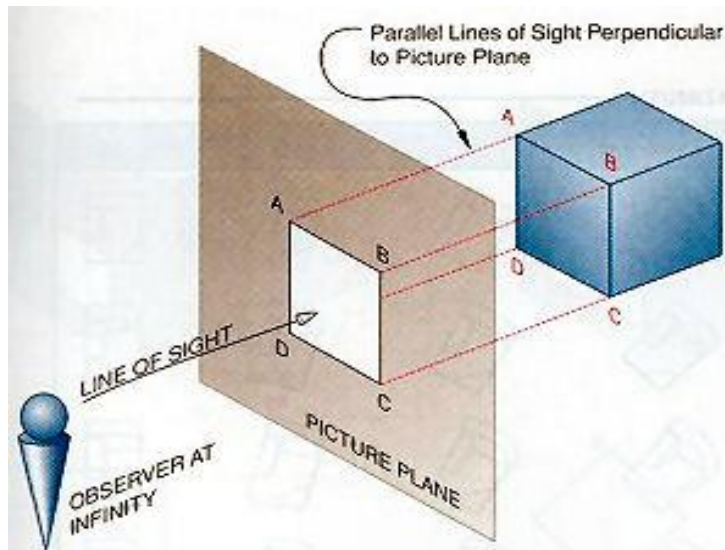


(a) PERSPECTIVE

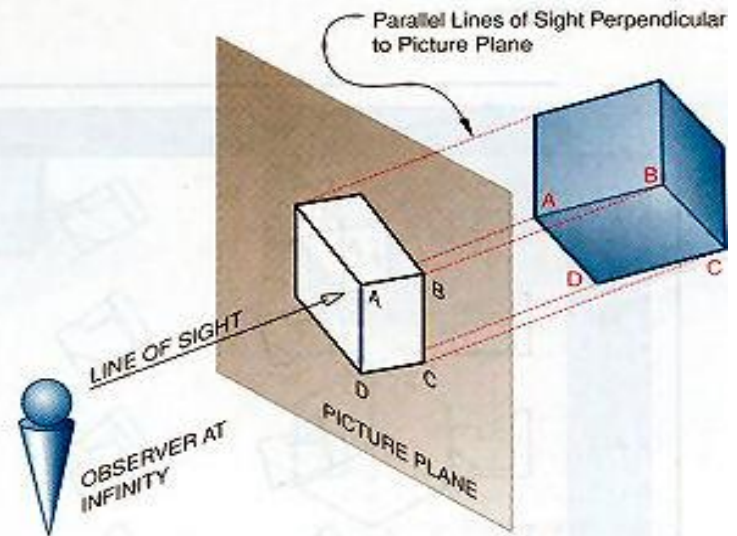


(b) PARALLEL PROJECTION

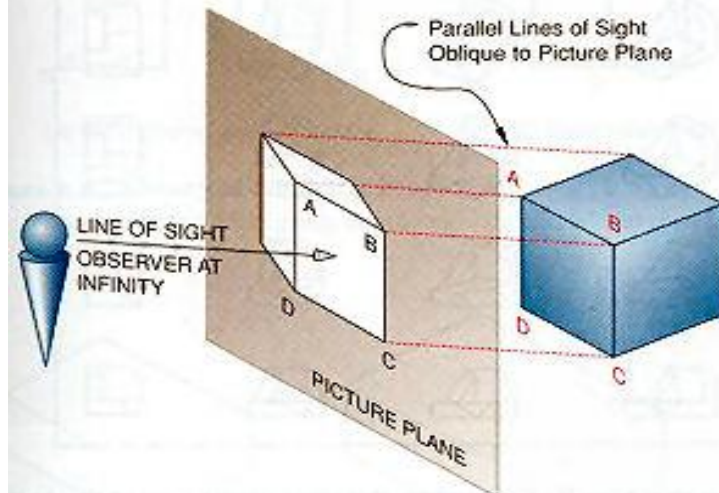
PERBANDINGAN ANTARA LUKISAN-LUKISAN ISOMETRI, OBLIK, AND PERSPEKTIF



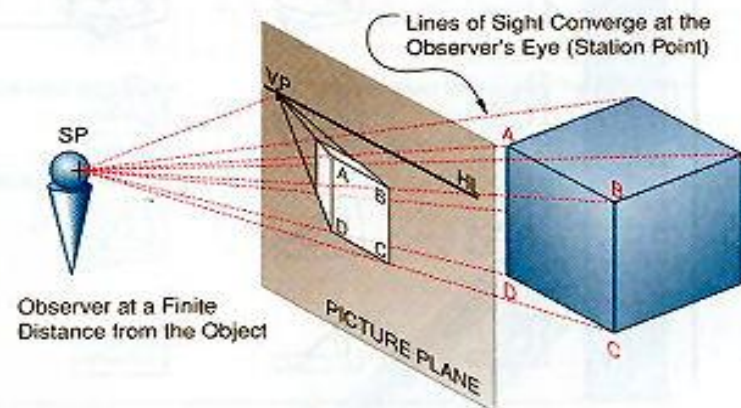
1. Multiview Projection



2. Axonometric Projection

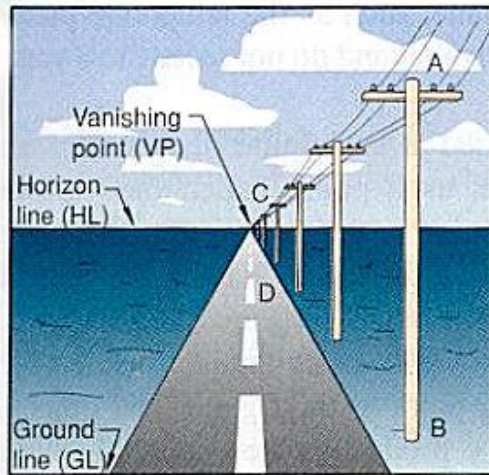


3. Oblique Projection

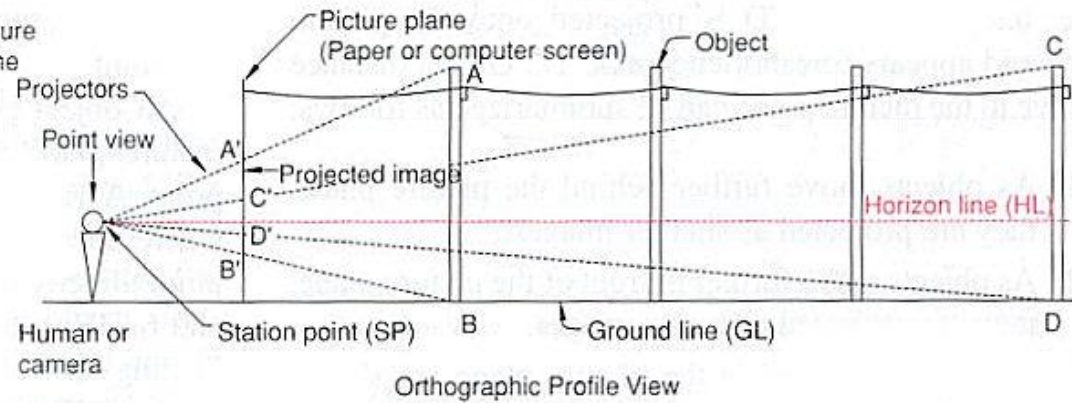


4. Perspective Projection

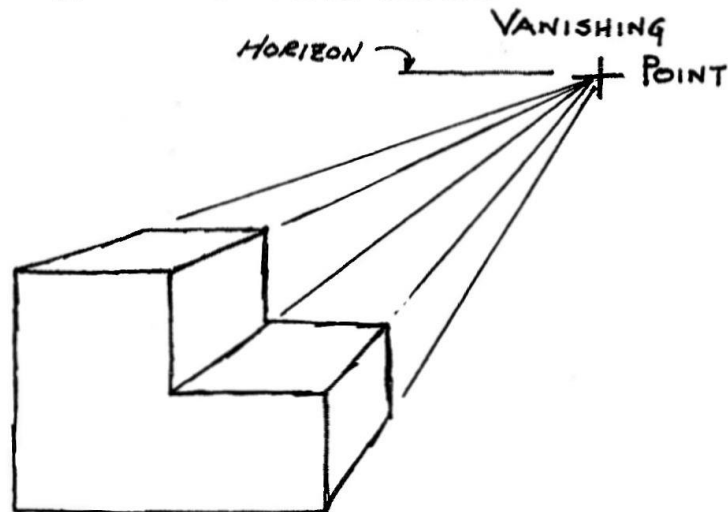
PERSPECTIVE SKETCHES – EYE VIEW



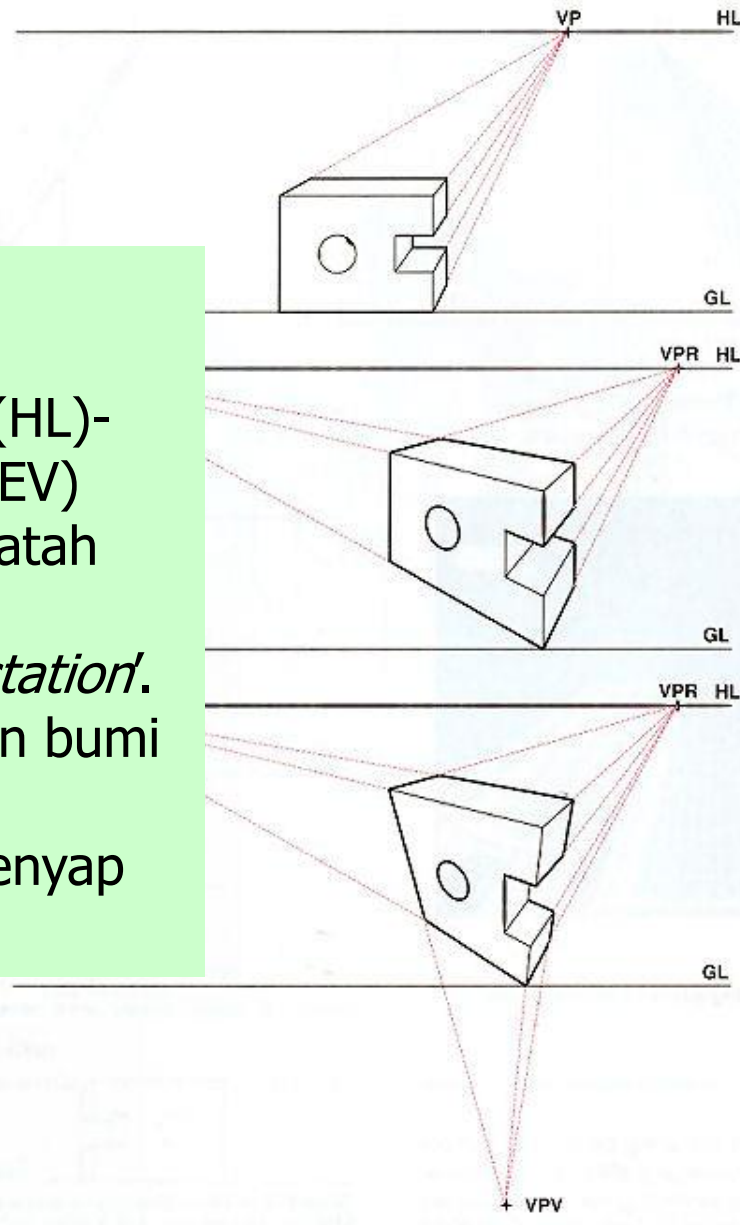
Perspective View



1 POINT PERSPECTIVE

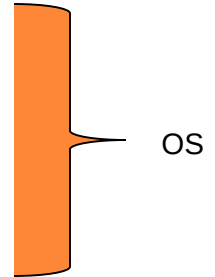


Lukisan pers



Lukisan perspektif:

1. Garisan menegak (HL)- pandangan mata (EV)
2. Jarak objek dari satah gambar. (OS)
3. Kedudukan titik '*station*'.
4. Kedudukan garisan bumi (*ground line*)
5. Jumlah titik-titik lenyap (*vanishing point*)



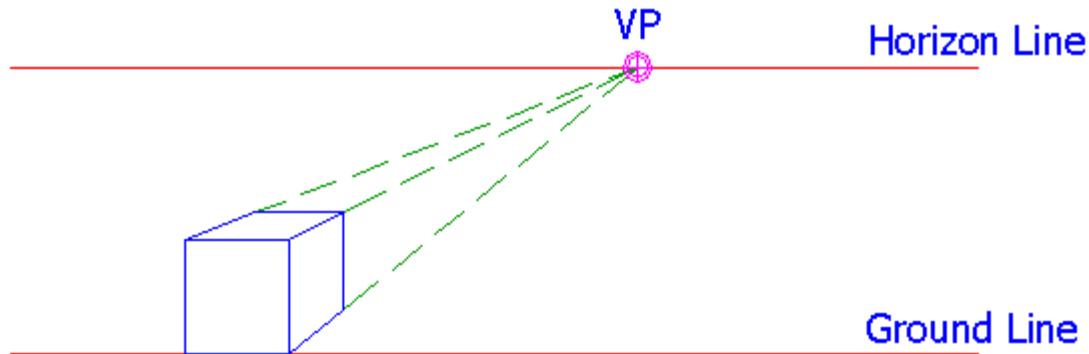
PERSPECTIVE PROJECTION CHARACTERISTICS

- Center of Projection (CP) is a finite distance from object
- Projectors are rays (i.e., non-parallel)
- *Vanishing points*
- Objects appear smaller as distance from CP (eye of observer) increases
- Difficult to determine exact size and shape of object
- Most realistic, difficult to execute



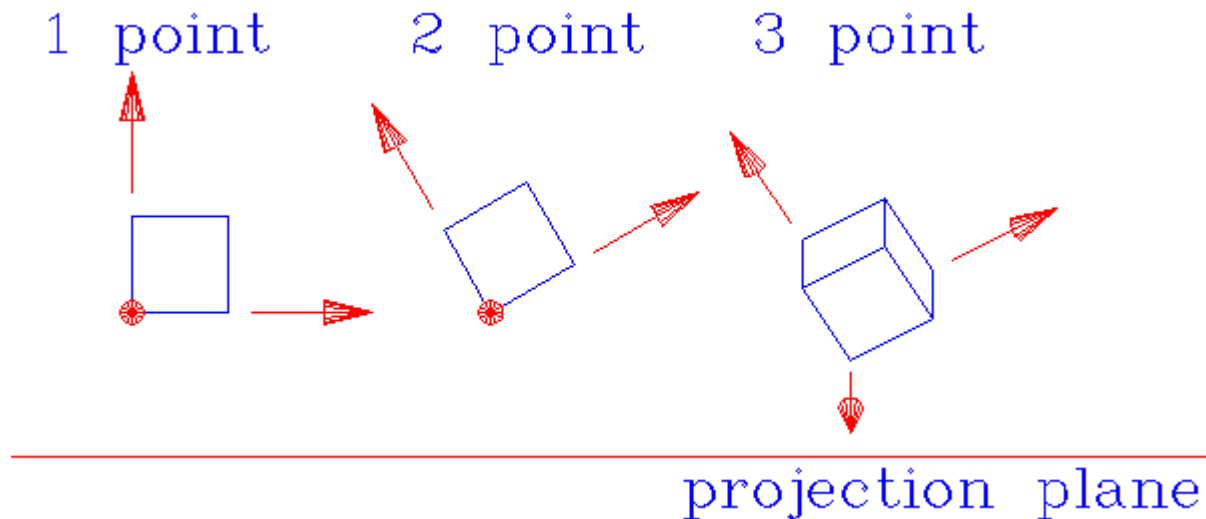
PERSPECTIVE SKETCH

- Horizon – observer's eye level
- Ground Line – plane on which object rests
- Vanishing point – position on horizon where depth projectors converge
- Projection plane – plane upon which object is projected



CLASSES OF PERSPECTIVE PROJECTION

- One-Point Perspective
- Two-Point Perspective
- Three-Point Perspective

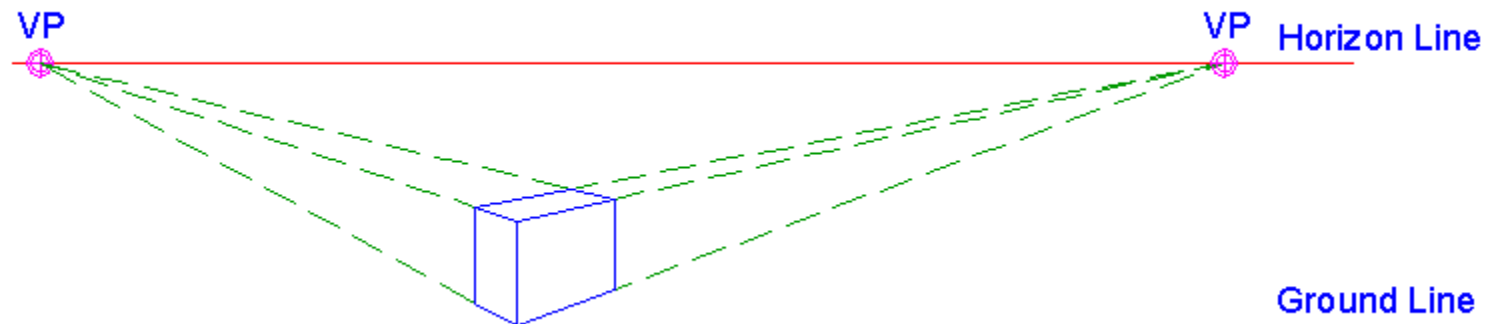


View from Above



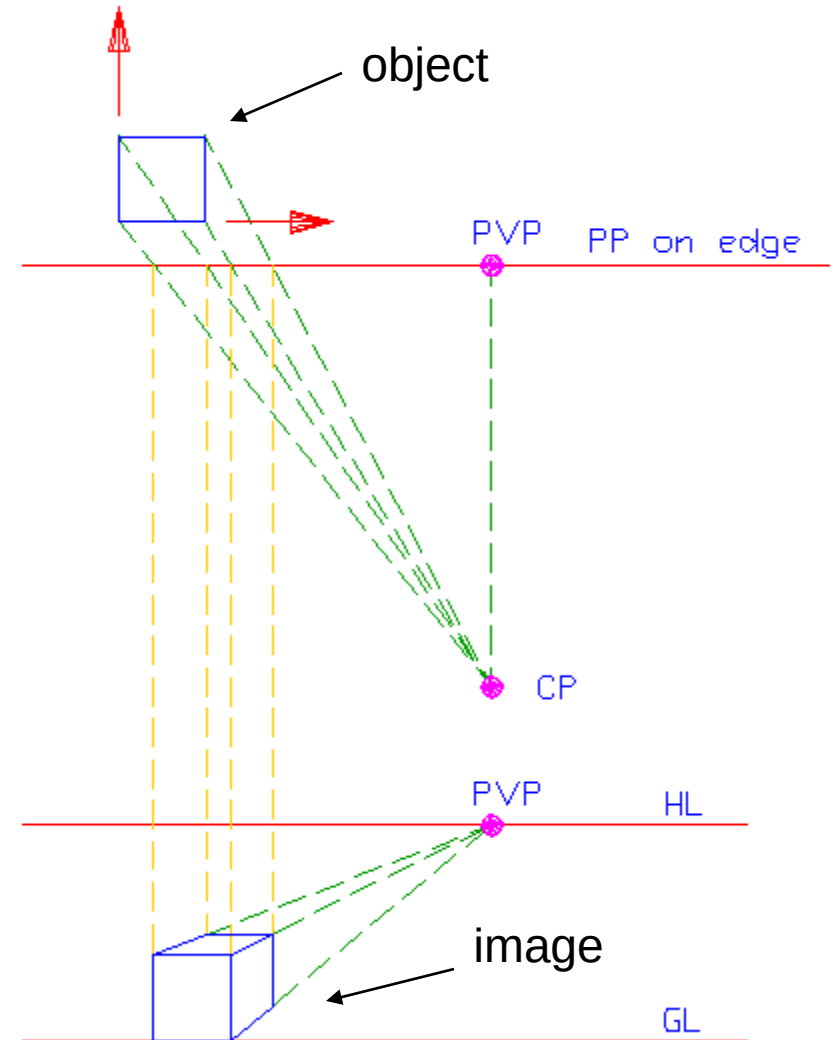
VANISHING POINTS

- Object edges parallel to projection plane remain parallel in a perspective projection
- Object edges not parallel to projection plane converge to a single point in a perspective projection → *vanishing point (vp)*
- Vanishing point of a principal axis → *principal vanishing point (pvp)*



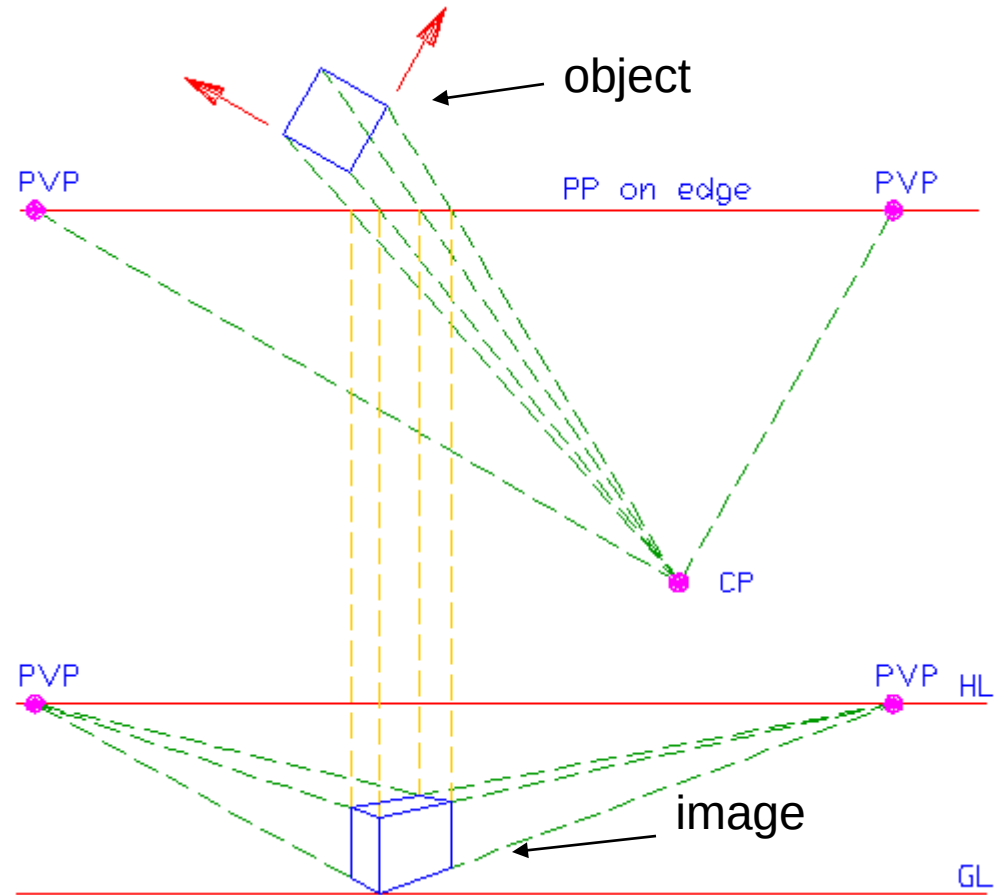
ONE-POINT PERSPECTIVE

- One principal axis cuts projection plane → one principal vanishing point
 - Projection plane parallel to one principal plane



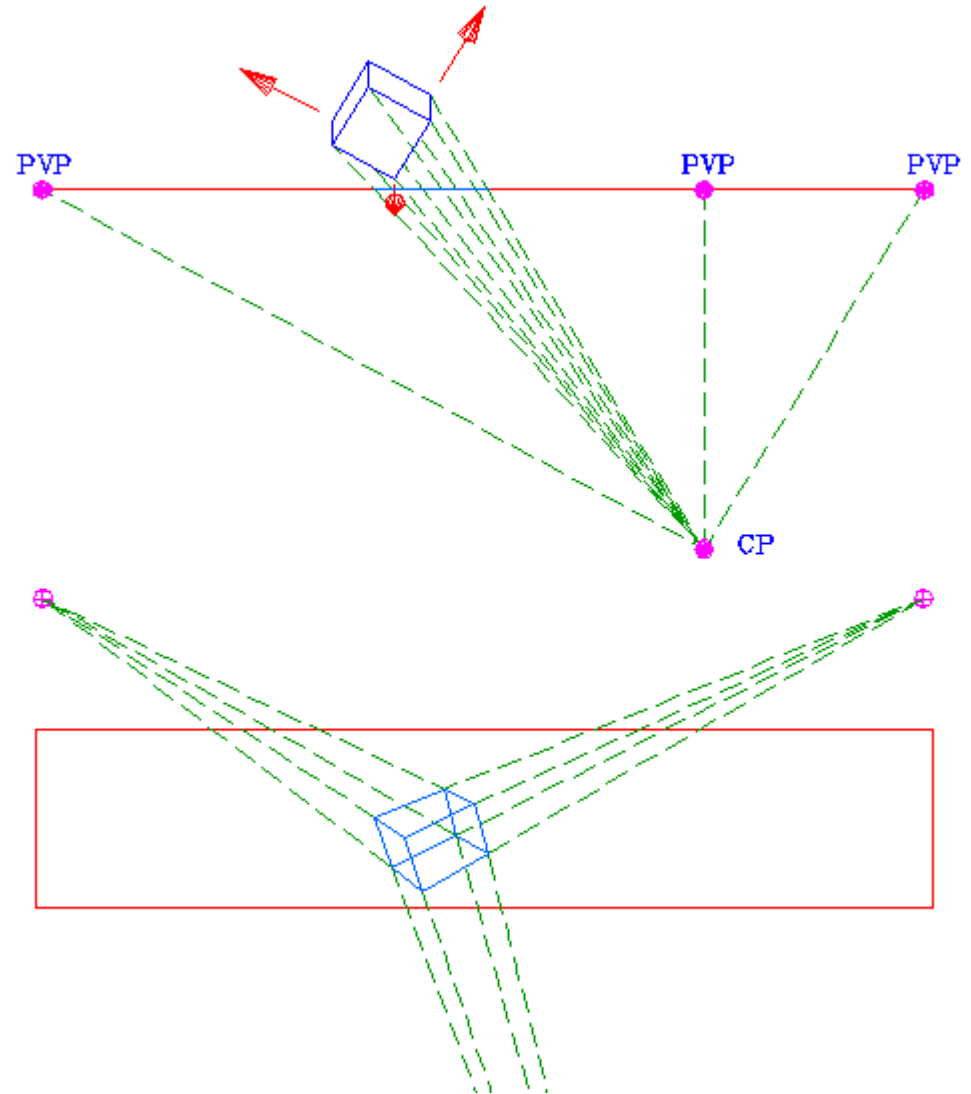
TWO-POINT PERSPECTIVE

- Two principal axes cut projection plane → two principal vanishing points
 - Projection plane parallel to one principal axis



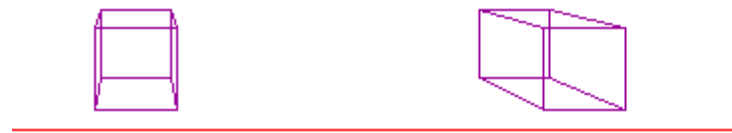
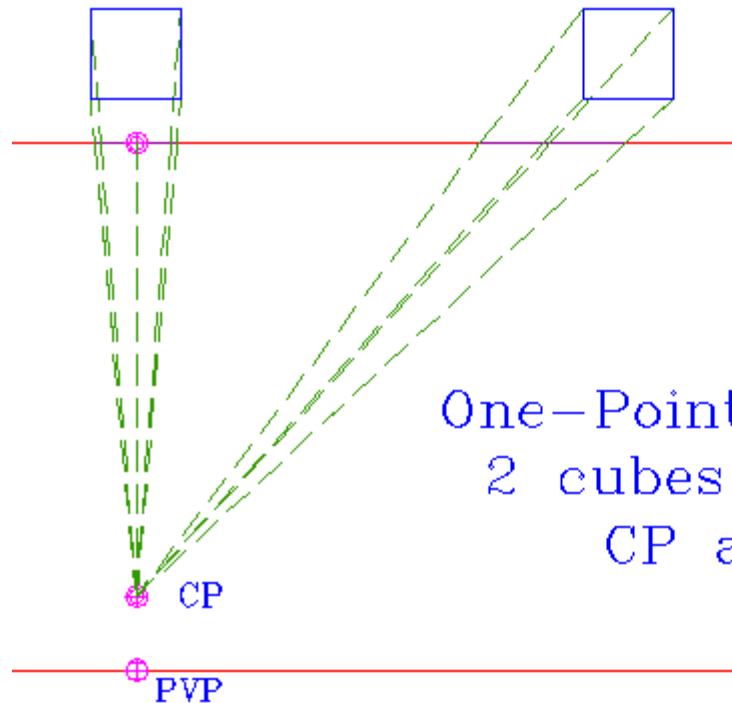
THREE-POINT PERSPECTIVE

- Three principal axes cut projection plane → three principal vanishing points



LATERAL MOVEMENT OF CP

View from Above

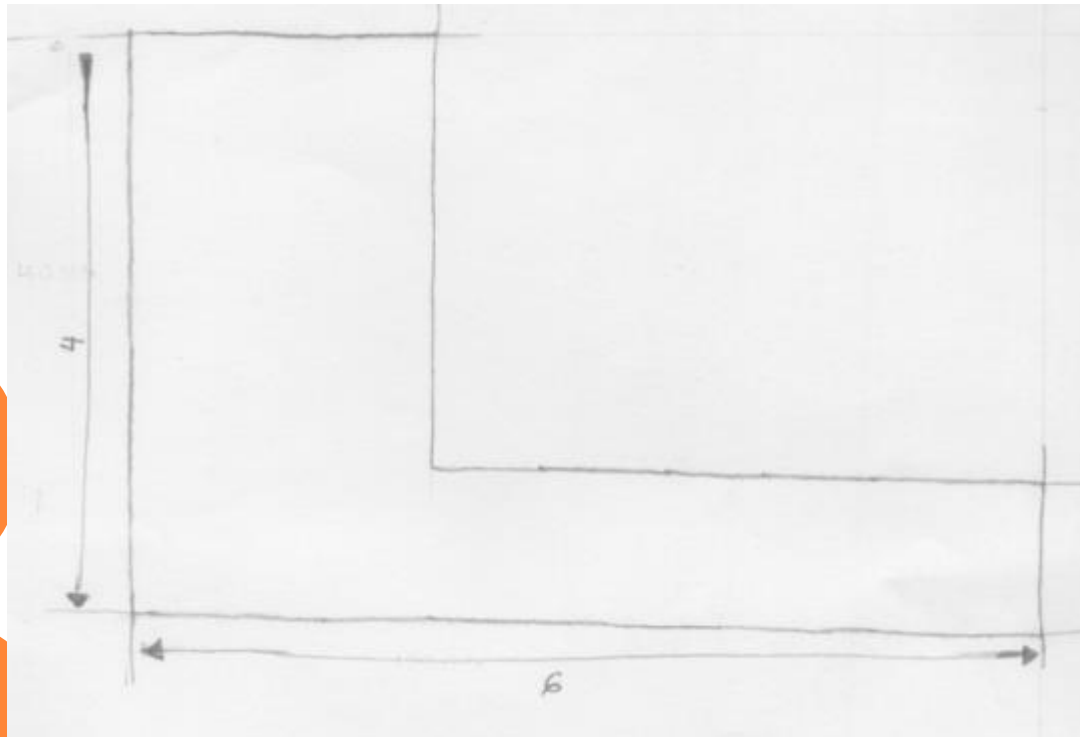


Projected Images



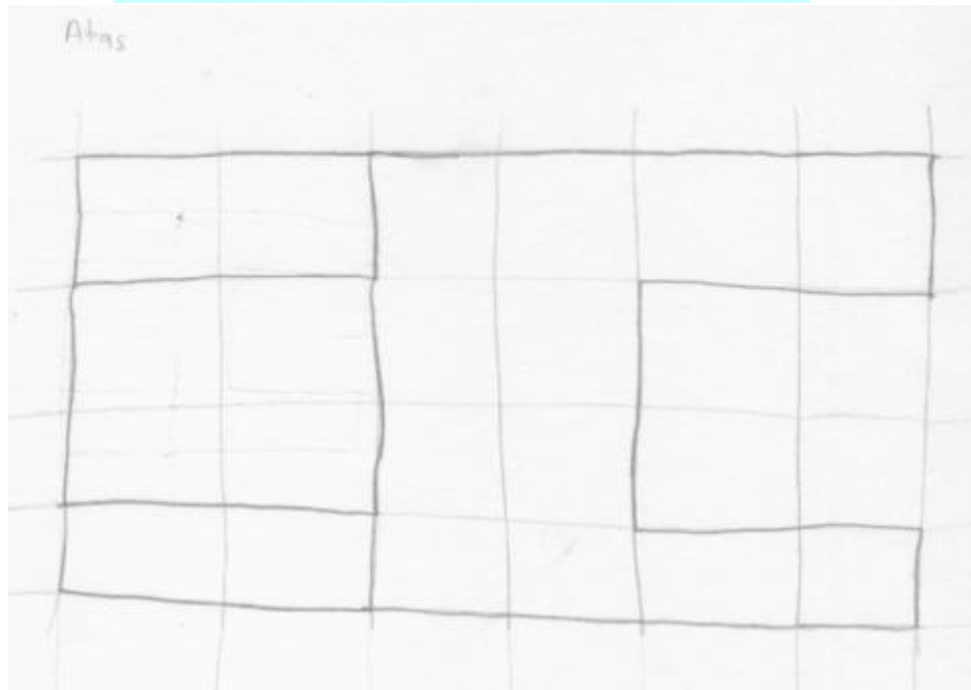
POST MORTEM

Bolehkah kamu tentukan kelemahan lakaran ini?

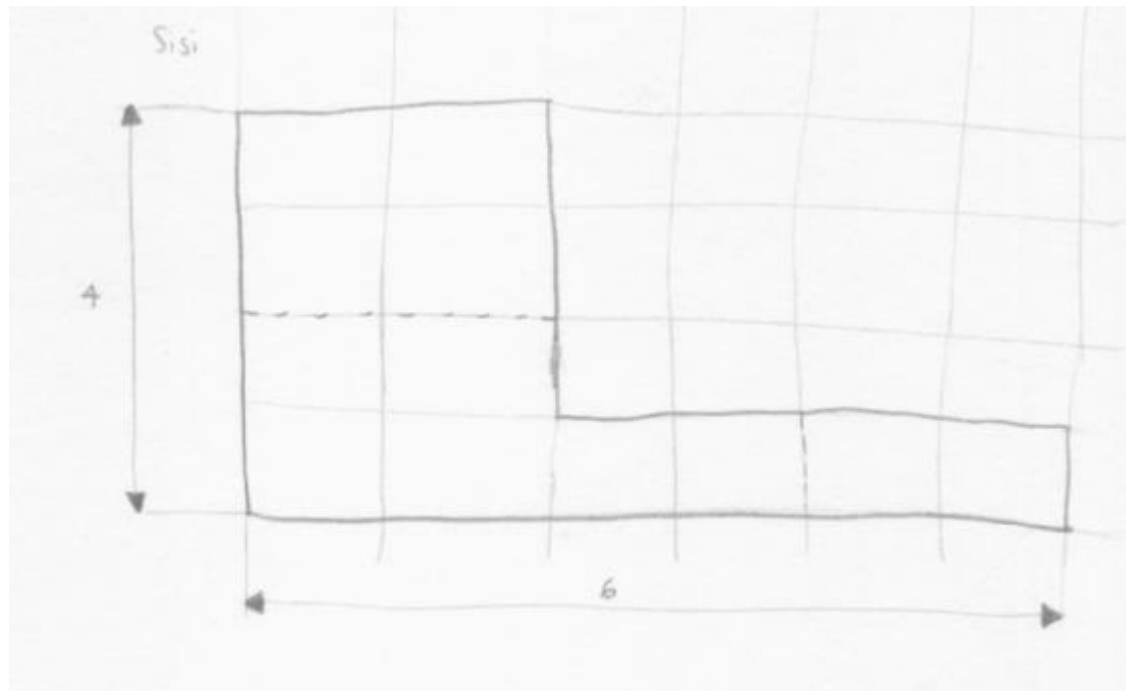


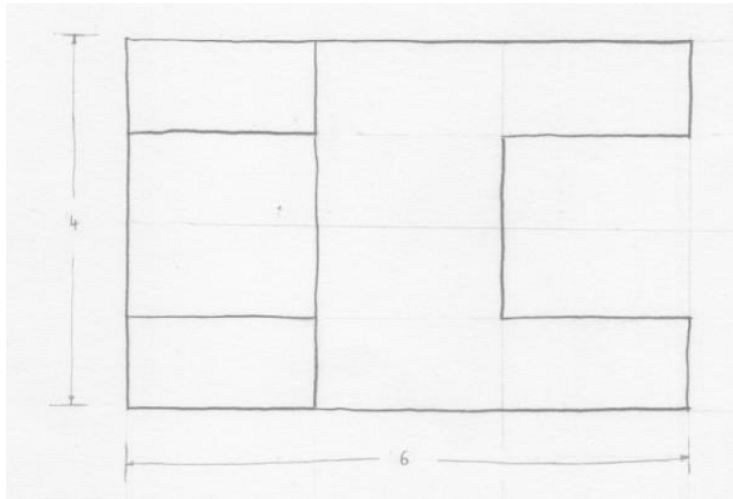
- Kedudukan teks dimensi yg tidak betul
- Garisan dimensi sengit
- Anak panah ada yg hilang!

- Garisan nyata sengit
- Garisan tengah/simetri tiada



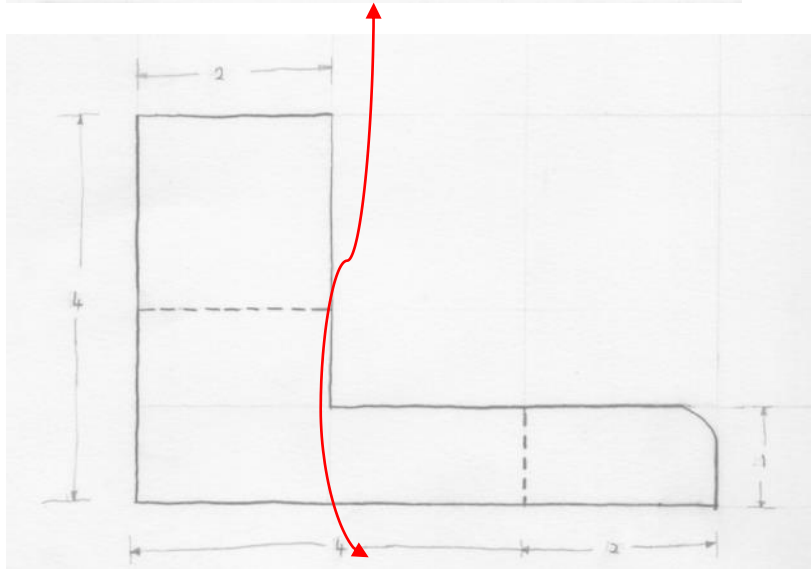
- Kedudukan teks dimensi yg tidak betul
- Garisan dimensi sengit
- Garisan terlindung tidak kemas



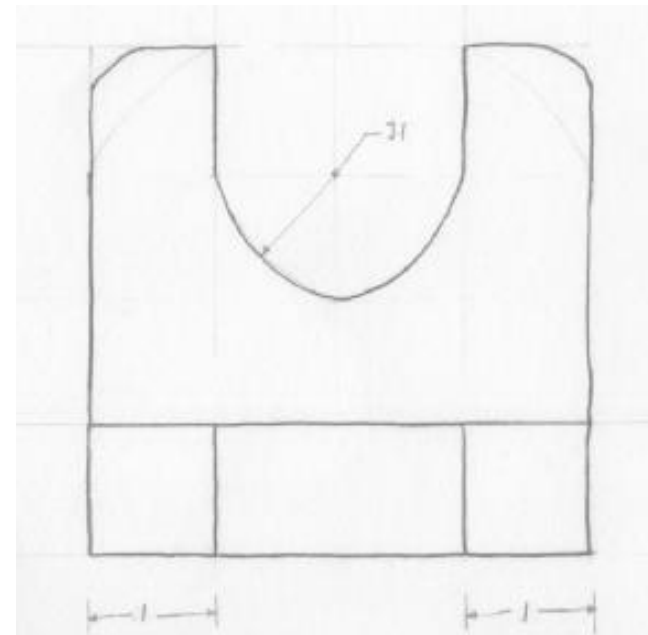


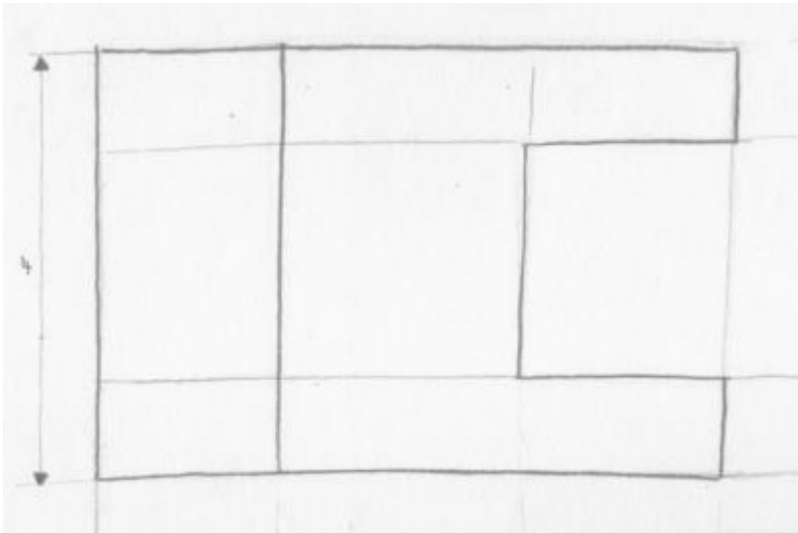
Terdapat beberapa kelemahan dlm lakaran:

- Dimensi perlu lengkap
- Dimensi perlu berada pada kedudukan yg sesuai
- Elakkan dimensi yg berulang (*redundant*)

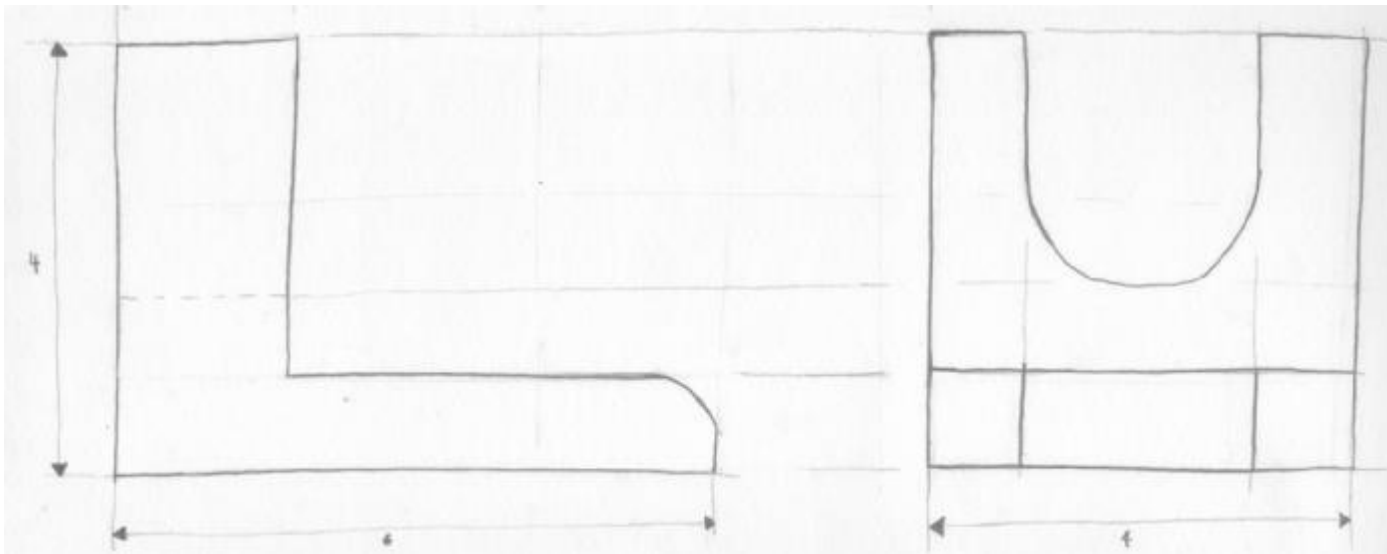


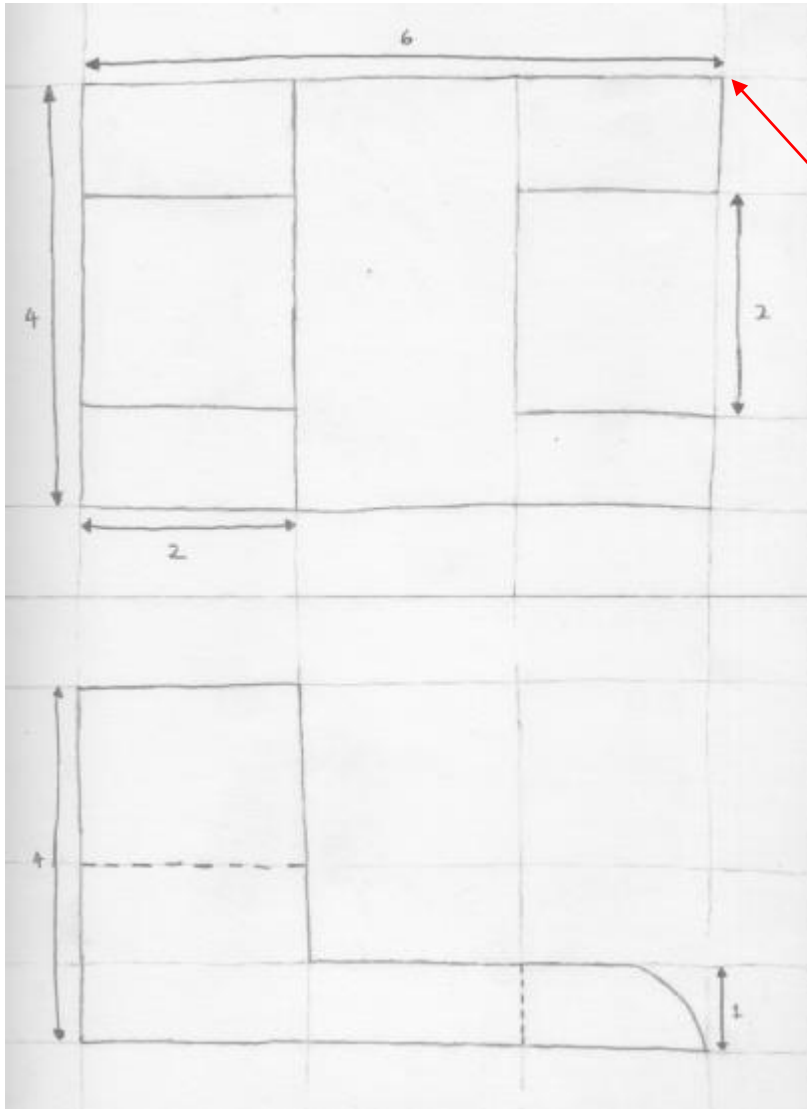
NOTE:
ALL FILLET RADIUS
IS 1MM



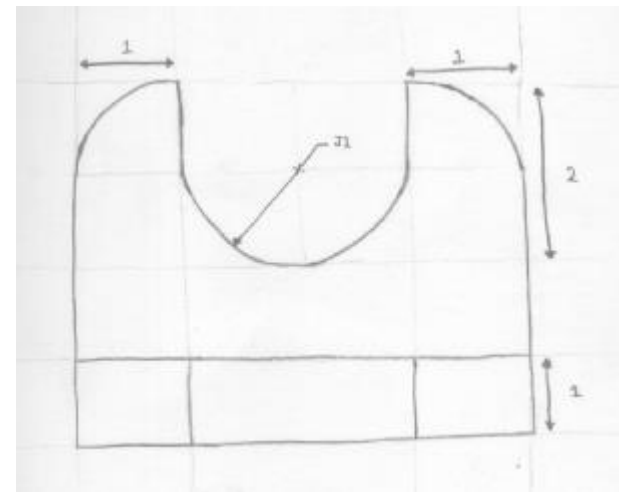


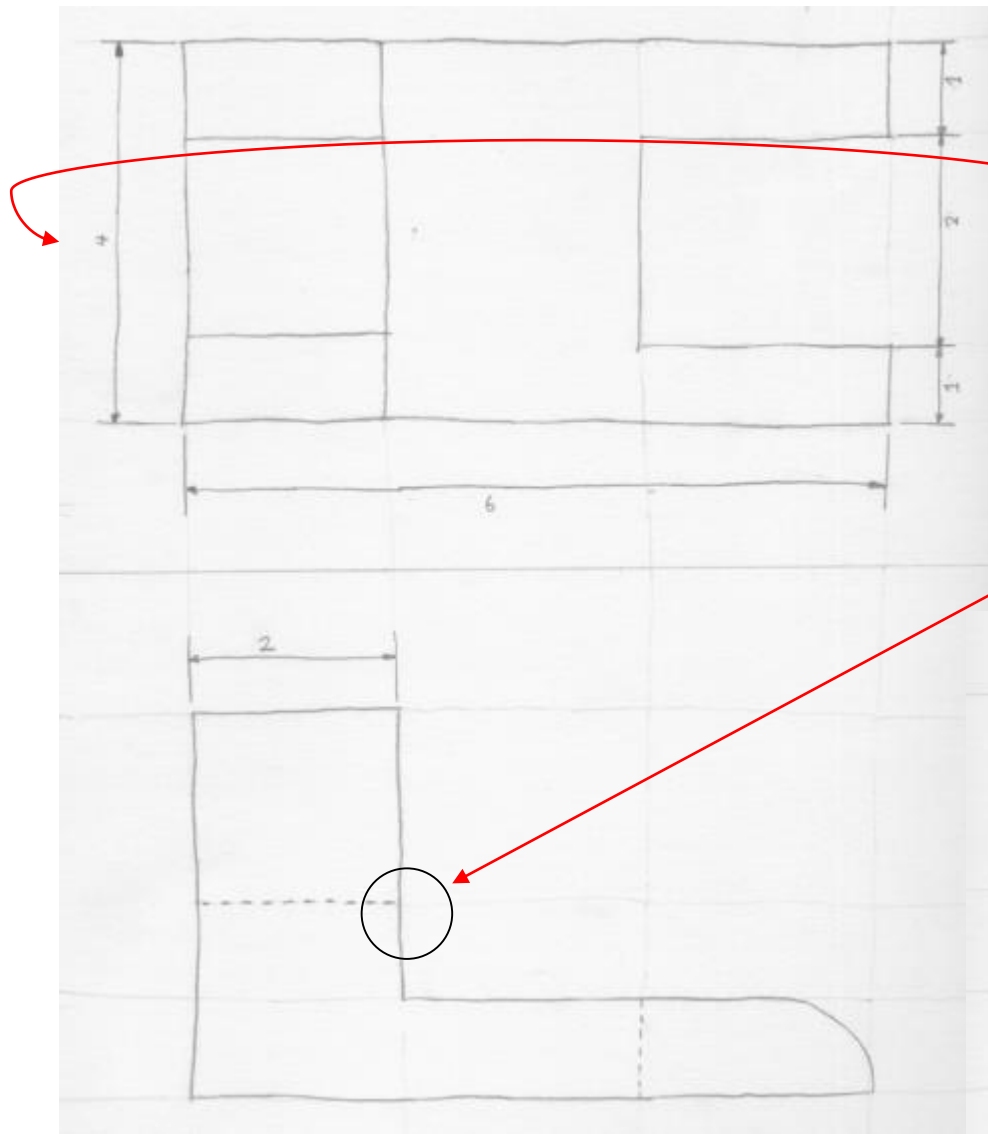
- Dimensi perlu lengkap
- Dimensi perlu berada pada kedudukan yg sesuai
- Garisan terlindung ada yg tertinggal
- Garisan tengah tiada.
- Dimensi jejari tiada



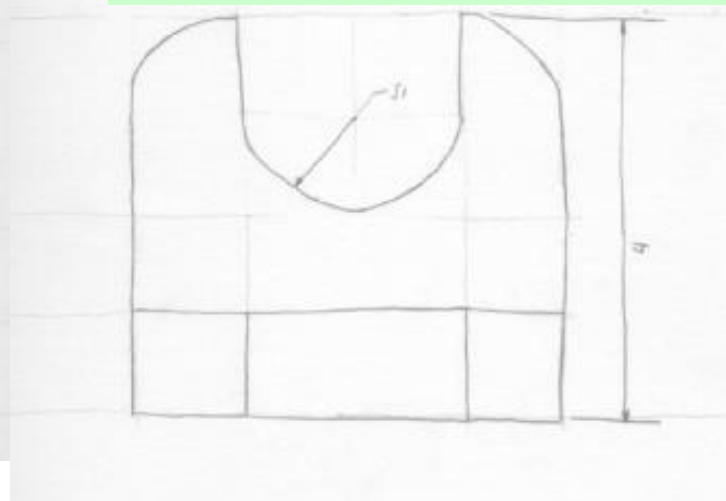


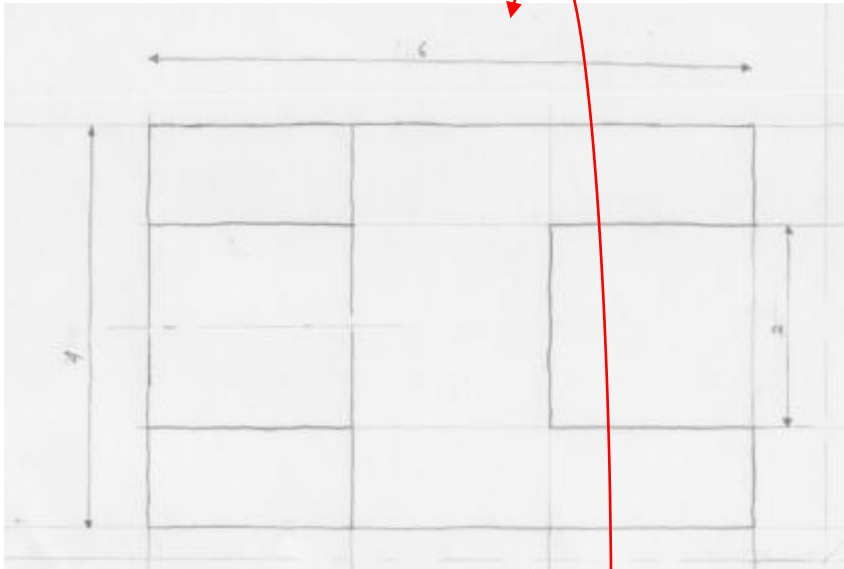
- Dimensi perlu berada pada kedudukan yg sesuai
- Jarak garisan dimensi hampir dgn sempadan objek
- Garisan tengah/simetri tiada.
- Ketebalan garisan nyata, dimensi, dan nyata kelihatan sama.





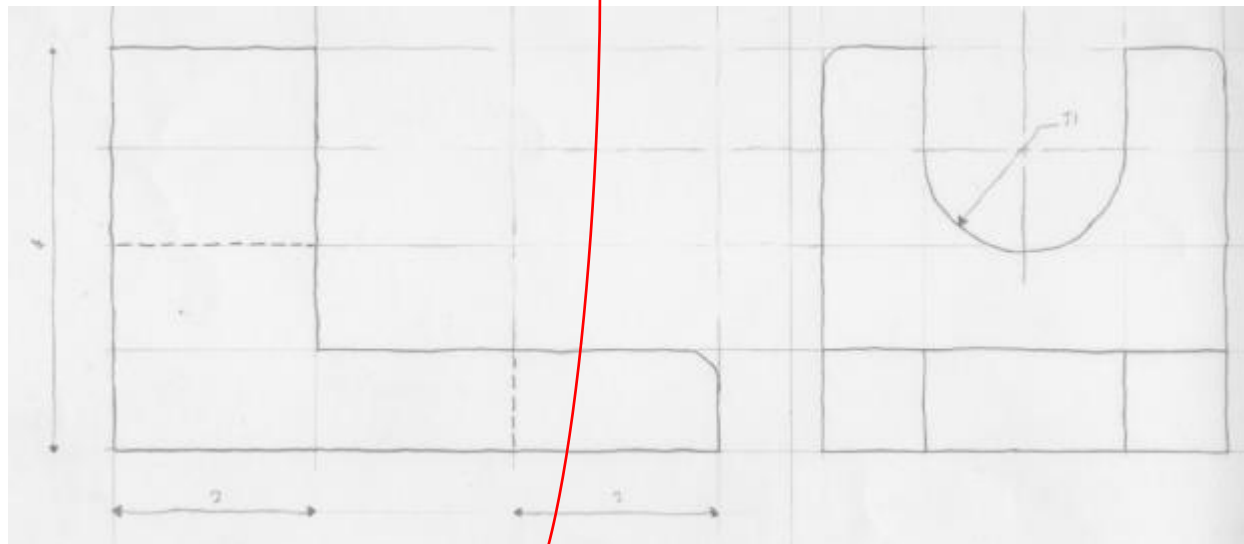
- Dimensi perlu berada pada kedudukan yg sesuai
- Garisan tengah/simetri tiada.
- Ketebalan garisan nyata, dimensi, dan nyata kelihatan sama.
- Dimensi ada yg berulang
- Ada kesilapan kecil pada garisan terlindung (jgn ada ruang, mesti sentuh sempadan objek)

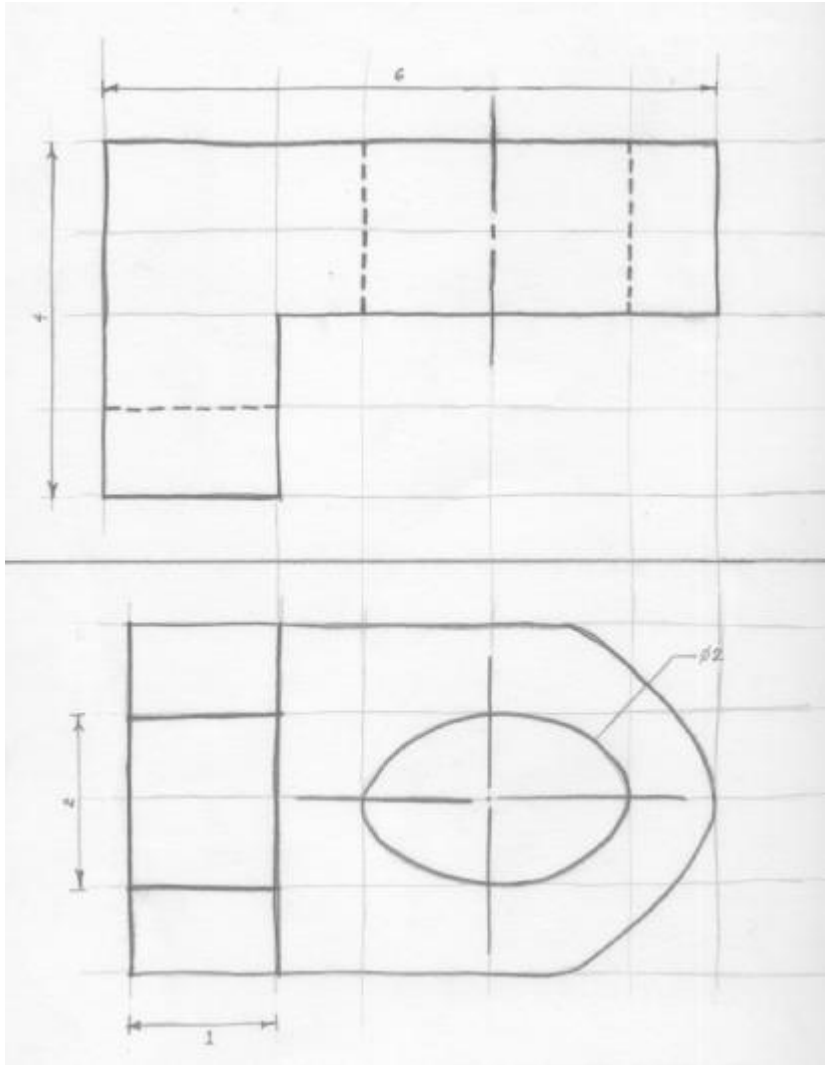




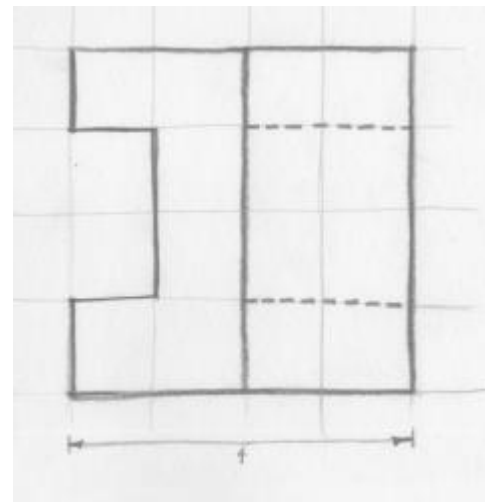
Lakaran kemas dan bersih, tetapi...

- Dimensi perlu berada pada kedudukan yg sesuai
- Satu lagi garisan tengah/simetri tiada.
- Ketebalan garisan nyata dan terlindung kelihatan sama.

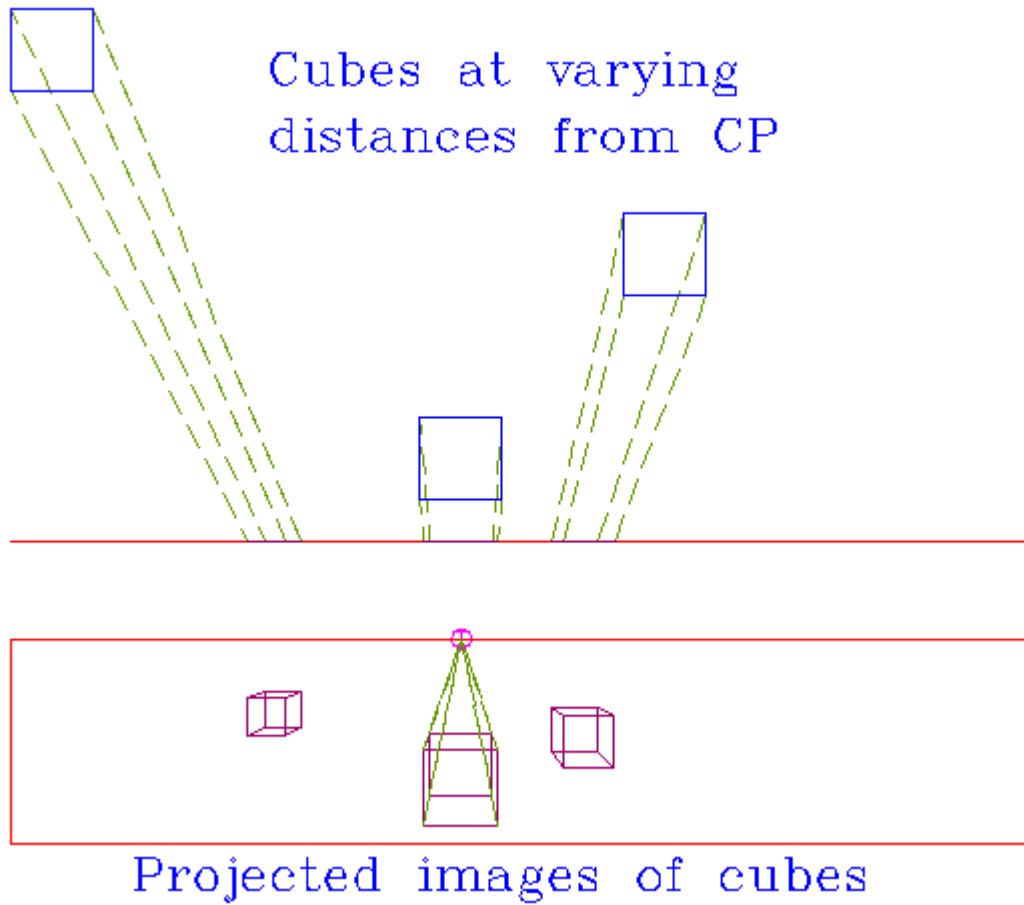




- Orientasi lakaran yg tidak tepat.
- Bulatan menjadi elips....tidak 'propotional'
- Dimensi perlu berada pada kedudukan yg sesuai
- Satu lagi garisan tengah/simetri tiada.
- Ketebalan garisan nyata, tengah dan terlindung kelihatan sama.

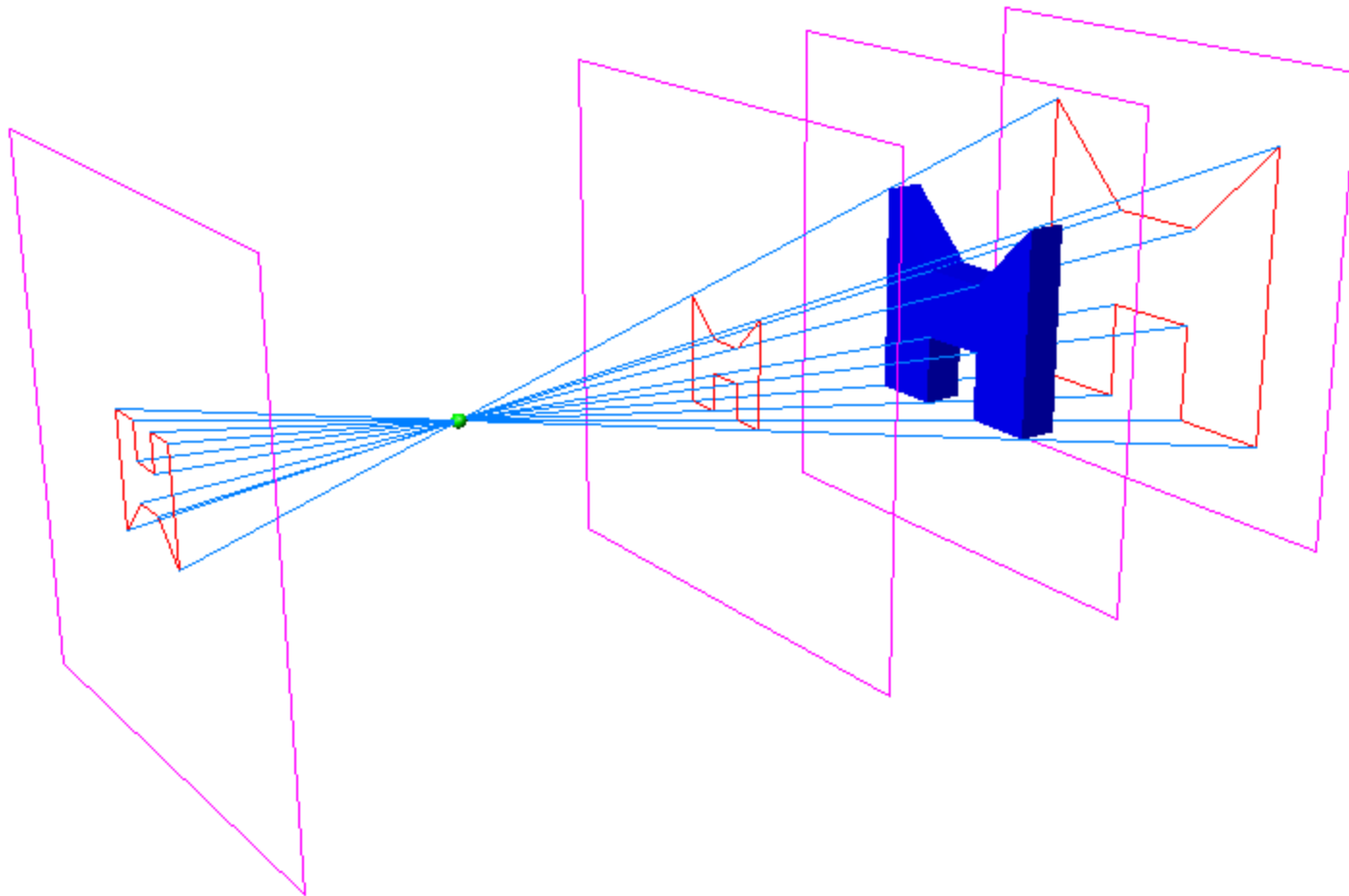


VARYING DISTANCE FROM CP



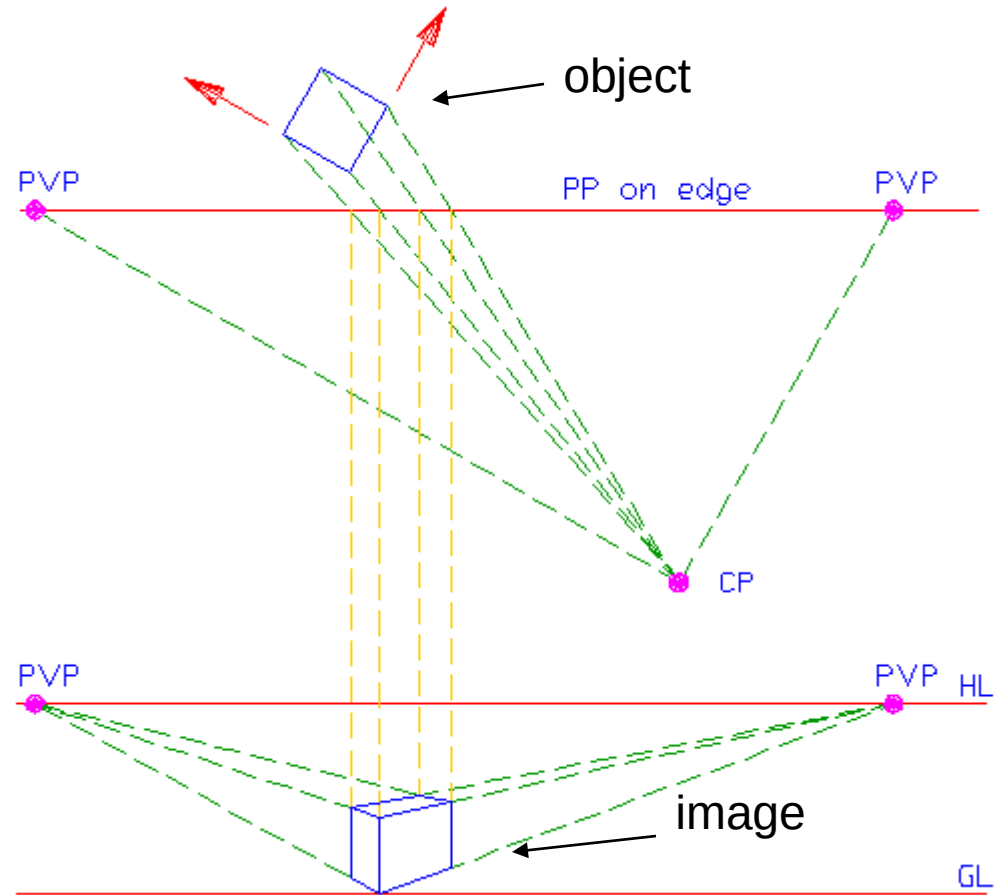
PROJECTION PLANE LOCATION

- Size of projected image depends upon location of projection plane with respect to object



VANISHING POINTS REVISITED

A vanishing point is found by passing a line through the center of projection, parallel to a set of parallel object edges. The point where the line pierces the projection plane is the vanishing point.

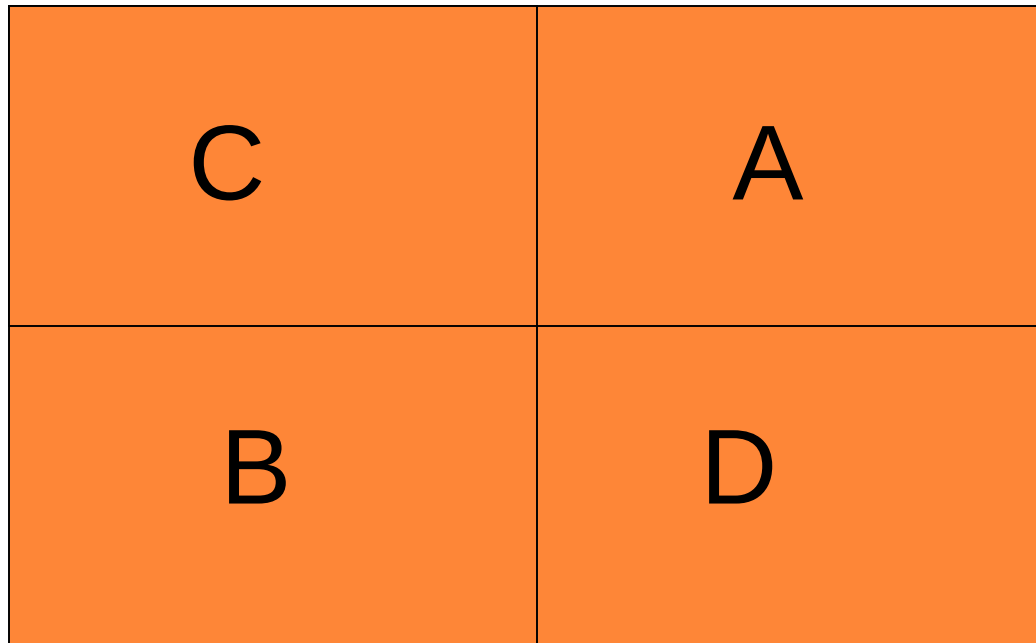




Lukisan Multi Pandangan Orthogonal Drawaing

4 ANGLE PROJECTION/MULTI VIEW

- Orthogonal drawing- 1st, 2nd , 3rd and 4th
- Can you distinguish between this 4 view ?

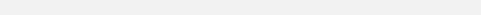
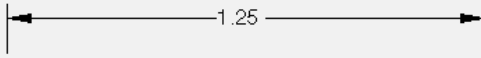
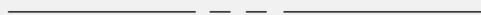
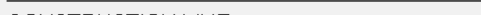


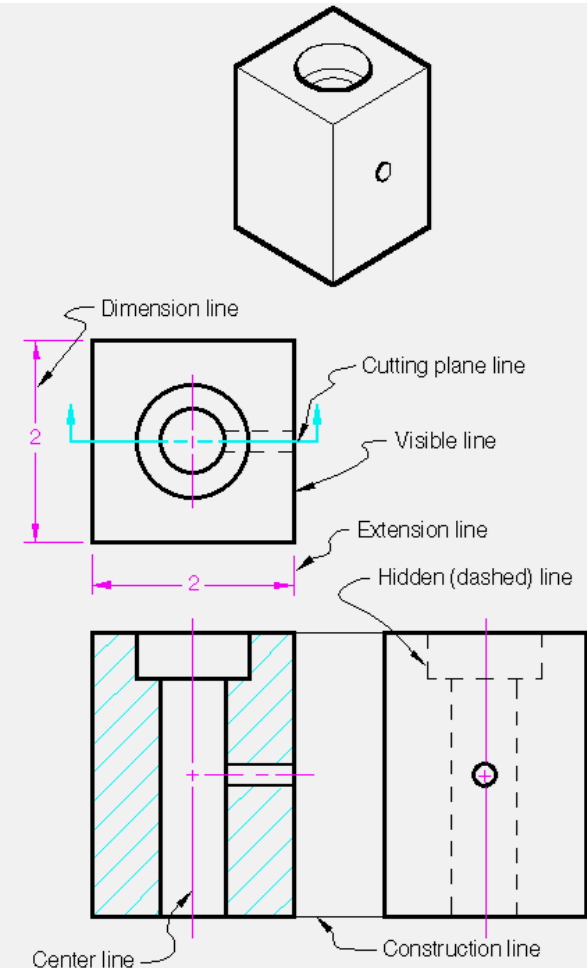
The “Alphabet of Lines”...

Lines have both style and precedence.

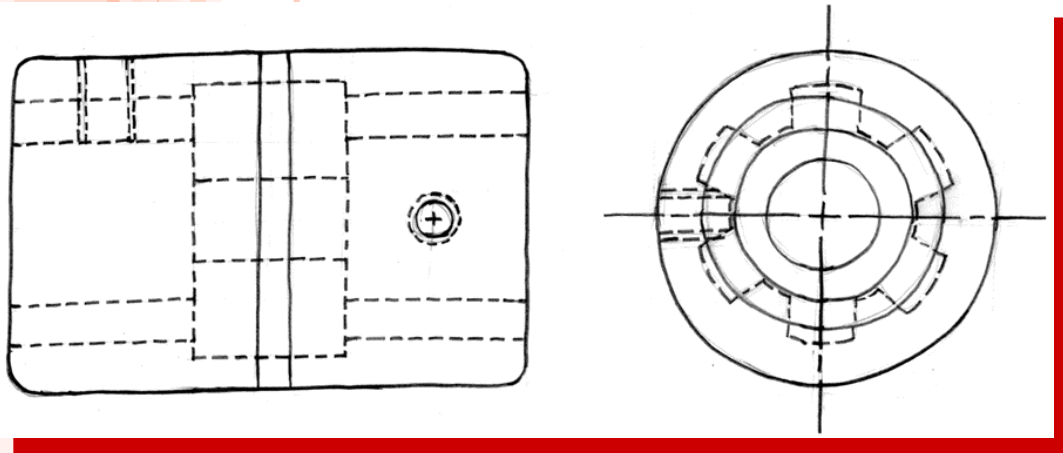
*Object (visible) lines are the **MOST** important...then hidden lines...then center lines...etc.*

50

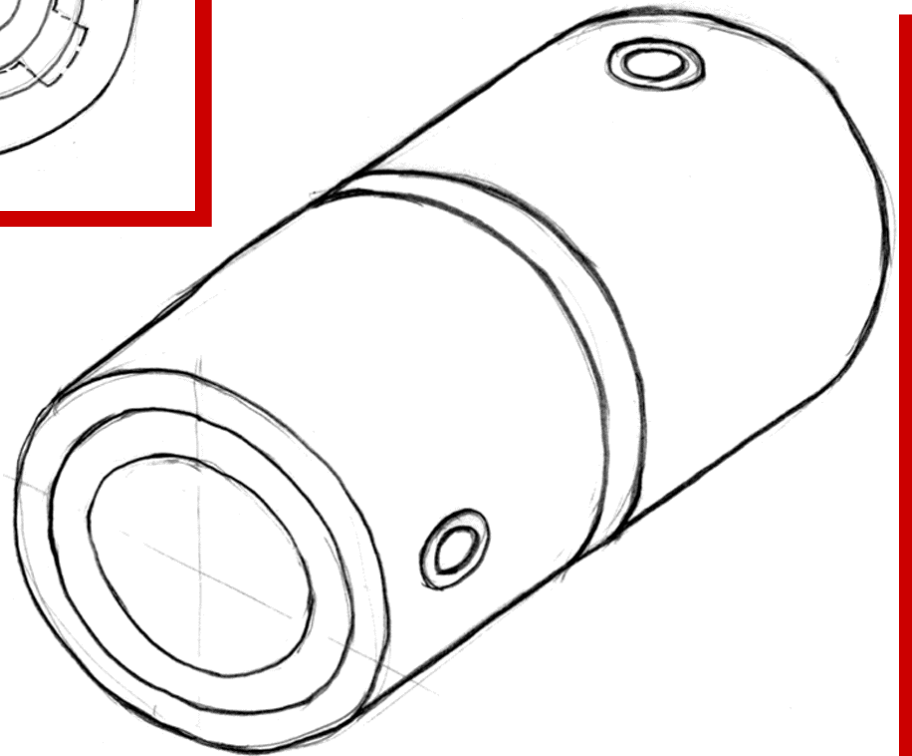
	.7 mm
VISIBLE LINE	
	.35 mm
HIDDEN (DASHED) LINE	
	.35 mm
CENTER LINE	
	.35 mm
DIMENSION & EXTENSION LINES	
	.7 mm
PHANTOM LINE	
	.7 mm
CUTTING PLANE LINE	
	.35 mm
CONSTRUCTION LINE	
	.35 mm
SECTION LINES	



Examples of Sketches:

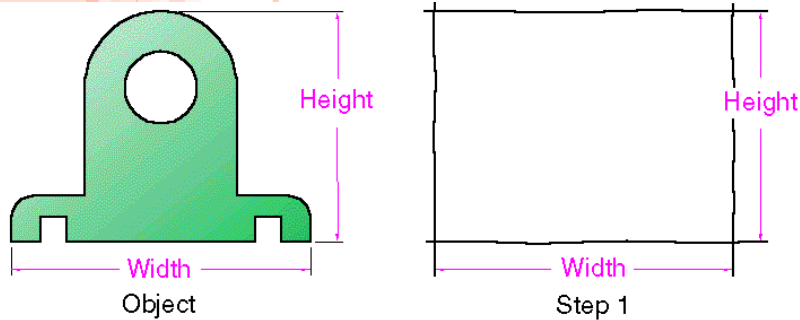


Multiview Sketch



Pictorial Sketch

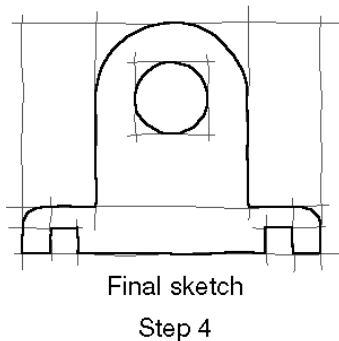
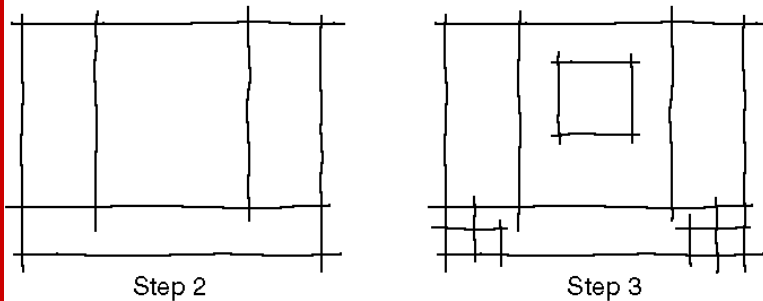
Sketches use “proportion”, not scale!



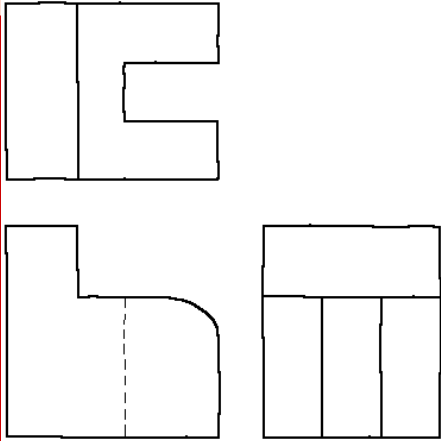
Proportion allows the designer to use approximate values to create a balanced looking object.

Sketches are...accurate freehand drawings which use single lines to represent edges and features.

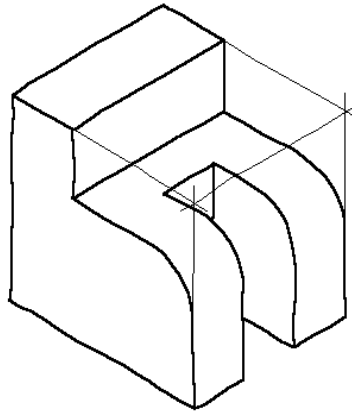
Multi-line sketching is NOT used in engineering design. (Scribbling!)



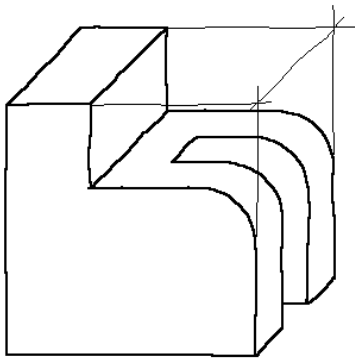
Classification of Sketches:



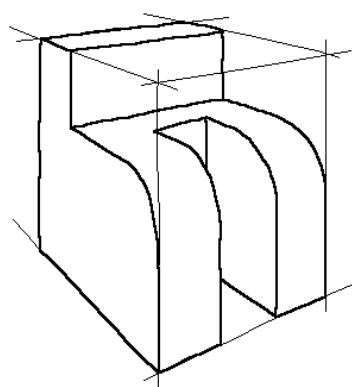
(A) Multiview



(B) Axonometric



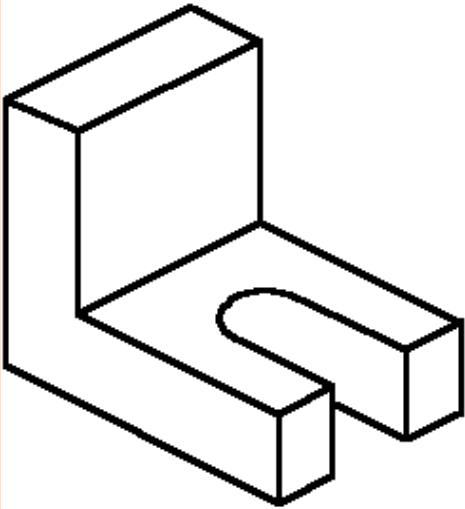
(C) Oblique



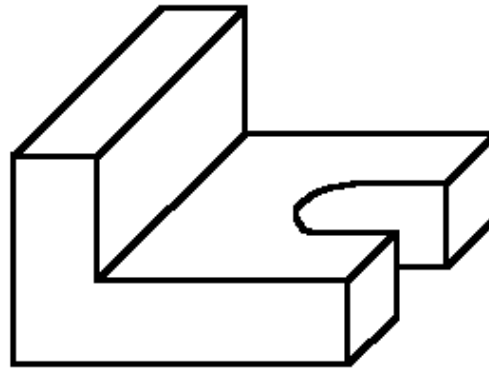
(D) Perspective

Each classification of sketch has a particular purpose from production use...to technical illustration.

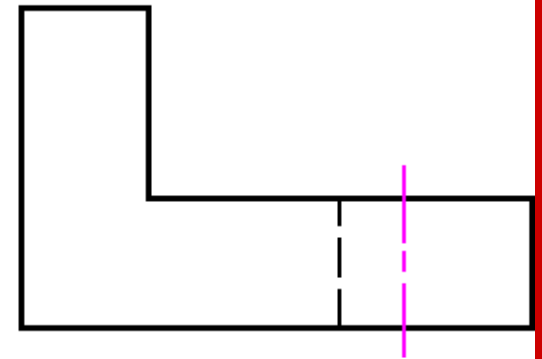
Projection types:



Isometric



Oblique



Multiview

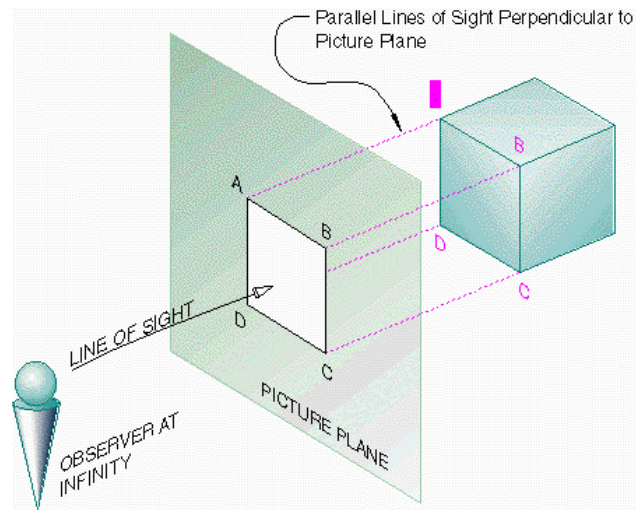
Here's how the same object may look using different projection styles.

Projection types:

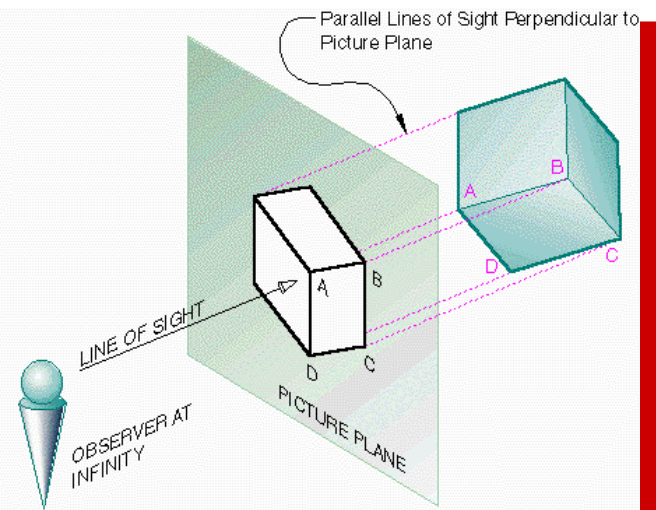
Projection type is defined by the “line of sight” from the observer.

Let’s look at some of these.....

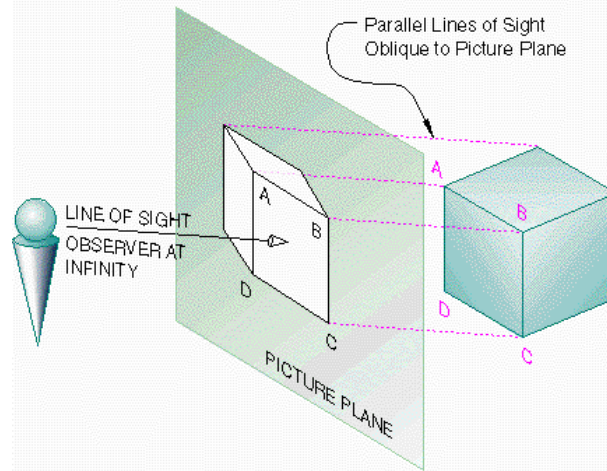
55



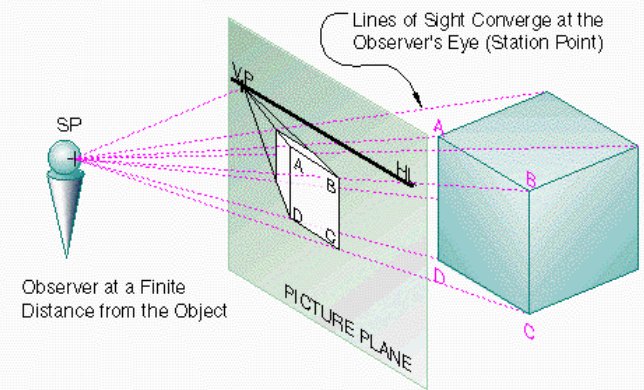
(A) Multiview Projection



(B) Axonometric Projection



(C) Oblique Projection



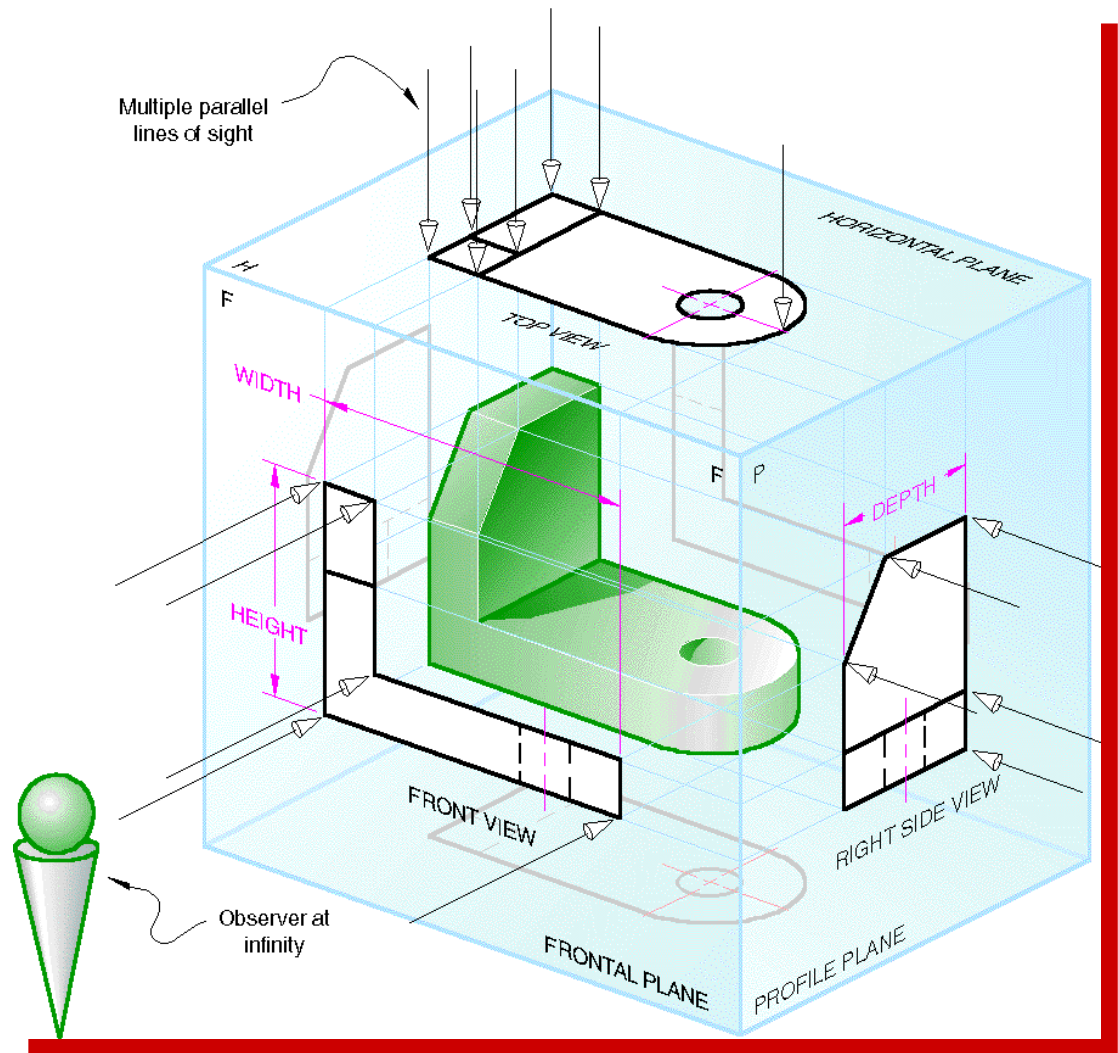
(D) Perspective Projection

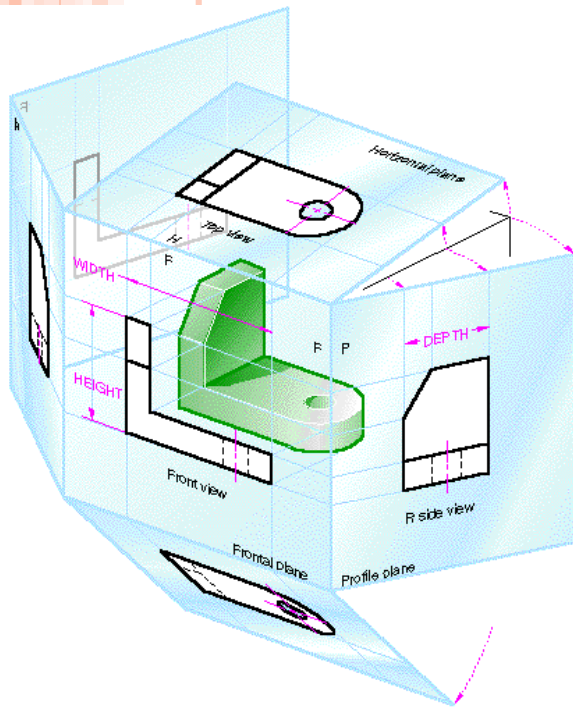


*Let's now take another look at
multiview drawings in more
detail.....*

We have already seen how views are aligned with the surface of an object.

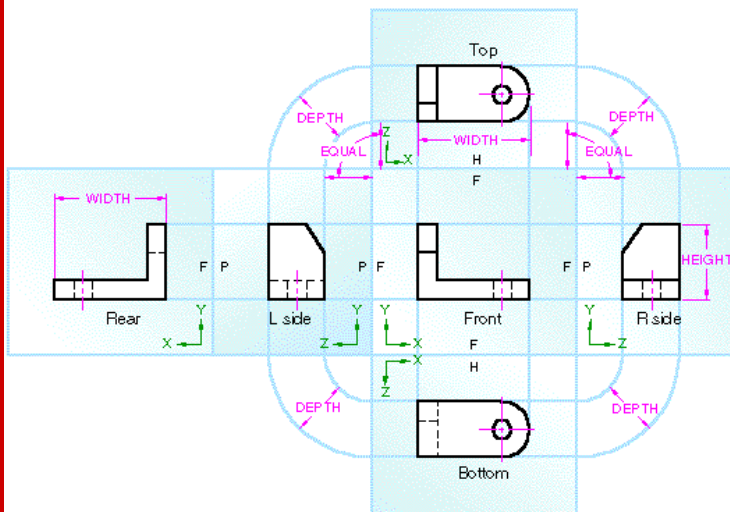
Using the “glass box” method of visualization helps us understand the relationship views have with one another, i. e. the front view is next to the top and right side views, etc.





Here we can see all the principle views of an object as the glass box is unfolded.

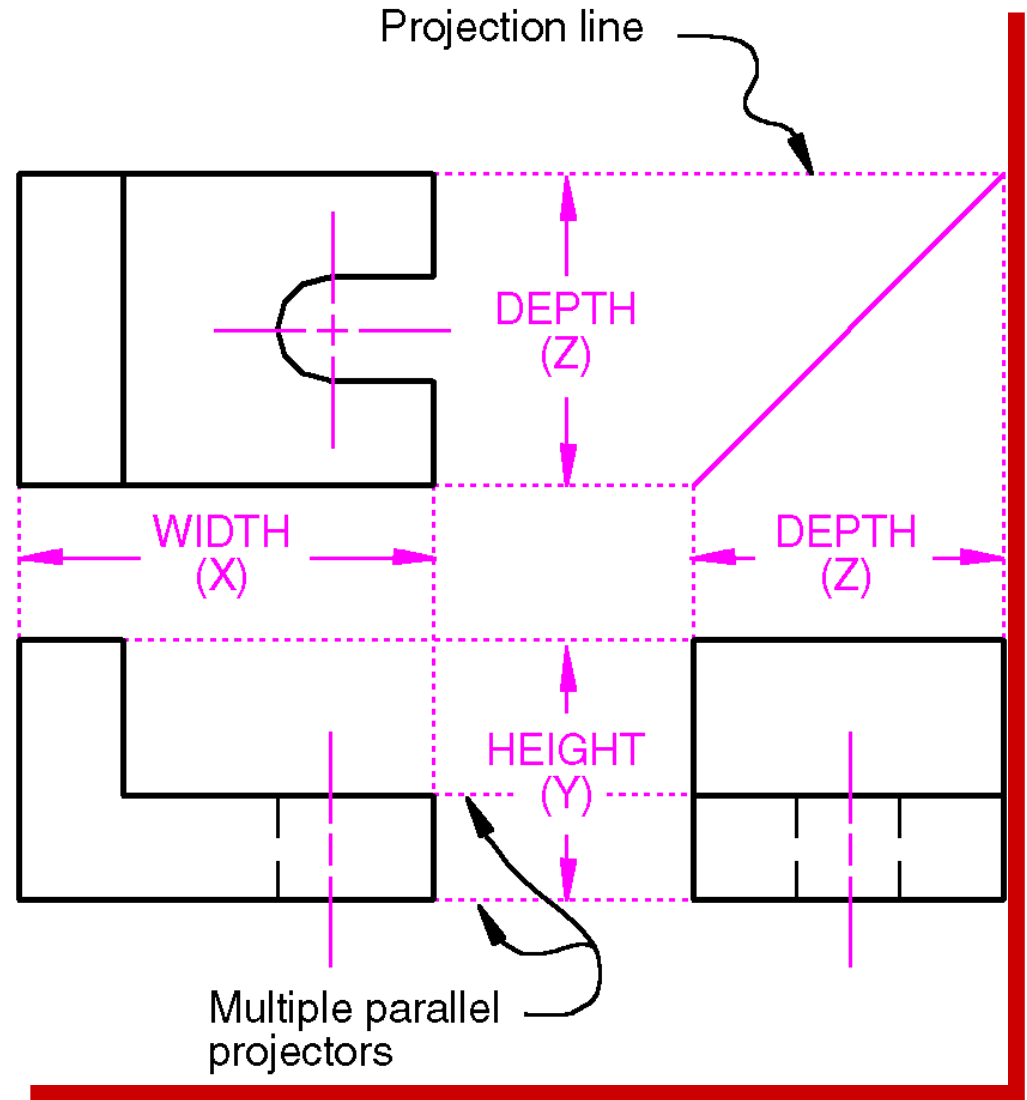
It is easy to see that some of the principle views have more detail through the use of object (visible) lines than others.



Always choose views that have the least amount of hidden lines in them and show the most detail.

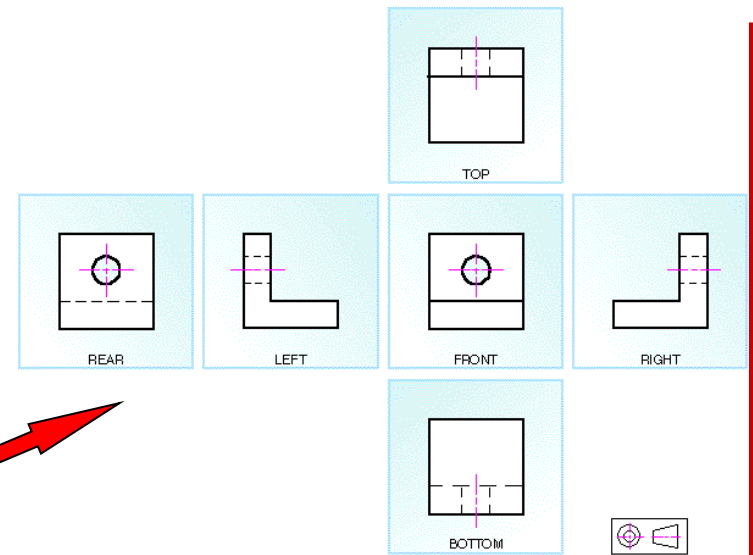
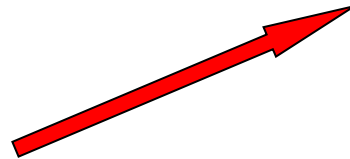
Using miter and projection lines, we can easily transfer “space dimensions” between views.

59



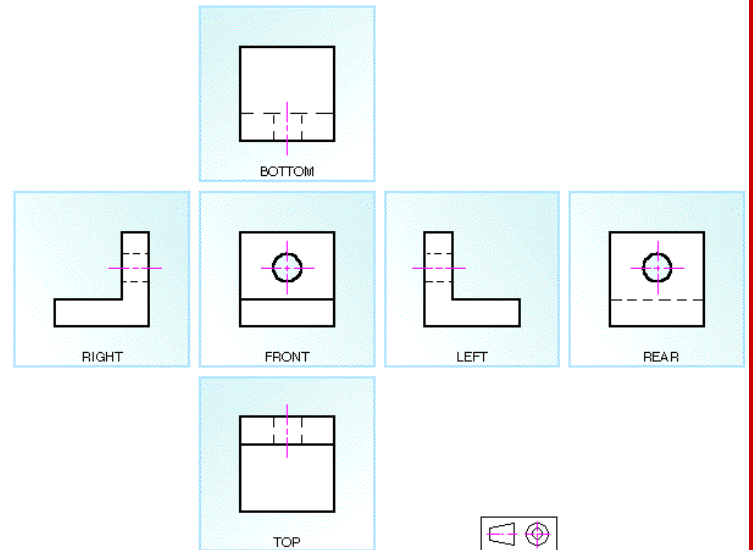
Projection methods:

3RD Angle (US Standard)



(A) U.S. Standard

ISO (1ST Angle Metric Standard)

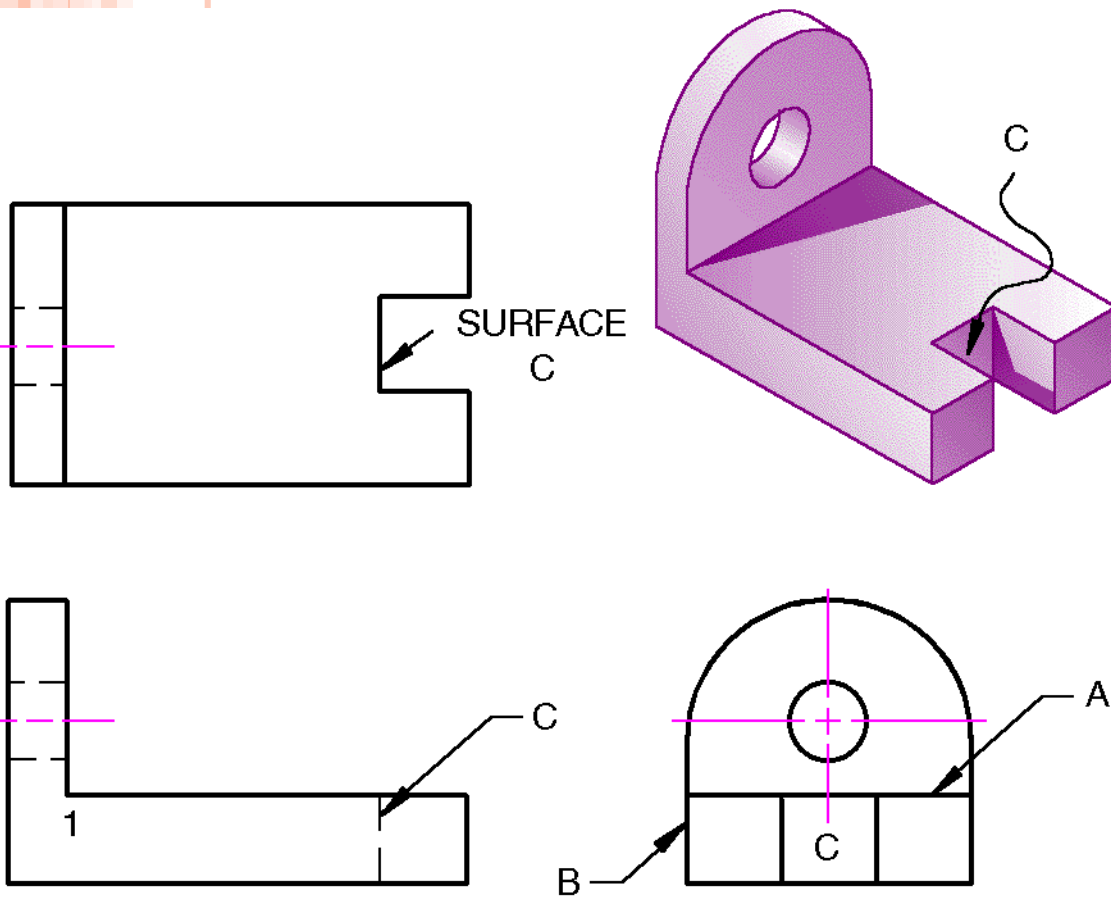


(B) European Standard

NOTE:

Reverse construction methods work just as well in 1ST Angle projection.

60

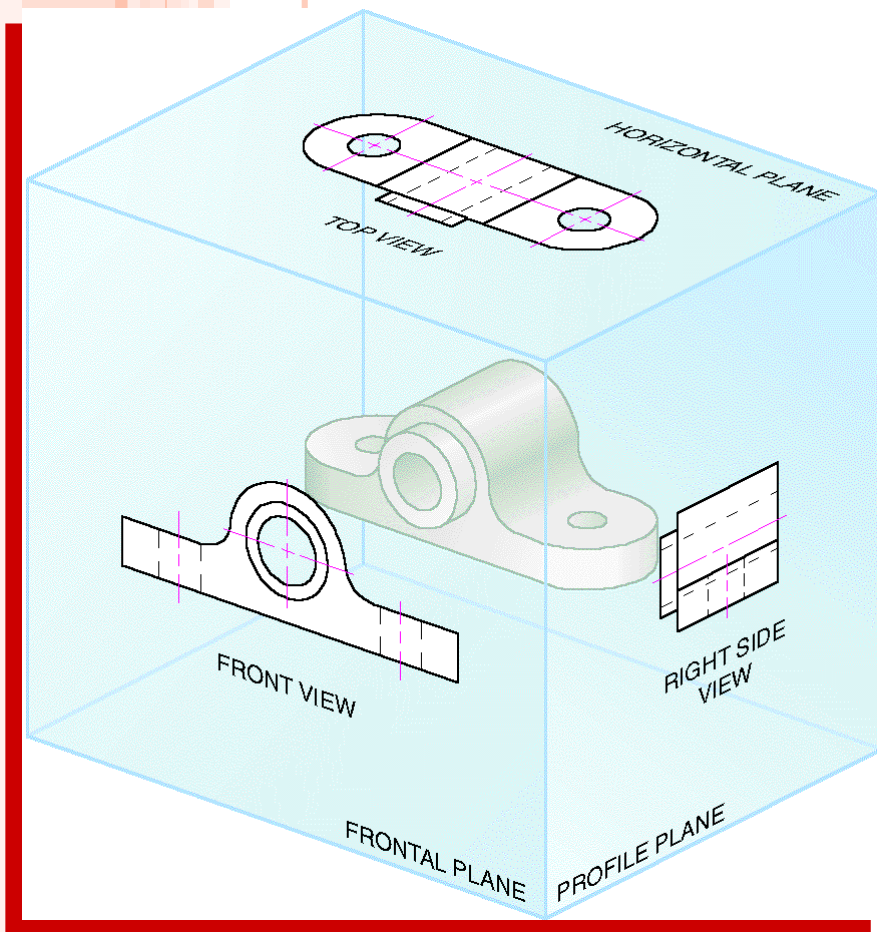


Here, we can see that surface C is shown as both as object and hidden lines depending on the view we are looking at.

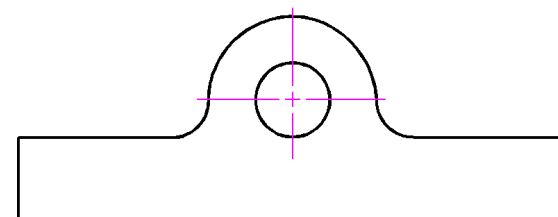
Remember: *One definition of a “line” is that it is the geometry on the edge of a surface. (Surface C appears in its edge view in the front and top views.)*

When choosing which of the principle views to draw, remember these rules:

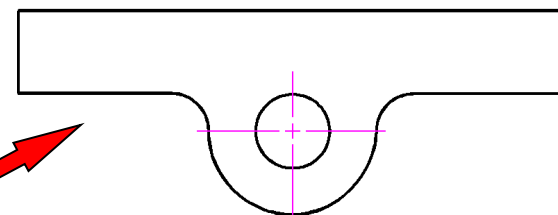
- 1. Choose as many views as it takes to show ALL the details of the object. The front view usually shows the most detail, or best view of the general shape of the object in its natural position.***
- 2. Choose views that shows a majority of object (visible) lines, and a minimum of hidden lines.***
- 3. Choose views that show features as surfaces first, and as lines second.***



Always try to draw views in their most natural position.



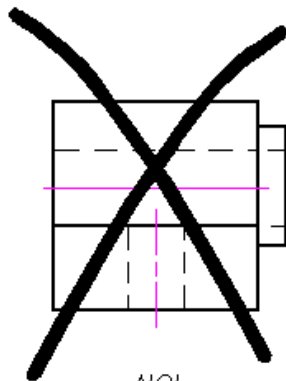
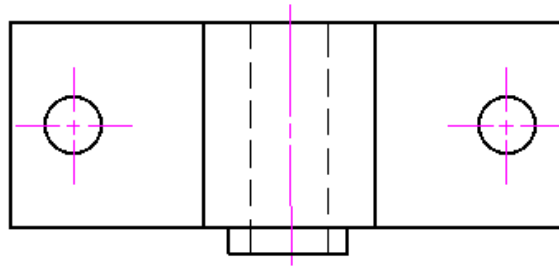
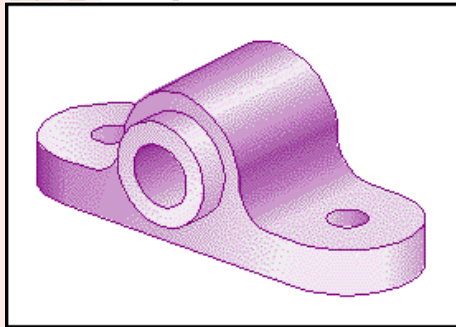
Natural Position



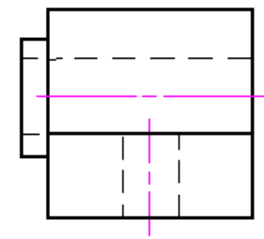
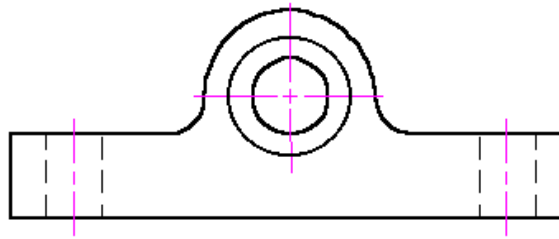
Unnatural Position
No!

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This is obviously more difficult to visualize!



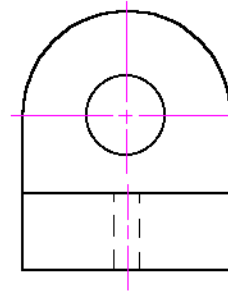
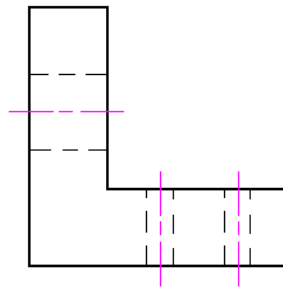
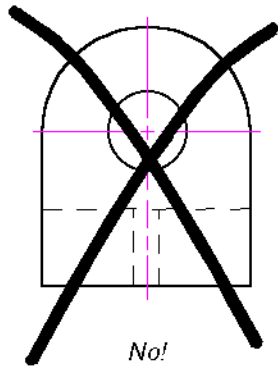
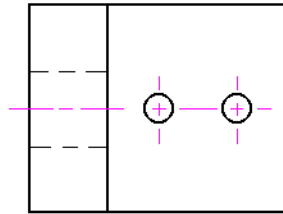
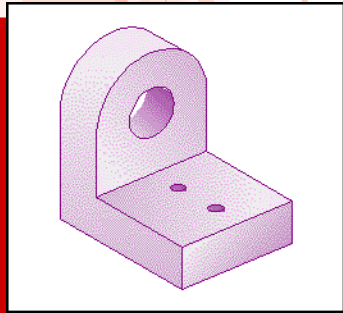
NO!



64

Why is the left side view not required?

ANSWER: It doesn't add any new information!

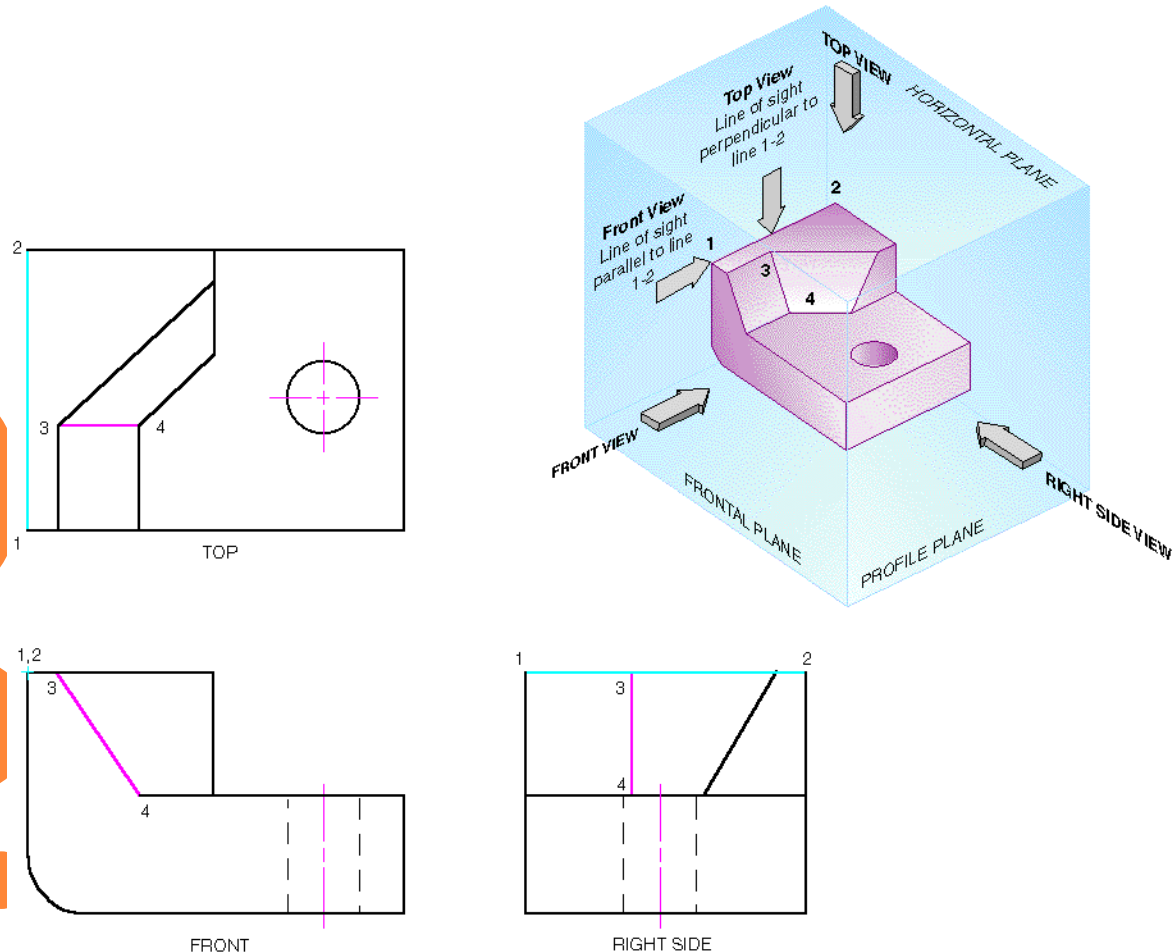


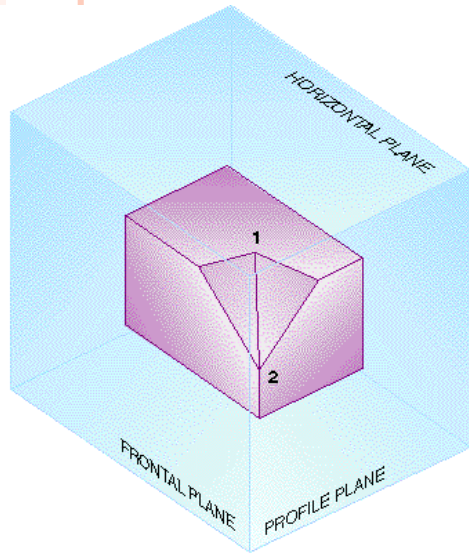
Why is the left side view not required?

65

ANSWER: *It has too many hidden lines!*

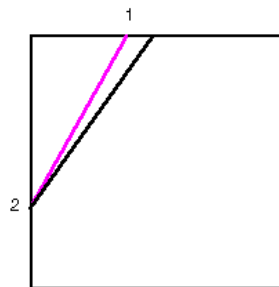
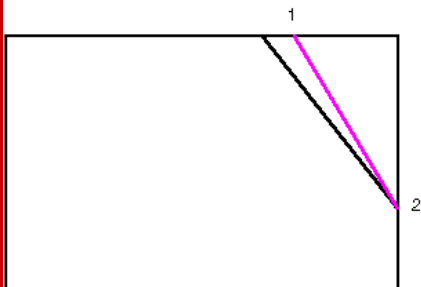
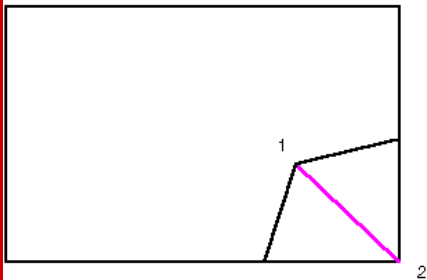
Surfaces will appear as edges at times. Edges may be foreshortened (shorter than normal), or “True Length” (TL).

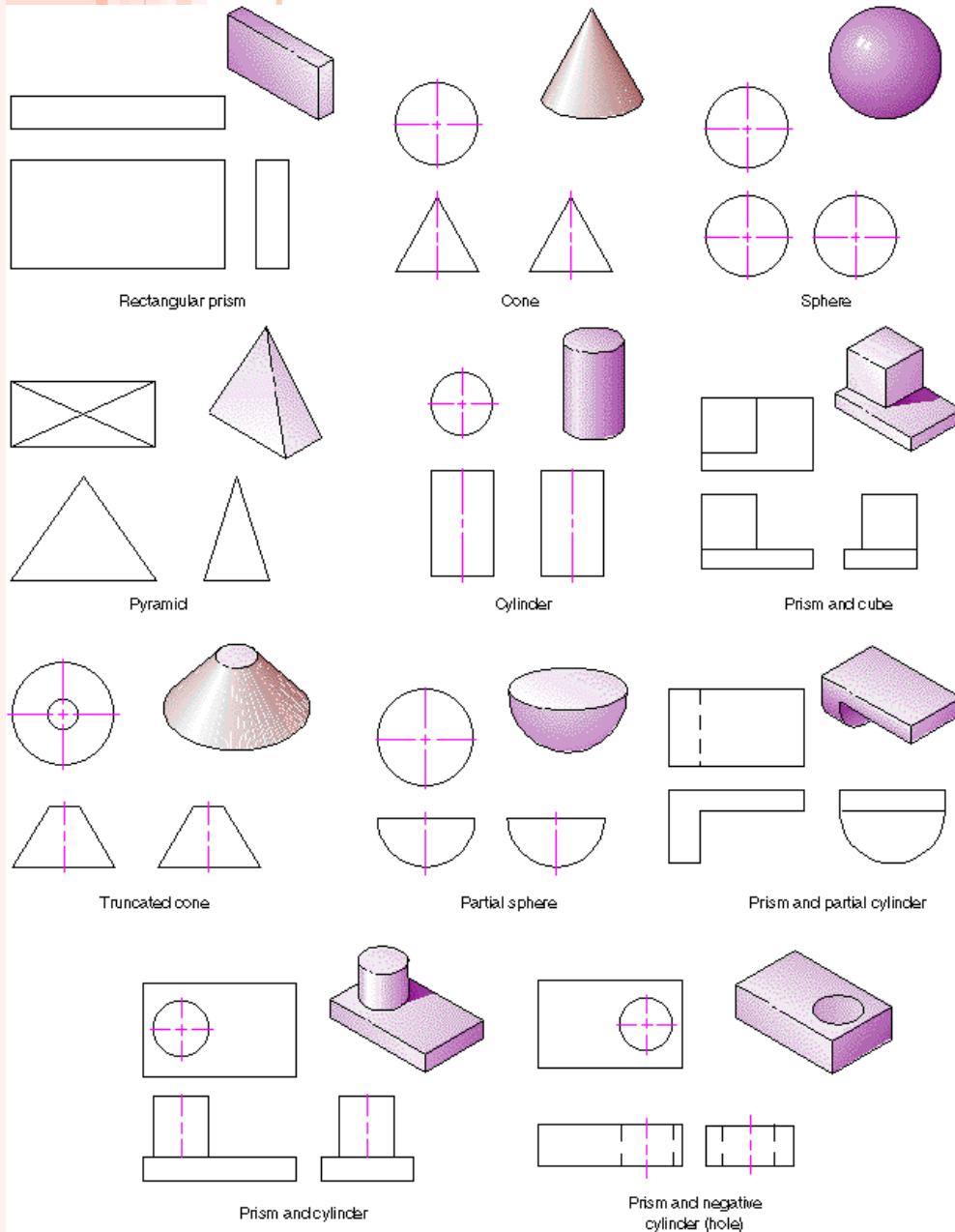




Oblique edge lines are created by oblique surfaces.

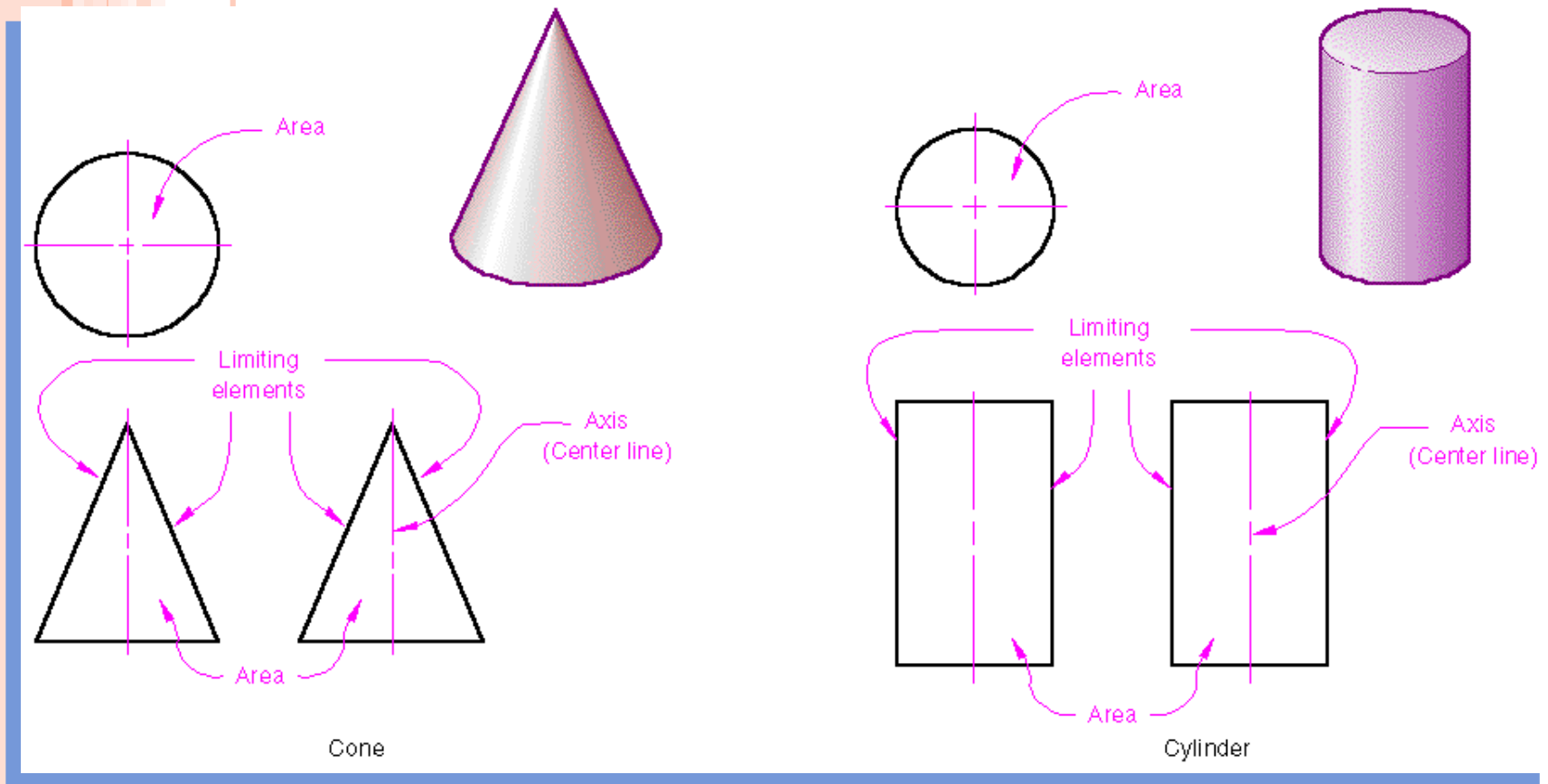
These are surfaces that are neither true shape or true size in any principle view.



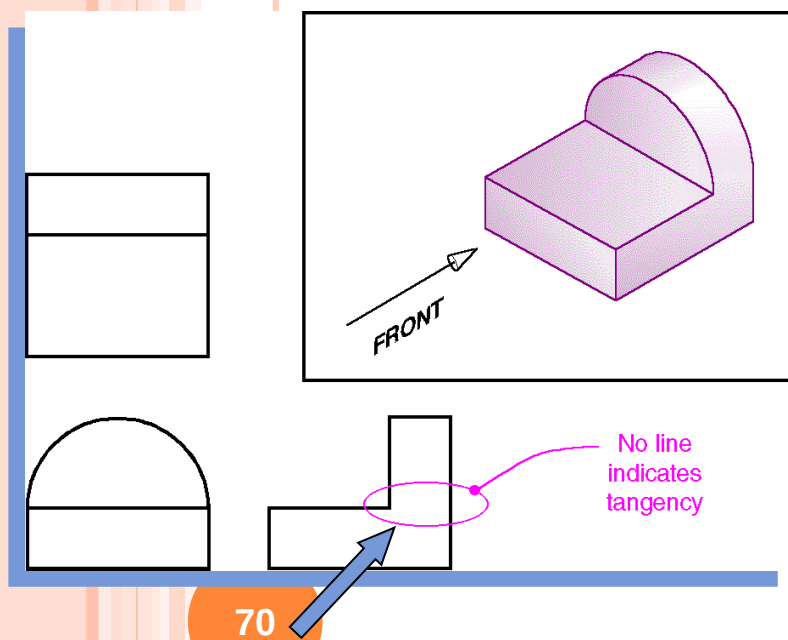


Even simple, primitive shapes often need several views to fully describe their topology.

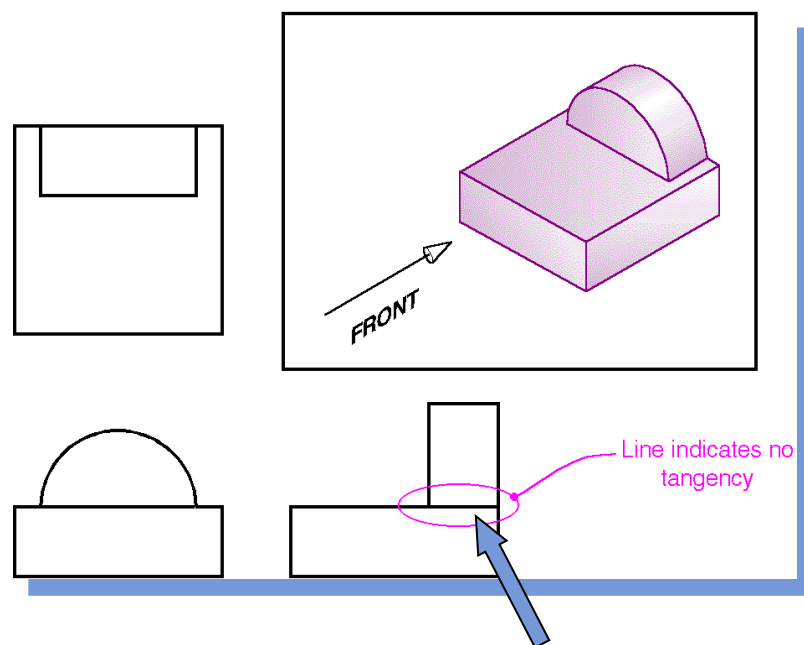
“Limiting Elements” are lines that show the outer boundaries of cylindrical or conical objects. How many views of such objects are usually needed to show its shape?



Remember: In multiview drawings, tangency is shown between two surfaces by the absence of any line.

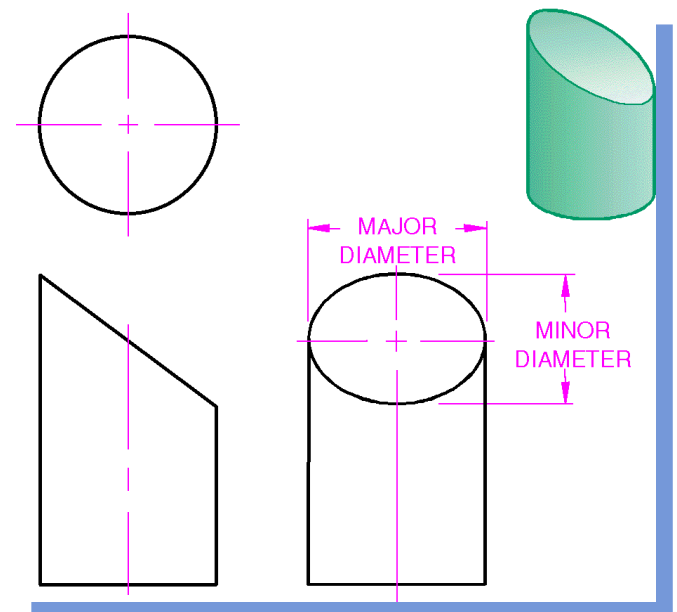
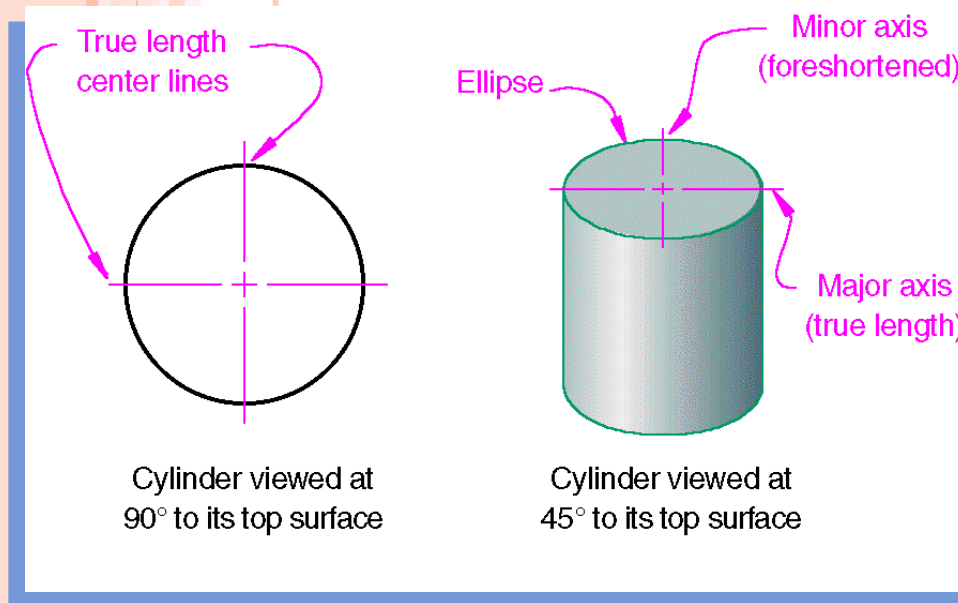


Here, the arched and planar surfaces are tangent.



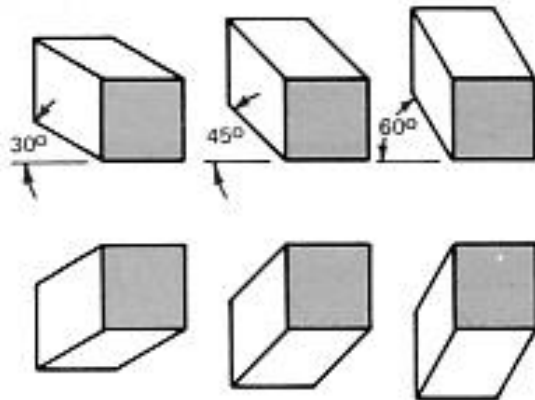
Arched and planar surfaces which are NOT tangent.

Holes and cylinders may appear “True Shape and Size” (TSS), or foreshortened depending on the view in which they appear. (Foreshortened circles will appear as ellipses.)



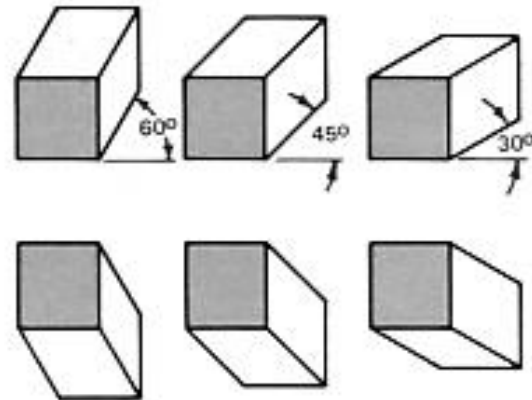
THE DIRECTION OF PROJECTION CAN BE TOP-LEFT, TOP-RIGHT, BOTTOM-LEFT, OR BOTTOM-RIGHT. THE RECEDING AXIS IS TYPICALLY DRAWN AT 60, 45, OR 30 DEGREES.

Top Left



Bottom Left

Top Right



Bottom Right



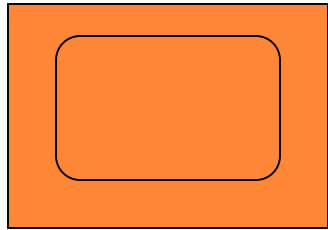
PERSOALAN LAKARAN BEBAS

1. Adakah lakaran bebas masih sesuai di era CAD?
 - Ya kerana ia merupakan teknik lukisan paling asas, murah dan pantas.
 - Hanya memerlukan kemahiran tangan (yang boleh digilap) tanpa bekalan elektrik, hanya kertas dan pensel.
 - PDA.Pad dan HP sudah menyediakan kemudahan lakaran menggunakan 'stylus' /jari pada skrin sentuh!

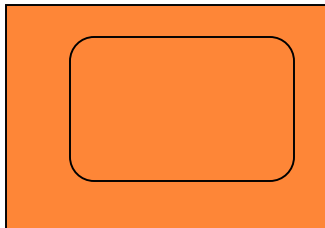


PRACTICE ACTIVITY

- Sketch this objek in 3D form



1. Find out type of drawing ?
2. Fill the missing angle
3. Draw it back in 3D view



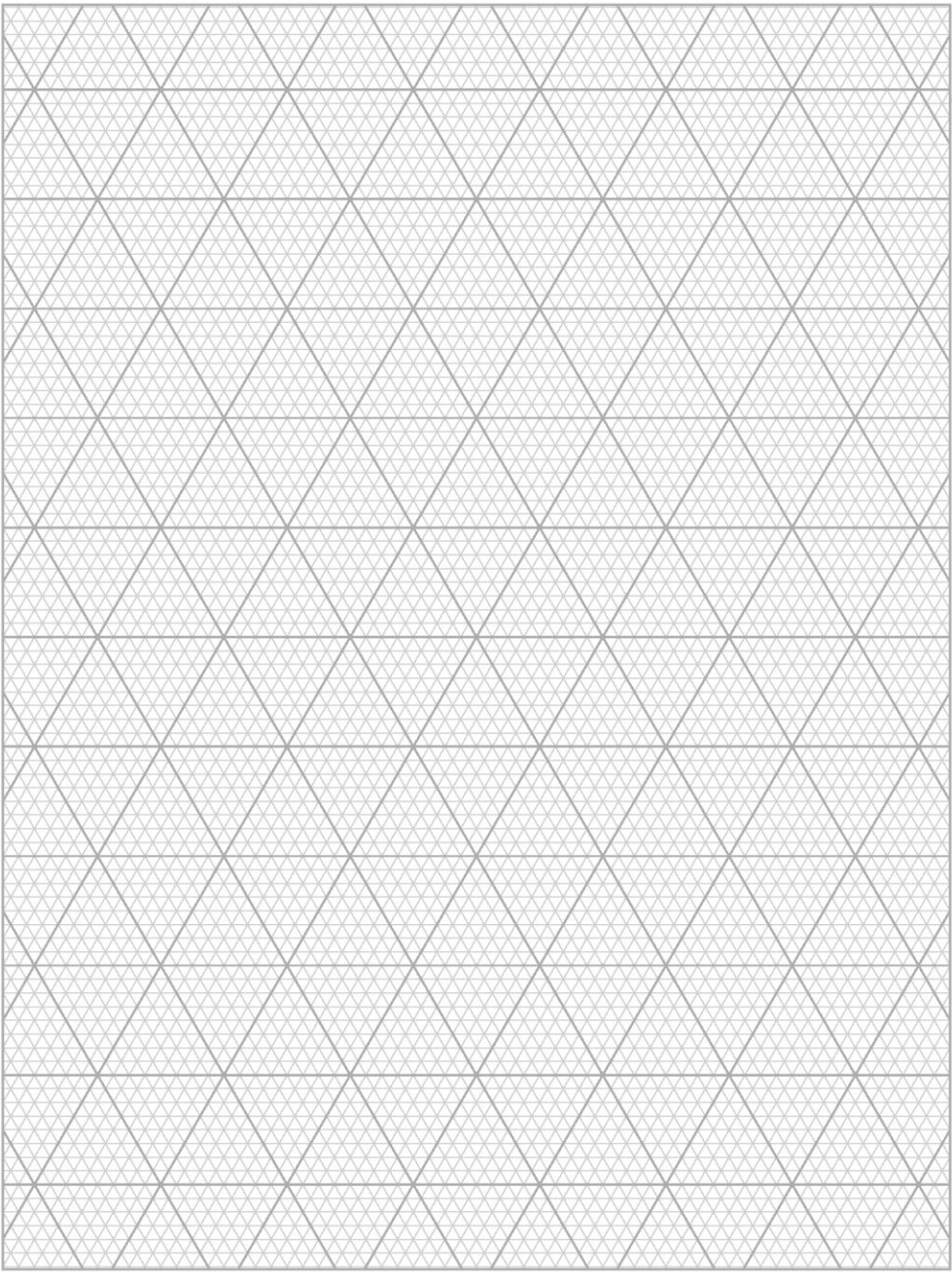
LATIHAN Q

1. Pictorial drawings have a disadvantages. List out all of it
2. Describe an orthographic (multi-view) sketch.





Custom GraphTM



1/8 Per Inch Isometric 3D Light Gray Watermark MC - Land Letter

<http://customgraph.com>

RUMUSAN

- Lakaran bertujuan untuk:

- Lakaran boleh berlaku pada objek yang sudah ada atau yang belum pernah wujud
- _____
- Lakaran boleh jadi dalam ____atau ____
- Dalam lakaran reka bentuk ialah mengutamakan _____

