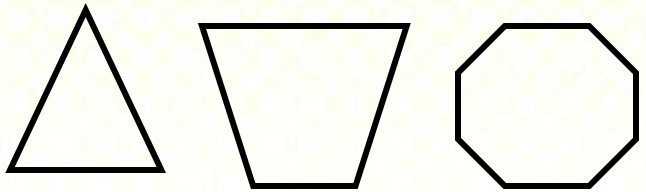
Ukur Kejuruteraan
DDPQ 1162
Luas dan Isipadu

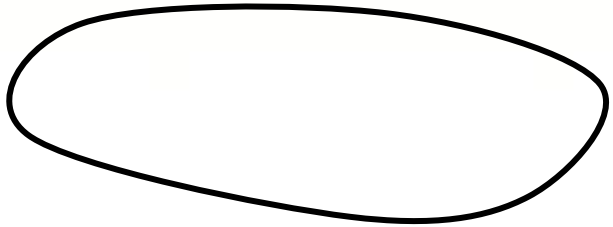
Sakdiah Basiron

JENIS HITUNGAN LUAS

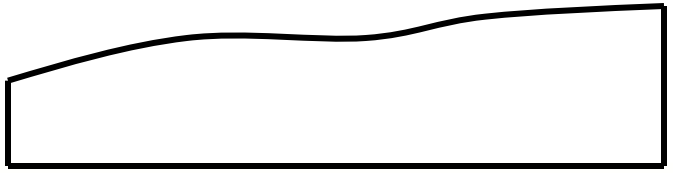
1. Sempadan Lurus



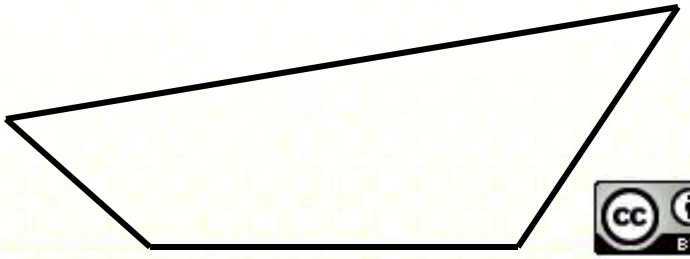
2. Sempadan Tidak Lurus



3. Gabungan Sempadan Lurus dan Tidak Lurus



4. Keratan Rentas

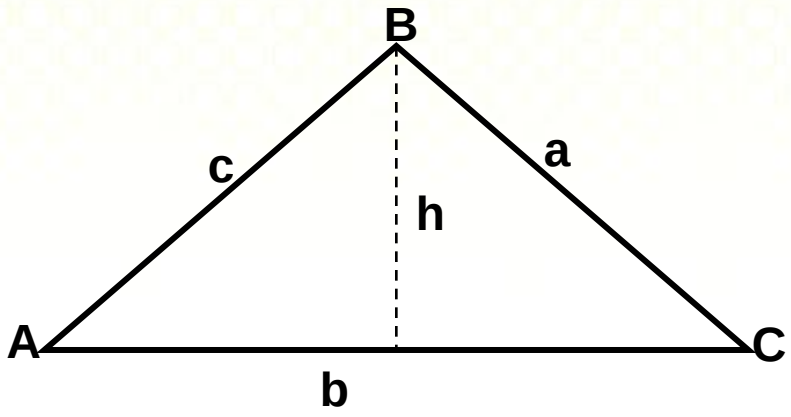


Sempadan Lurus

Segi Tiga

Luas = [s(s-a)(s-b)(s-c)]^{½} ……(i)

dimana s = ½ (a+b+c)



Luas = ½ b x h ……..(ii)

Masukkan h = a Sin C ke dalam (ii):

Luas = ½ ab Sin C ……..(iii)

Masukkan b = a Sin B ke dalam (iii):
Sin A

Luas = $\frac{a^2 \text{ Sin B Sin C}}{2\text{Sin A}}$ …….(iv)

Jika A = 180 – (B+C), Sin A = Sin (B+C)

$$\text{Luas} = \frac{a^2 \text{ Sin B Sin C}}{2\text{Sin (B+C)}}$$

$$= \frac{a^2 \text{ Sin B Sin C}}{2(\text{Sin B Kos C + Kos B Sin C})}$$

$$\textbf{Luas} = \frac{\mathbf{a^2}}{\mathbf{2(Kot\ C + Kot\ B)}}$$

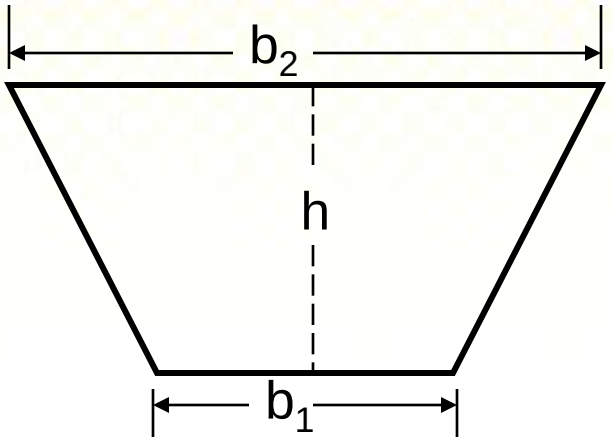
Contoh:

Diberi AB = 1 : 4
BC = 1 : 6
AC = 10m

$$\text{Luas} = \frac{10^2}{2(4+6)} = \frac{100}{20} = 5 \text{ m}^2$$

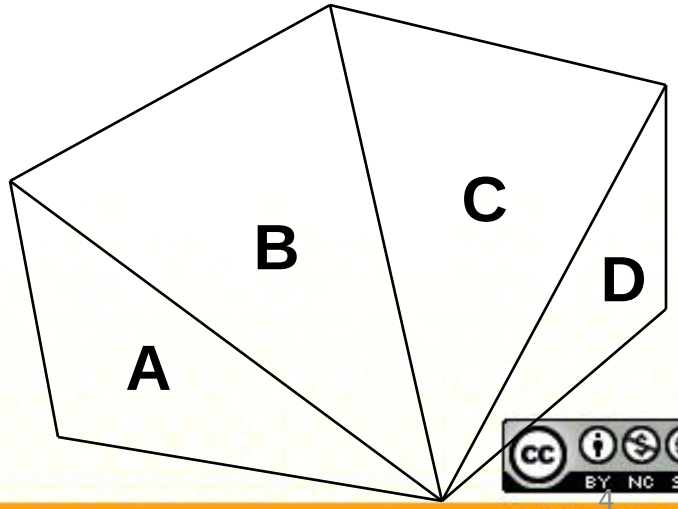
Trapizium

Luas = ½ $(b_1 + b_2)$ h



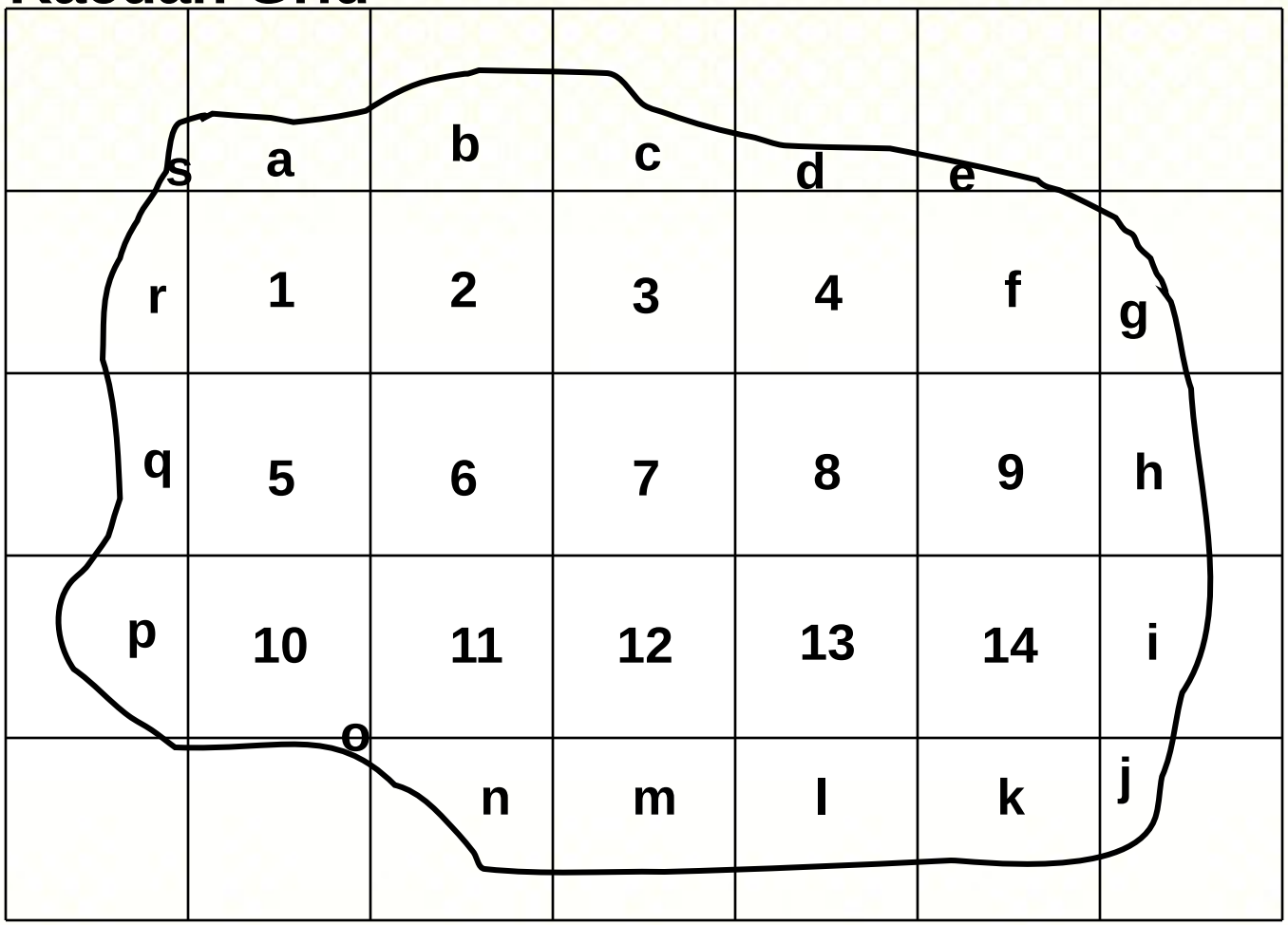
Poligon

a) Bahagi kepada segi tiga (A+B+C+D)
b) Guna Kaedah Kordinat
c) Guna kaedah Dua kali latit dan dua kali dipat



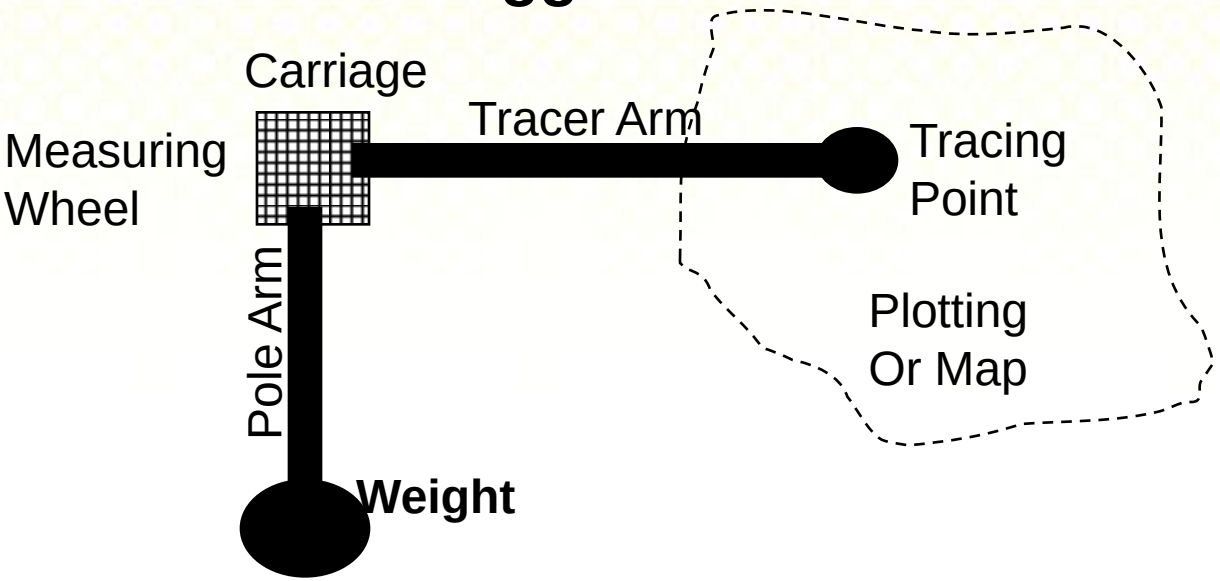
Sempadan Tidak Lurus

Kaedah Grid



a) Dapatkan keluasan grid penuh (1 + 2 + 3 + …… + 14)
b) Aggarkan keluasan a, b, c, ……., s untuk membentuk grid penuh
c) Jumlahkan (a) dan (b) di atas

Menggunakan Planimeter

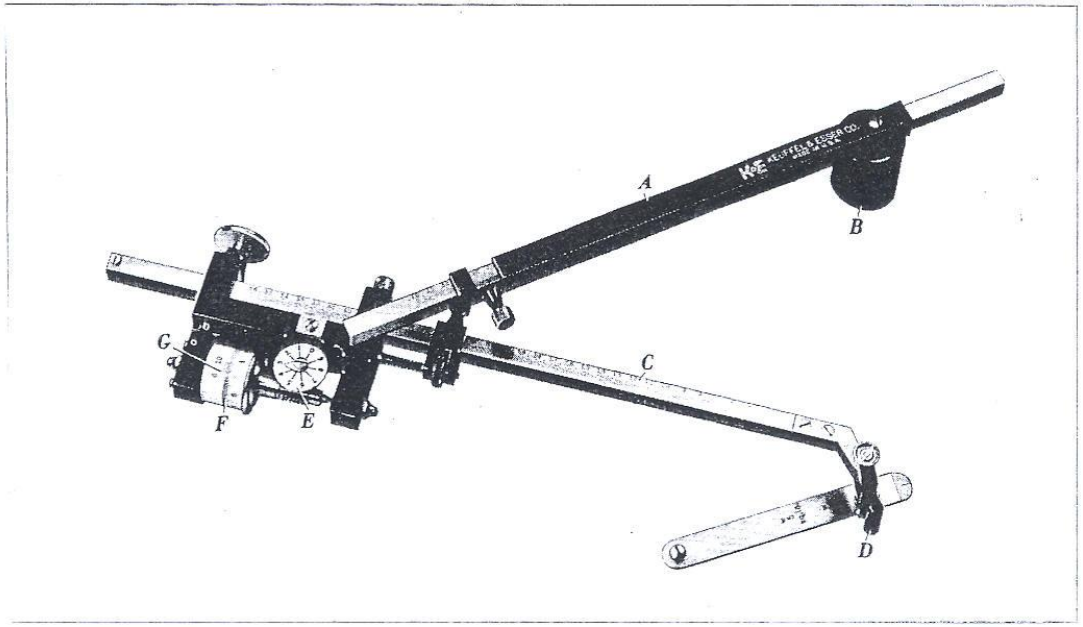


Planimeter ialah sejenis alat yang mengukur luas secara mekanikal. Komponen asasnya adalah seperti di dalam rajah. Ia boleh digunakan untuk mencari keluasan atas plotan/peta bagi sempadan lurus dan tidak lurus dengan cepat

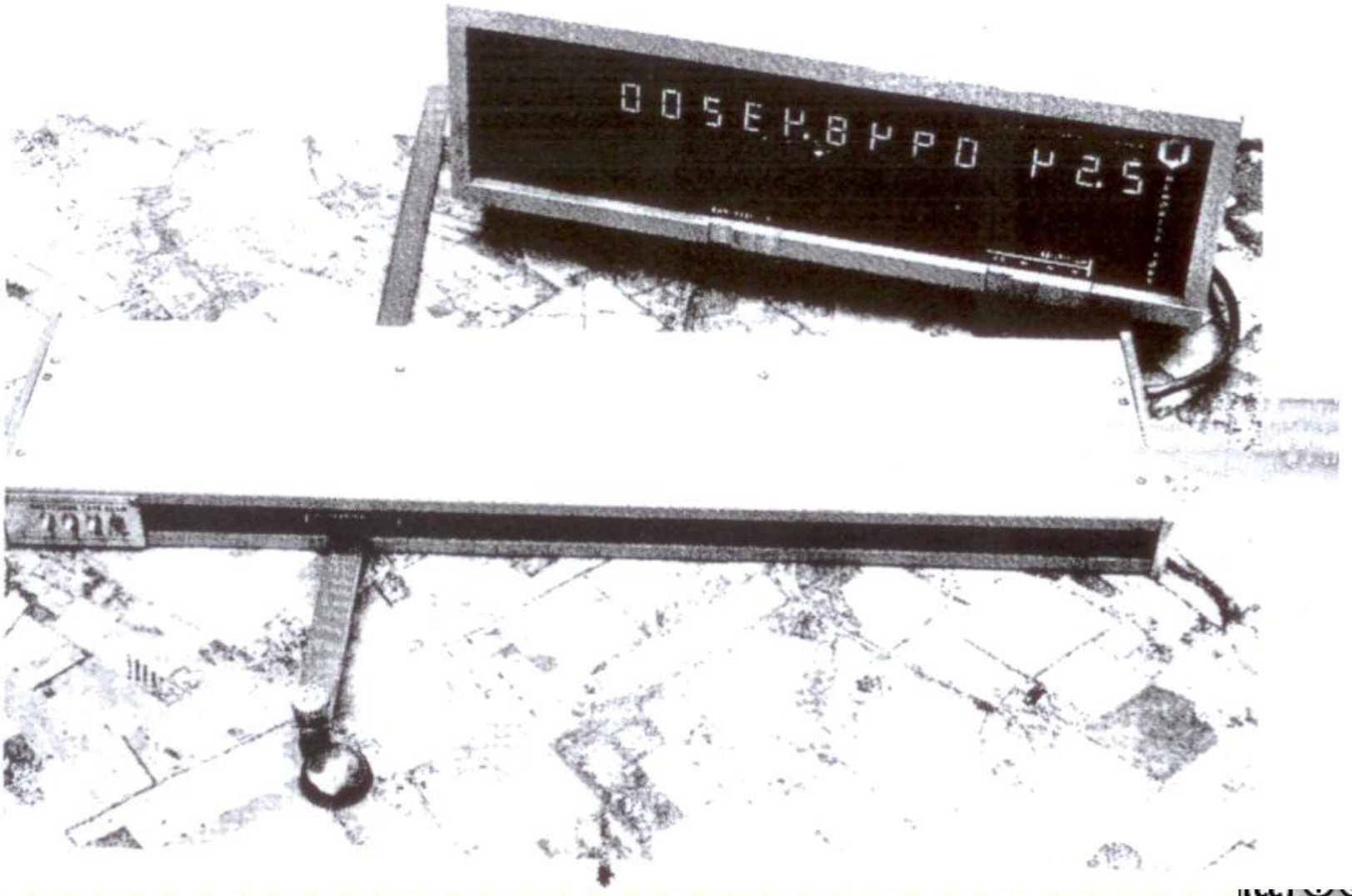
Jenis Planimeter:

1. Fixed Tracing Arm - nilai yang didapati (mm^2) ditukar kepada luas sebenar berdasarkan kepada fungsi bacaan & skala
2. Moveable Tracing Arm - luas sebenar didapati terus
3. Digital Planimeter - memaparkan luas secara langsung

Planimeter Analog



Planimeter Digital

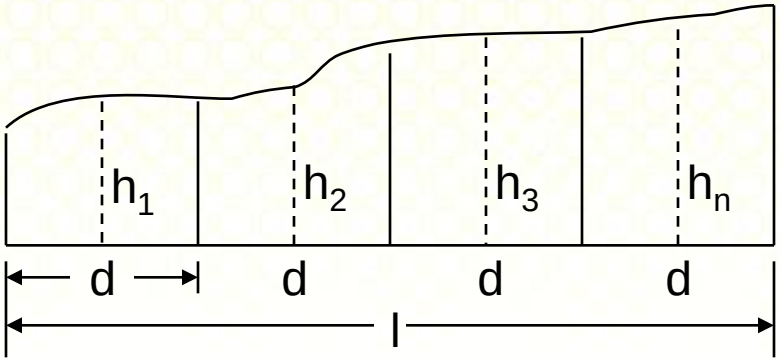


Gabungan Sempadan Lurus & Tidak Lurus

1. Kaedah Ordinat Tengah

Luas = $\frac{(h_1 + h_2 + \ldots.. + h_n)}{n} \times l$

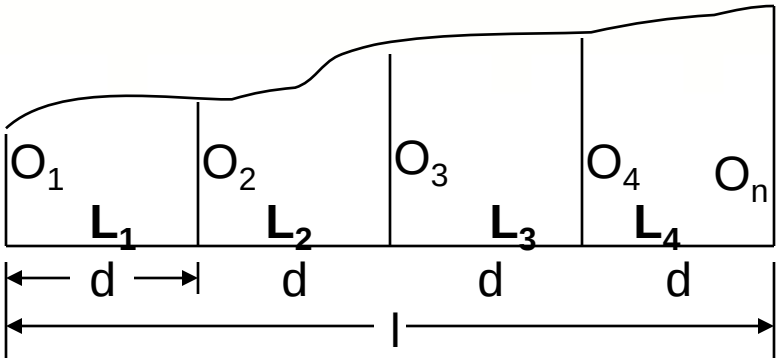
= $(h_1 + h_2 + \ldots.. + h_n) \times d$



2. Kaedah Ordinat Purata

Luas = $\frac{(O_1 + O_2 + \ldots.. + O_n)}{n} \times l$

= $(O_1 + O_2 + \ldots.. + O_n) \times d$



3. Kaedah Trapezoid

$L_1 = \frac{d}{2}(O_1 + O_2)$; $L_2 = \frac{d}{2}(O_2 + O_3)$; $L_3 = \frac{d}{2}(O_3 + O_4)$; $L_4 = \frac{d}{2}(O_4 + O_5)$

Luas $= (L_1 + L_2 + \ldots.. + L_n) = \frac{d}{2}(O_1 + O_2 + O_2 + O_3 + O_3 + \ldots.. + O_{n-1} + O_{n-1} + O_n)$

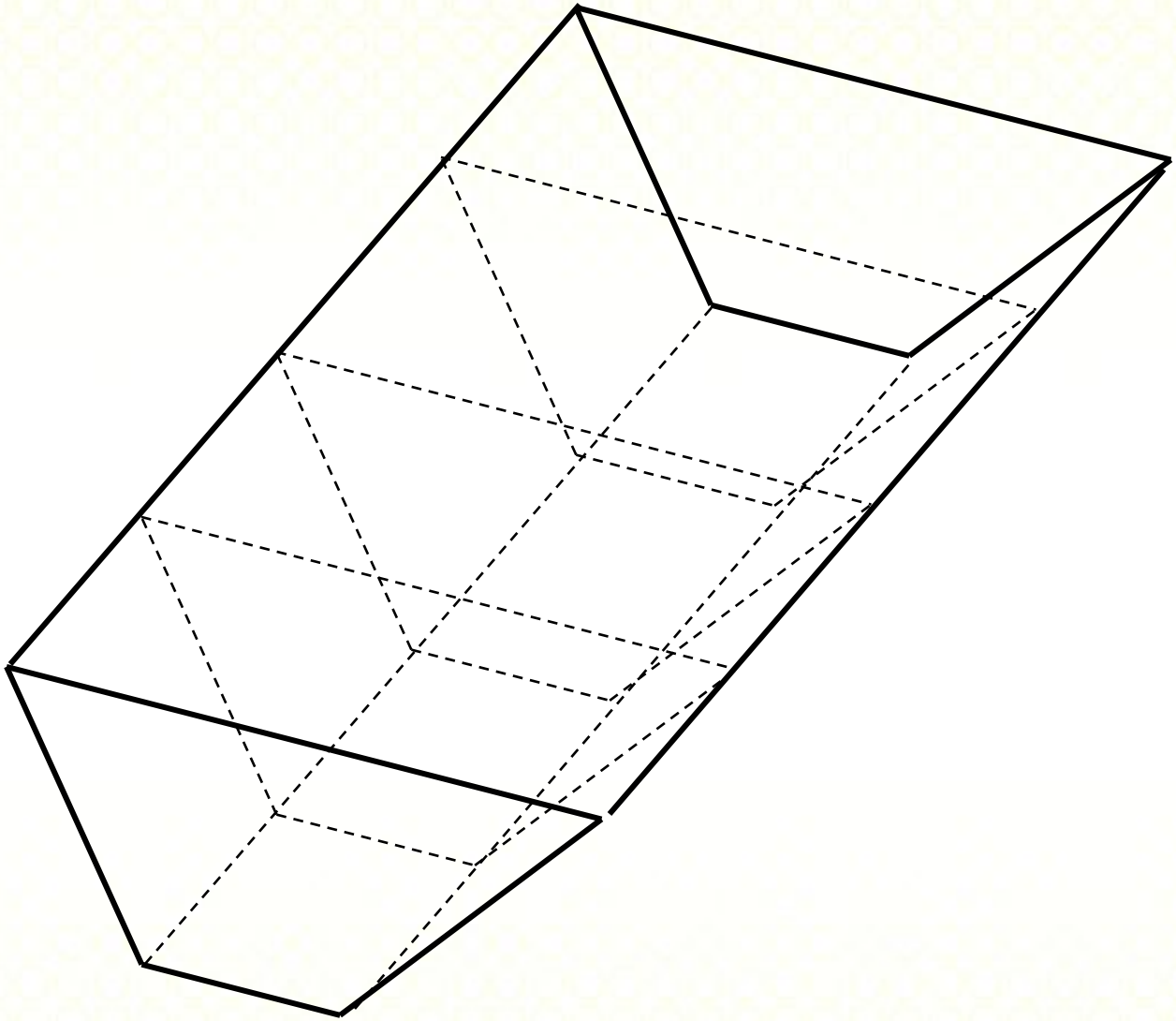
$= d\left(\frac{O_1 + O_n}{2} + O_2 + O_3 + \ldots.. + O_{n-1}\right)$

4. Kaedah Simpson

Luas = $\frac{d}{3}(O_1 + O_n + 2\Sigma O_{ganjil} + 4\Sigma O_{genap})$

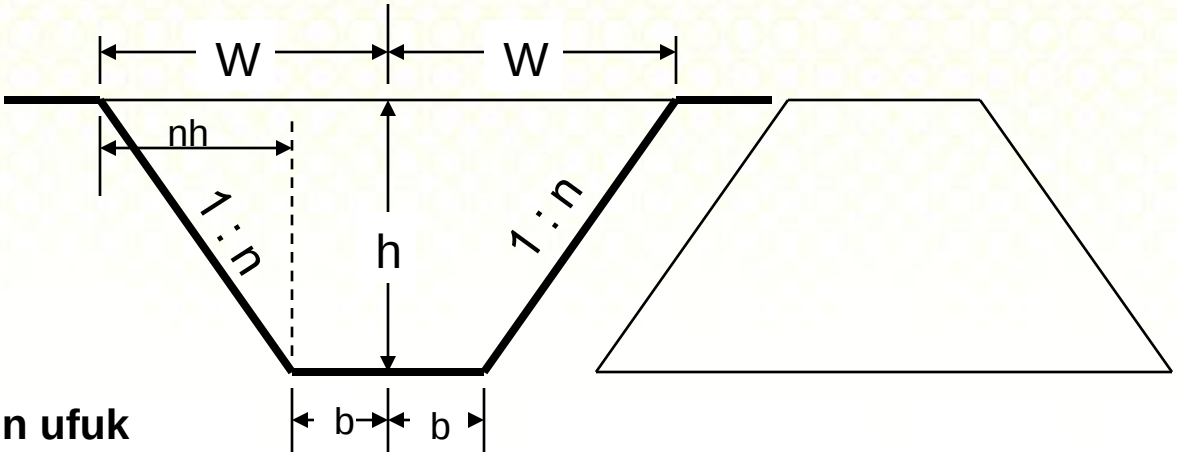
Kaedah Simpson hanya boleh digunakan untuk bilangan ordinat yang ganjil dan ianya lebih tepat daripada kaedah Trapezoid kerana ia anggapkan garisan tidak lurus sebagai parabola (Trapezoid anggapkannya sebagai garis lurus)

Keratan Rentas



Hitungan Luas Keratan Rentas

Keratan Satu Aras



$2W = 2(b + nh)$

$\text{Luas} = [2b + 2(b + nh)] \frac{h}{2}$

$= (2b + nh)h$

Catitan: 1 : n ialah 1 tegak n ufuk

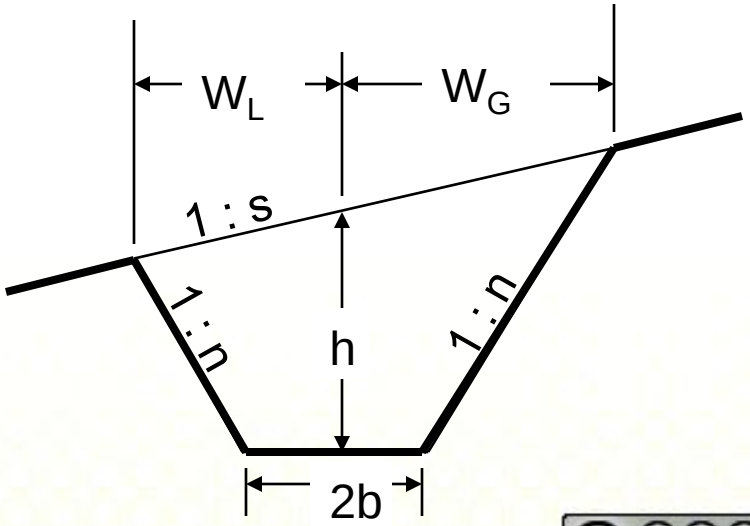
Keratan Dua Aras

$\text{Luas} = \frac{1}{2} [h + b/n] (W_L + W_G) - b^2/n$

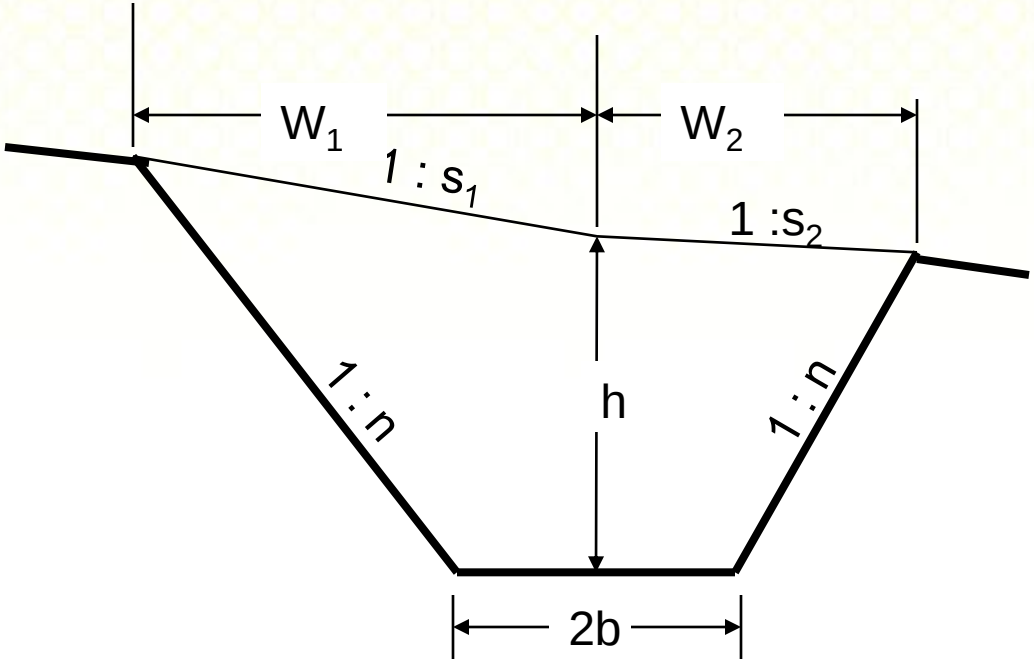
Dimana:

$W_L = \frac{s(b + nh)}{(s + n)}$

$W_G = \frac{s(b + nh)}{(s - n)}$



Keratan Tiga Aras



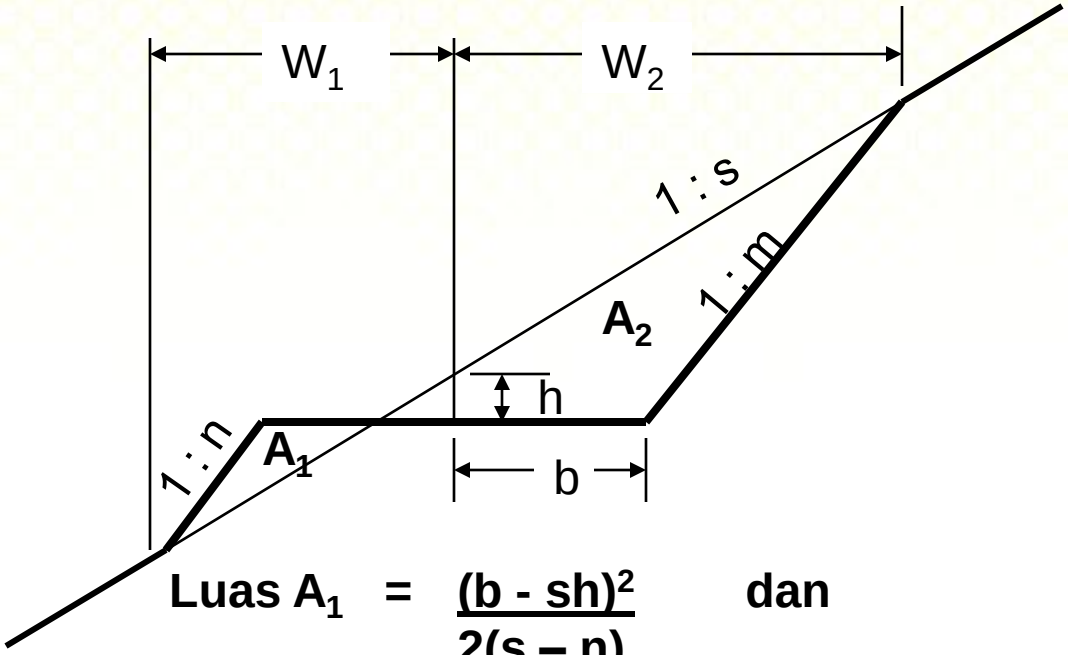
Luas = ½ [h + b/n] (W_1 + W_2) – b^2/n

Dimana:

W_1 = s_1(b + nh) / (s_1 - n)

W_2 = s_2(b + nh) / (s_2 – n)

Keratan Rentas Camporan (Potongan dan Timbusan)



Luas A_1 = $\frac{(b - sh)^2}{2(s - n)}$ dan

Luas A_2 = $\frac{(b + sh)^2}{2(s - m)}$

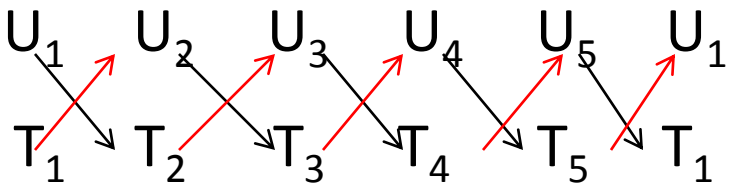
dan:

W_1 = $s_1\frac{(b + nh)}{(s_1 - n)}$

W_2 = $s_2\frac{(b + mh)}{(s_2 - m)}$

kaedah koordinat

2 x keluasan =



$$\text{Keluasan} = \frac{1}{2}\left\{ U1T2 + U2T3 + U3T4 + U4T5 + U5T1 - U2T1 - U3T2 - U4T3 - U5T4 - U1T5 \right\}$$

Contoh:

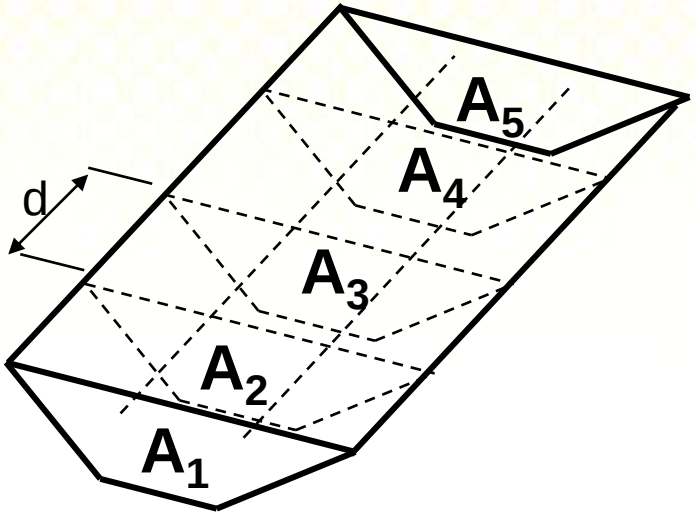
	Koordinat	
Stn No	U/S	T/B
1	100.000	100.000
2	133.283	158.858
3	87.458	222.481
4	8.925	194.949
5	15.457	142.540
1	100.000	100.000
	65406.455	-46474.673
	18931.782	

Keluasan = 18931.782 / 2

= 9465.891 m^2

= 0.947 hektar

HITUNGAN ISIPADU DARIPADA KERATAN RENTAS



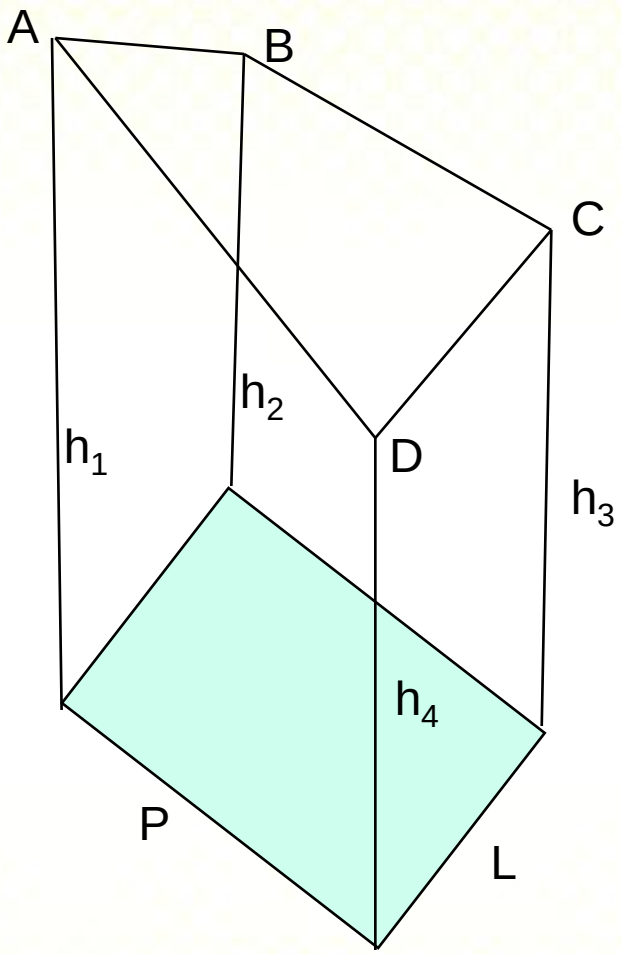
1. **Kaedah Trapezoid**

$$\text{Isipadu} = d\left(\frac{A_1 + A_n}{2} + A_2 + A_3 + \ldots + A_{n-1}\right)$$

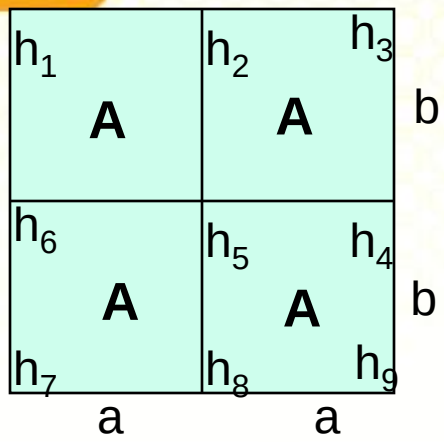
2. **Kaedah Simpson/Prismoid**

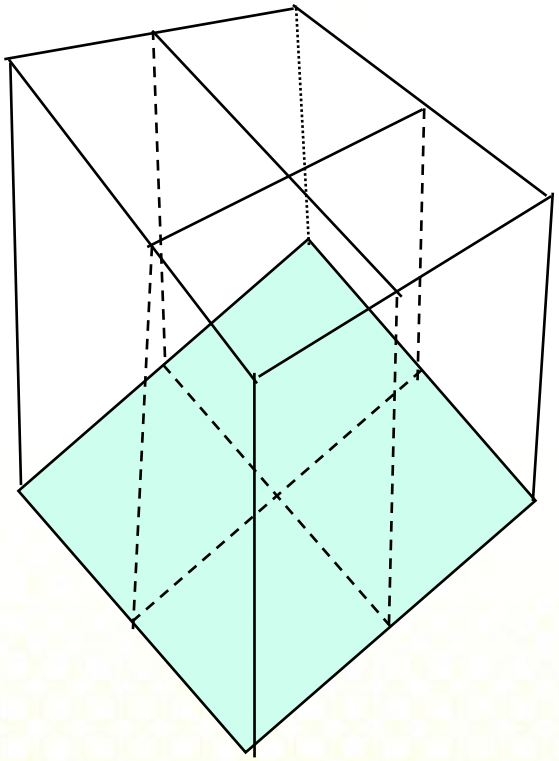
$$\text{Isipadu} = \frac{d}{3}\left(A_1 + A_n + 2\Sigma A_{ganjil} + 4\Sigma A_{genap}\right)$$

HITUNGAN ISIPADU DARIPADA KETINGGIAN TITIK



$$\text{ISIPADU} = \left(\frac{h_1 + h_2 + h_3 + h_4}{4} \right) P \times L$$





$$\text{Isipadu} = \frac{A}{4}(h_1 + h_2 + h_5 + h_6) + \frac{A}{4}(h_2 + h_3 + h_4 + h_5) + \frac{A}{4}(h_4 + h_5 + h_8 + h_9) + \frac{A}{4}(h_5 + h_6 + h_7 + h_8)$$

$$= \frac{A}{4}[(h_1 + h_3 + h_7 + h_9) + 2(h_2 + h_4 + h_6 + h_8) + 4(h_5)]$$

$$= \frac{\text{Luas Grid}}{4}[\Sigma(\text{Ketinggian Se Kali}) + 2\Sigma(\text{Ketinggian Dua Kali}) + 3\Sigma(\text{Ketinggian Tiga Kali}) + 4\Sigma(\text{Ketinggian Empat Kali}) + \ldots\ldots\ldots]$$

A T A U

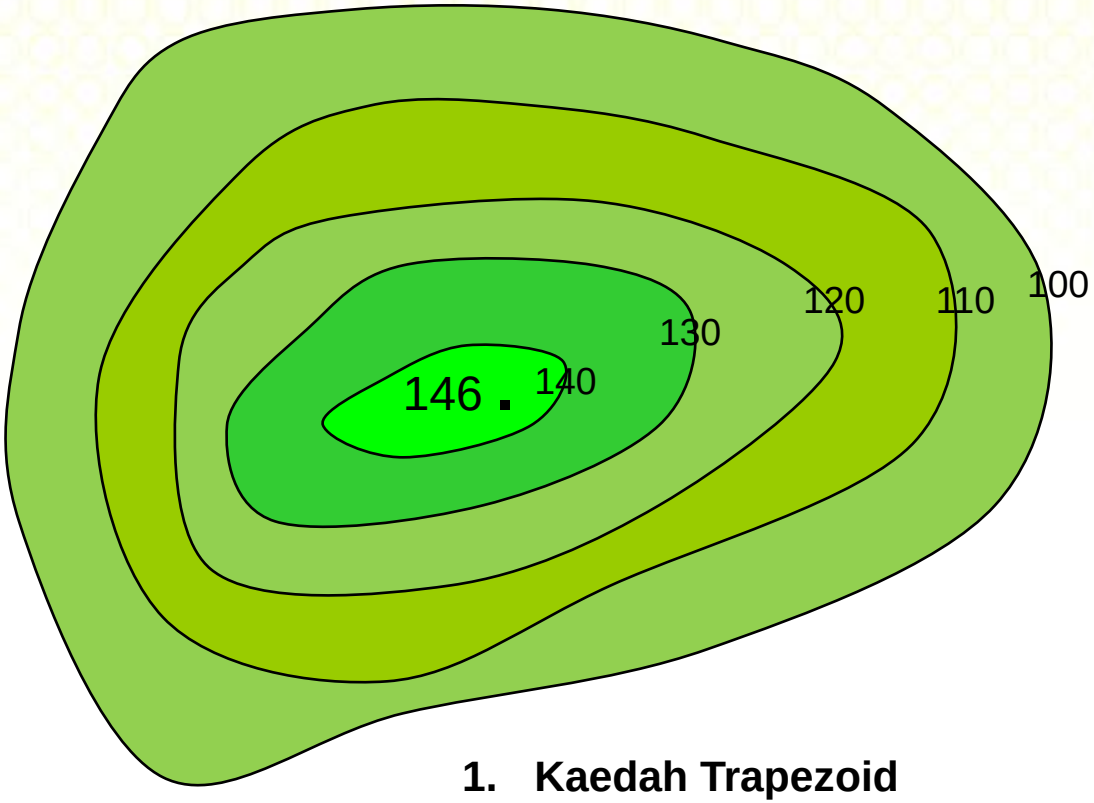
Isipadu = Luas Tapak x Purata Ketinggian
= 2a x 2b x H

Di mana:

h	n	n x h
h1	1	x1
h2	2	x2
h3	1	x3
h4	2	x4
h5	4	x5
h6	2	x6
h7	1	x7
h8	2	x8
h9	1	x9
Σ	16	X

H = X/16

HITUNGAN ISIPADU DARIPADA GARIS KONTOR



A_1 = Luas garis kontor 100
A_2 = Luas garis kontor 110
A_3 = Luas garis kontor 120
A_4 = Luas garis kontor 130
A_5 = Luas garis kontor 140
Dan
d = sela kontor (10)

1. **Kaedah Trapezoid**

$$\text{Isipadu} = d\left(\frac{A_1 + A_n}{2} + A_2 + A_3 + \ldots + A_{n-1}\right)$$

2. **Kaedah Simpson/Prismoid**

$$\text{Isipadu} = \frac{d}{3}\left(A_1 + A_n + 2\Sigma A_{ganjil} + 4\Sigma A_{genap}\right)$$

Catitan: Bagi kawasan puncak, dapatkan anggaran dengan menggunakan rumus untuk kontur