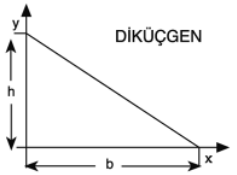
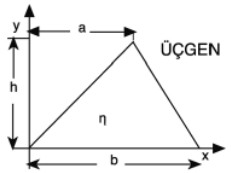
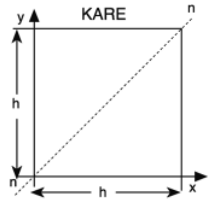
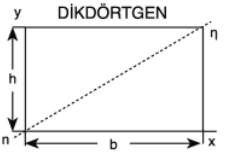
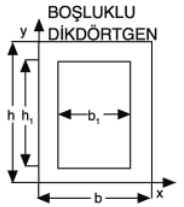
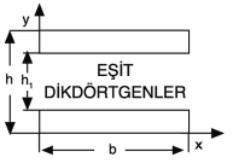
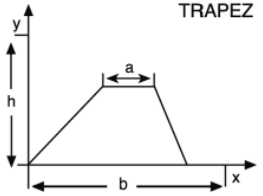
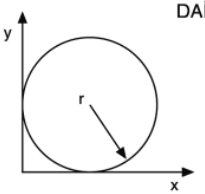
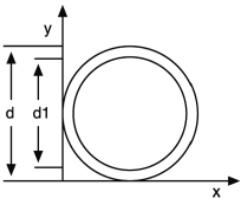
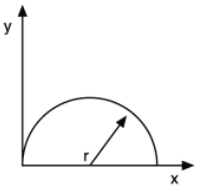
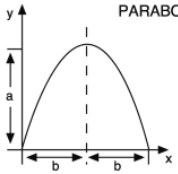
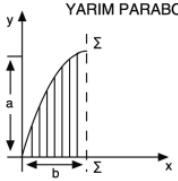
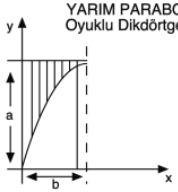
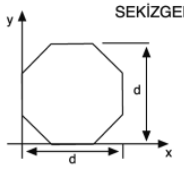
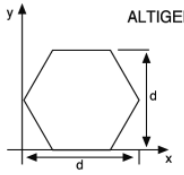
Düzlemsel Geometrik Şekillerin Özellikleri

Geometrik Şekil	Alan - Geometrik Merkez	Eylemsizlik Momenti	Dayanım Momenti
	$A = \frac{bh}{2}$ $X_c = \frac{b}{3}$ $Y_c = \frac{h}{3}$	$I_{xc} = bh^3 / 36$ $I_{yc} = hb^3 / 36$ $I_x = bh^3 / 12$ $I_y = hb^3 / 12$	$W_{xc} = \frac{bh^2}{24}$ $W_{yc} = \frac{hb^2}{24}$
	$A = \frac{bh}{2}$ $X_c = \frac{a+b}{3}$ $Y_c = \frac{h}{3}$	$I_{xc} = bh^3 / 36$ $I_{yc} = \frac{bh}{36}(b^2 - ab + a^2)$ $I_x = bh^3 / 12$ $I_y = \frac{bh}{12}(b^2 - ab + a^2)$	$W_{xc} = \frac{bh^2}{24}$
	$A = h^2$ $X_c = \frac{h}{2}$ $Y_c = \frac{h}{2}$	$I_{xc} = I_{xc} = h^4 / 12$ $I_x = I_y = h^4 / 3$ $I_\pi = h^4 / 12$	$W_{xc} = W_{yc} = \frac{h^3}{6}$
	$A = b.h$ $X_c = \frac{b}{2}$ $Y_c = \frac{h}{2}$	$I_{xc} = bh^3 / 12$ $I_{yc} = hb^3 / 12$ $I_x = bh^3 / 3$ $I_y = hb^3 / 3$ $I_y = hb^3 / 3$ $I_\pi = \frac{b^3 h^3}{6(b^2 + h^3)}$	$W_{xc} = \frac{bh^2}{6}$ $W_{yc} = \frac{hb^2}{6}$
	$A = bh - b_1 h_1$ $X_c = \frac{b}{2}$ $Y_3 = \frac{h}{2}$	$I_{xc} = \frac{(bh^3 - b_1 h_1^3)}{12}$ $I_{yc} = \frac{(hb^3 - h_1 b_1^3)}{12}$	$W_{xc} = \frac{1}{6}\left(\frac{bh^3 - b_1 h_1^3}{h}\right)$ $W_{yc} = \frac{1}{6}\left(\frac{hb^3 - h_1 b_1^3}{b}\right)$
	$A = b(h - h_1)$ $X_c = \frac{b}{2}$ $Y_c = \frac{h}{2}$	$I_{xc} = \frac{b(h^3 - h_1^3)}{12}$ $I_{yc} = \frac{b^3(h - h_1)}{12}$	$W_{xc} = \frac{b(h^3 - h_1^3)}{6h}$ $W_{yc} = \frac{b^2(h - h_1)}{6}$

Düzlemsel Geometrik Şekillerin Özellikleri

Geometrik Şekil	Alan - Geometrik Merkez	Eylemsizlik Momenti	Dayanım Momenti
TRAPEZ 	$A = \frac{h}{2}(a+b)$ $y_c = \frac{h}{3}\frac{(2a+b)}{a+b}$	$I_{xc} = \frac{h^3(a^2+4ab+b^2)}{36(a+b)}$ $I_x = \frac{h^3(3a+b)}{12}$	$W_{xc} = \frac{I_{xc}}{h-y_c}$
DAİRE 	$A = \pi r^2$ $X_c = r$ $Y_c = r$	$I_{xc} = I_{xc} = \frac{\pi r^4}{4}$ $I_x = I_y = \frac{5\pi a^4}{4}$	$W_{xc} = W_{yc} = \frac{\pi r^3}{4}$
BOŞLUKLU DAİRE 	$A = \frac{\pi(d^2-d^2_1)}{4}$ $X_c = \frac{d}{2}$ $Y_c = \frac{d}{2}$	$I_{xc} = I_{yc} = \frac{\pi(d^4-d^4_1)}{64}$	$W_{xc} = W_{yc} = \frac{\pi(d^4-d^4_1)}{32d}$
YARIM DAİRE 	$A = \frac{\pi r^2}{2}$ $X_c = r$ $Y_c = \frac{4r}{3\pi}$	$I_{xc} = \frac{r^4(9\pi^2-64)}{72\pi}$ $I_{yc} = \frac{\pi r^4}{8}$ $I_x = \frac{\pi r^4}{8}$ $I_y = \frac{5\pi r^4}{8}$	$W_{xc} = \frac{I_{xc}}{(r-y_c)}$ $W_{yc} = \frac{\pi r^3}{8}$

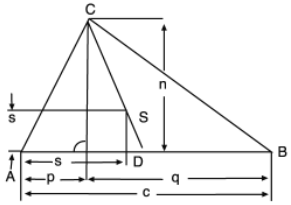
Düzlemsel Geometrik Şekillerin Özellikleri

Geometrik Şekil	Alan - Geometrik Merkez	Eylemsizlik Momenti	Dayanım Momenti
	$A = \frac{4}{3} ab$ $X_c = b$ $y_c = \frac{2}{5} a$	$I_{xc} = \frac{16}{175} a^3 b$ $I_{xc} = \frac{4}{15} ab^3$ $I_x = \frac{32}{105} a^3 b$	$W_{xc} = \frac{16}{105} a^2 b$ $W_{yc} = \frac{4}{15} ab^2$
	$A = \frac{2}{3} ab$ $X_c = \frac{5}{8} b$ $y_c = \frac{2}{5} a$	$I_{xc} = \frac{8}{175} a^3 b$ $I_{yc} = \frac{19}{480} ab^3$ $I_x = \frac{16}{105} a^3 b$ $= \frac{2}{15} ab^3$	$W_{xc} = \frac{8}{105} a^2 b$ $W_{yc} = \frac{19}{300} ab^2$
	$A = \frac{1}{3} ab$ $X_c = \frac{1}{4} b$ $y_c = \frac{7}{10} a$	$I_{xc} = \frac{37}{2100} a^3 b$ $I_{yc} = \frac{1}{80} ab^3$	$W_{xc} = \frac{37}{1470} a^2 b$ $W_{yc} = \frac{1}{60} ab^2$
	$A = 0.8284\ d^2$ $X_c = y_c = \frac{d}{2}$	$I_{xc} = I_{yc} = 0.055\ d^4$	$W_{xc} = W_{yc} = 0.110\ d^3$
	$A = 0.866\ d^2$ $X_c = y_c = \frac{d}{2}$	$I_{xc} = I_{yc} = 0.06\ d^4$	$W_{xc} = W_{yc} = 0.120\ d^3$

A = geometrik şeklin alanı
X_c, y_c = alan geometrik merkezinin x ve y koordinatları
I_{xc}, I_{yc} = alanın geometrik merkezden geçen ve x, y koordinat eksenlerine paralel olan eksenler etrafındaki eylemsizlik momentleri
I_x, I_y = alanın x, y koordinat eksenleri etrafındaki eylemsizlik momentleri
W_{xc}, W_{yc} = alanın geometrik merkezden geçen ve x, y koordinat eksenlerine paralel olan eksenler etrafındaki dayanım momentleri

Ağırlık Merkezleri

ÜÇGEN

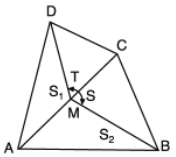


SD =1/3 CD; AD = BD

S = 1/3 h

$S^1 = 1/3\ (q + 2p) = 1/3\ (c + p)$

DÖRTGEN

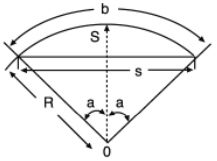


S_1 ve S_2 sıra ile Δ A B C ve Δ A C D ağırlık merkezleri;

S_1 T = S S_2

S Dörtgenin ağırlık merkezidir.

DAİRE YAYI



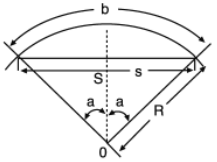
$$OS = \frac{R \sin \alpha}{\alpha^0} \times \frac{180}{\pi} - \frac{Rs}{b}$$

Yarım Daire OS = 2R / π = 0.6366 R

Dörttebir Daire OS = 2R 2 / √π = 0.9003 R

Altıdabir Daire OS = 3R / π = 0.9549 R

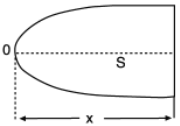
DAİRE PARÇASI

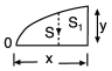


F = Alan

$$OS = \frac{s^3}{12F} = \frac{2}{3} \frac{R \sin^3 \alpha}{\frac{\alpha^0 \pi}{180} - \sin\alpha \cos\alpha} \times F$$

PARABOL PARÇASI





$$OS = \frac{3}{5} x : SS_1 = \frac{3}{8} Y$$

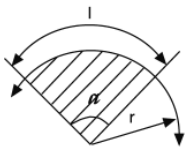
PRİZMA
Üst ve alt yüzeylerin ağırlık merkezlerini birleştiren doğrunun orta noktası

PİRAMİT
Tepe noktasını taban ağırlık merkezine birleştiren doğru üzerinde tabandan itibaren yüksekliğin dörtte birinde

KONİ
Tepe noktasını taban ağırlık merkezine birleştiren doğru üzerinde tabandan itibaren yüksekliğin dörtte birinde

Alan - Çevre

DAİRE DİLİMİ



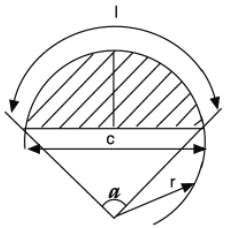
l = Yay boyu, α = Merkez Açısı, r = Yarıçap, A = Alan

$A = \frac{\pi \times r^2 \times \alpha}{360} = 0.008727 \times \alpha \times r^2$

$l = \frac{2 \times \pi \times r \times a}{360} = \frac{\pi \times r \times a}{180}$

$\alpha = \frac{57.295 \times l}{r}$ $r = \frac{2 \times A}{l} = 57.295 \times l \div \alpha$

DAİRE KESMESİ



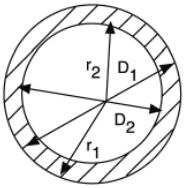
A = Alan, l = Yay boyu, c = Kiriş, r = Yarıçap, α = Merkez Açısıdır

$c = 2\sqrt{h\,(2r - h)}$ $l = 0.01745 \times r \times \alpha$

$h = r - \frac{1}{2}\sqrt{4r^2 - c^2}$ $r = (c^2 + 4h^2) \div 8h$

$\alpha = 57.295 \times l \div r$ $A = \frac{r \times 1}{2} - \frac{c(r - h)}{2}$

DAİRE HALKASI



D_1 ve D_2 = Büyük ve küçük dairelerin çapları

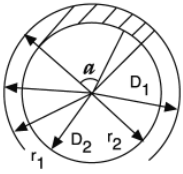
r_1 ve r_2 = Büyük ve küçük dairelerin yarıçapları

A = Dairesel halkanın alanıdır.

$A = \frac{\pi}{4}(D_1^2 - D_2^2)$

$A = \frac{\pi}{4}(D_1 + D_2)(D_1 - D_2)$ $A = \pi(r_1^2 - r_2^2)$ olur

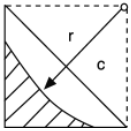
HALKA PARÇASI



A = Parça Alanı, α = Merkez Açısıdır.

$A = \frac{\alpha \pi}{360}\left(r_1^2 - r_2^2\right)$

TARALI ALAN



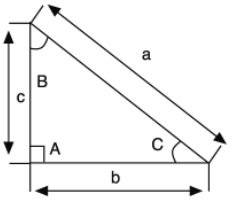
A = Alan, c= Kiriş boyudur.

$A = r^2 - \left(\frac{\pi \times r^2}{4}\right) = 0.125 \times r^2 = \frac{1}{2} r^2$

$A = 0.1075 \times c^2$

Alan - Çevre

DİK ÜÇGEN

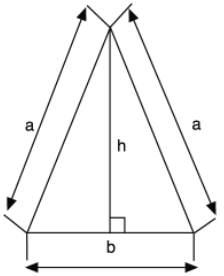


A= Alan, a= Hipotenüs, b ve c = Dik Kenarlar

$A = \frac{b \times c}{2}$ $a = \sqrt{b^2 + c^2}$

$b = \sqrt{a^2 - c^2}$ $c = \sqrt{a^2 - b^2}$ $Ç = a + b + c$

İKİZKENAR ÜÇGEN

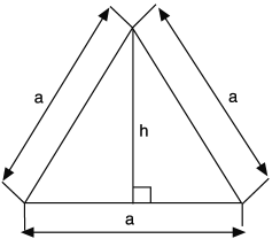


$A = \frac{h \times b}{2}$ $Ç = b + 2 \times a_2$

$a = \sqrt{\left(\frac{b}{2}\right)^2 + h^2}$ $h = \sqrt{a^2 - \left(\frac{b}{2}\right)^2}$

$b = 4\sqrt{a^2 - h^2}$

EŞİTKENAR ÜÇGEN

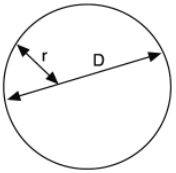


$A = \frac{a \times h}{2}$ $A = 0.433 \times a^2$

$Ç = 3 \times a$

$h = \frac{a\sqrt{3}}{2}$

DAİRE



D= Çap, r = Yarıçap, A= Alan, Ç= Çevre

$A = \pi \times r^2 = \frac{\pi \times D^2}{4} = 0.785398 \times D^2$

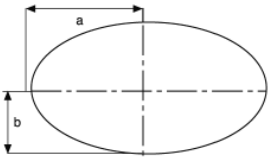
$D = \frac{2\sqrt{A}}{\sqrt{\pi}} = 1.128379$ $\sqrt{A}$ $\sqrt{\pi} = 1.7724539$

$D = \frac{Ç}{\pi} = 3.141593 \times Ç$

$Ç = 2 \times \pi r = \pi \times D = 3.141593 \times D$

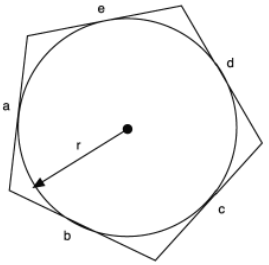
Alan - Çevre

ELİPS



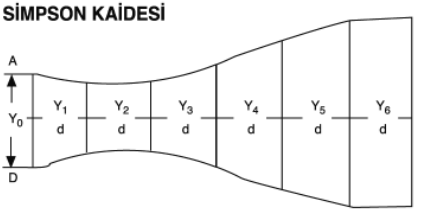
A = Alan, a = Büyük Yarıçap, b = Küçük Yarıçap
$A = \pi \times a \times b$ $Ç = \pi (a + b)$ (yaklaşık)
$Ç = \pi [1.5 (a + b) - \sqrt{ab}]$ (daha iyi yaklaşık)

DAİRENİN DIŞINA ÇİZİLEN HERHANGİ BİR ÇOKGEN



A = Alan, r = Dairenin Yarıçapı, ve
a, b,c, d, e = Çokgenin Kenarları
$A = 1/2 (a+b+c+d+e) \times r$
$Ç = a + b + c + d + e$

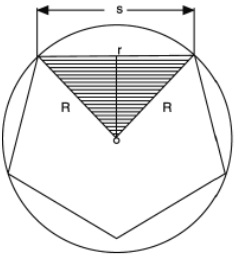
SİMPSON KAİDESİ



A, B, C, D, Alanı : iki bitişik dilimi sınırlayan eğri parçası bir parabol yayı olarak alınabilecek küçük d genişliğinde eşit dilimlere ayrılır ve şu formül ile hesaplanır.

$F = d/3 [Y_0 + Y_n + 2 (Y_2 + Y_4 + ...) + 4 (Y_1 + Y_3 + ...)]$

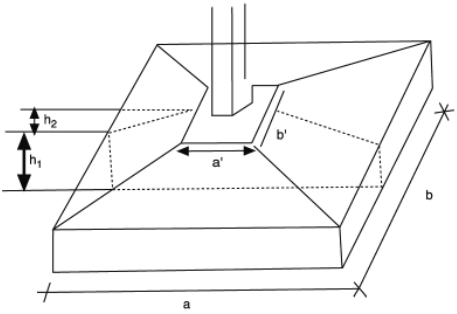
EŞİTKENAR ÇOKGEN (Kenar Sayısı : n)



Kenar Sayısı	Alan : F			Kenar : s		Dış daire Yarıçapı : R		İç daire Yarıçapı : r	
	$\frac{F}{s^2}$	$\frac{F}{R^2}$	$\frac{F}{r^2}$	$\frac{s}{R}$	$\frac{s}{r}$	$\frac{R}{s}$	$\frac{R}{r}$	$\frac{r}{R}$	$\frac{r}{s}$
3	0.4330	1.2990	5.1962	1.7321	3.4641	0.5774	2.000	0.5000	0.2887
4	1.000	2.0000	4.000	1.4142	2.000	0.7071	1.4142	0.7071	0.5000
5	1.7205	2.3776	3.6327	1.1756	1.4531	0.8507	1.2361	0.8090	0.6882
6	2.5981	2.5981	3.4641	1.000	1.1547	1.000	1,1547	0.8660	0.8660
8	4.8284	2.8284	3.3137	0.7654	0.8284	1.3066	1.0824	0.9239	1.2071
10	7.6942	2.9389	3.2492	0.6180	0.6498	1.6180	1.0515	0.9511	1.5388
12	11.196	3.0000	3.2154	0.5176	0.5359	1.9319	1.0353	0.9659	1.8660

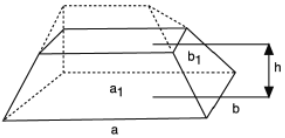
Hacimler

DİKDÖRTGEN PİRAMİTİN HACMİ (Temel Şekil)



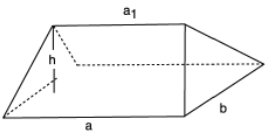
Alt Taban Alanı
$A_1 = a \times b$
Alt Taban Alanı
$A_2 = a' \times b'$
$V = A_1 \times h_1 + 1/3\ h_2 [\ A_1 + A_2 + \sqrt{(A_1 \times A_2)}\ ]$

KUM FİGÜRESİ VEYA SÖMEL OBELİSK



$V = h/6 [a \times b + (a + a_1) (b + b_1) + a_1 + b_1]$
Örnek ;
a = 8m, b=6 m, h= 1 m Eğim 1:1.5
$a_1 = 8 - 2 \times 1 \times 1.5 = 5m$
$b_1 = 6 - 2 \times 1 \times 1.5 = 3m$
$V = 1/6 [8 \times 6 + (8 + 5) (6 + 3) + 5 + 3] = 30m^3$

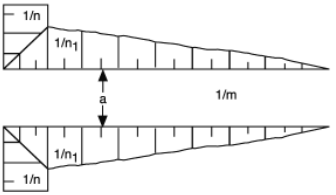
ÇATI (Kama)



$$V = \frac{h \times b}{6} (2 X a + a_1)$$

RAMPA

$$V = \frac{h^2}{6} \left[3 \times a + 2\, n_1 \times h \frac{m - n}{m} \right] (m - n)$$



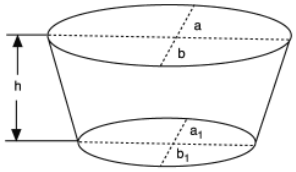
Örnek :
h= 1.5 m
a= 2.5, m= 12, n= n_1= 1

$$V = \frac{1.5^2}{6} \left[(3 \times 2.5) + 2 \times 1 \times 1.5 \frac{12-1}{12} \right] (12 - 1)$$

$= 42.28\ m^3$

Hacimler

TEKNE



a, b, a_1, b_1 Elips yarım eksenleri

$$V = \frac{\pi \times h}{6} \left[(2 \times a + a_1) b + (2a_1 + a) b_1 \right]$$

Örnek:

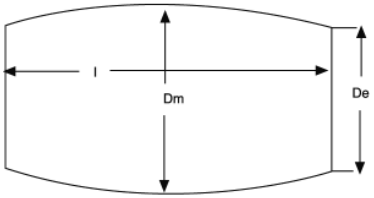
a = 45 cm, a_1 = 40 cm

b = 25 cm, b_1 = 20 cm, h = 50 cm

$$V = \frac{\pi \times 50}{6} \left[(2 \times 45 + 40) 25 + (2x40 + 45)x 20 \right]$$

=150.5 litre

FIÇI



Daire Kesiti

$$V = \frac{\pi \times 1}{12} (2 Dm^2 + De^2)$$

Parabol Kesitli

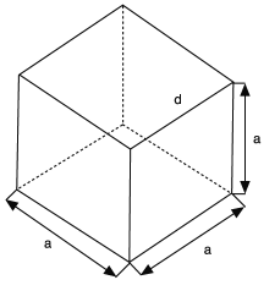
$$V = \frac{1}{15} (2 Dm^2 + Dm^2 \times De + 3 De^2)$$

Örnek:

De = 50 cm, Dm = 70cm, l = 100 cm

$$V = \frac{\pi \times 100}{12} (2 \times 70^2 + 50^2) cm^3 = 321.91 \text{ litre}$$

KÜP



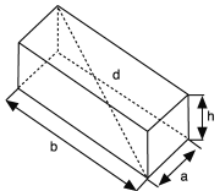
V = Hacim, A= Küpün yüzey Alanı, d = Köşegendir.

$$V = a^3 \quad a = \sqrt{\frac{A}{6}} = \sqrt[3]{v}$$

$$A = 6 \times a^2$$

$$d = a\sqrt{3}$$

DİKDÖRTGENLER PRİZMASI



V = Hacim, A= Küpün yüzey Alanı, d = Köşegendir.

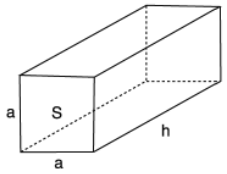
$$V = a \times b \times h$$

$$A = 2 \times ab + 2 \times ah + 2x\, bh = 2 \times (ab + ah + bh)$$

$$d = \sqrt{a^2 + b^2 + h^2}$$

Hacimler

KARE PRİZMA



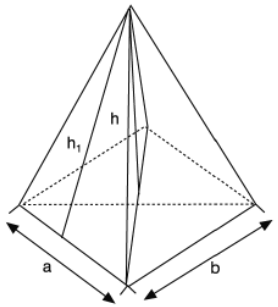
V = Hacim, S = Taban Alanıdır, A = Prizmanın Yüzey Alanı

$V = S \times h$

$A = 2 \times a^2 + 4 \times a \times h$ ya da

$A = 2a\,(a + 2h)$

PİRAMİT

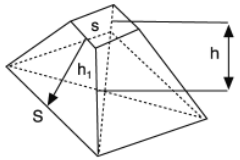


S = Taban Alanı, A = Piramitin Tüm Yüzeyi, V = Hacimdir.

$$V = \frac{a \times b \times h}{3} = \frac{S \times h}{3}$$

$A = ab + ah_1 + bh_1$

KESİK PİRAMİT

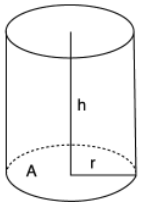


S = Taban Alanı, s = Üst Tabanın Alanı,

h = Piramitin Yüksekliği, h1 = Yanal Yüzlerin Yüksekliği, V = Hacimdir.

$$V = \frac{h}{3}\left(S + s + \sqrt{Ss}\right)$$

SİLİNDİR



S = Taban Alanı, A = Silindirin Tüm Yüzeyi, V = Hacim

h = Silindirin Yüksekliği, r = Silindir Taban Dairesi Yarıçapı

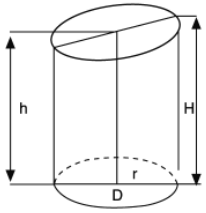
$V = S \times h$

$$V = \pi \times r^2 \times h = \frac{\pi \times D^2}{4} = 0.785398 \times D^2 \times h$$

$A = 2 \times \pi \times r^2 + 2 \times \pi r \times h = 2\pi r\,(r + h) = 6.28 \times r\,(r + h)$

Hacimler

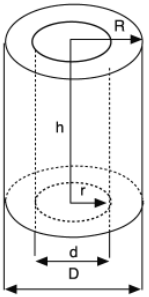
SİLİNDİR PARÇASI



D = Silindirin Taban Dairesi Çapı
S = Silindir Parçasının Yanal Yüzeyinin Alanı
r = Taban Dairesi Yarıçapı, V= Hacim, H ve h= Yüksekliklerdir.

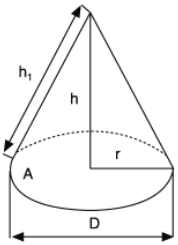
$V = 1.5708 \times r^2 (H + h)$

İÇİ BOŞ SİLİNDİR



S = Dış Yanal Yüzün Alanı, S_1 = İç Yanal Yüzün Alanı,
D ve d = Büyük ve Küçük Silindirlerin Çapları,
R ve r = Büyük ve Küçük Silindirlerin Yarıçapları
V = Hacim
$V = \pi \times R^2 \times h - \pi \times r^2 \times h = (R^2 - r^2) \pi.h$
$S = \pi \times D \times h \quad S_1 = \pi \times d \times h$

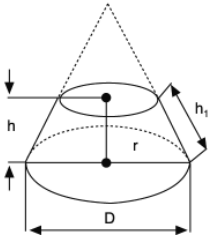
KONİ



S = Koninin Yanal Yüzeyinin Alanı, V = Hacimdir.
$S = \pi \times r \sqrt{r^2 + h^2} = \pi \times r \times h_1 = 1.5708 \times D \times h_1$

$V = \frac{\pi \times r^2 \times h}{3} = 1.0472 \times r^2 \times h = 0.2618 \times D^2 \times h$

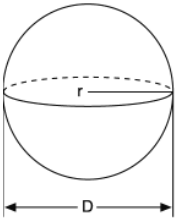
KESİK KONİ



S = Yanal Yüzeyin Alanı, D ve d = Üst ve Alt tabanların Çapları,
h ve h_1 = Koni ve Yanal Yüzün Yükseklikleri, V = Hacimdir.
$S = \pi \times h_1 (R + r) = 1.570796 \times h_1 (D + d)$
$V = 1.0472 \times h (R^2 + r^2 + Rr)$
a = R - r olduğundan
$h_1 = \sqrt{a^2 + h^2} = \sqrt{(R - r)^2 + h^2}$ olur.

Alan - Hacim

SİLİNDİR PARÇASI



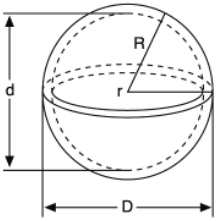
A = Kürenin Dış Yüzeyinin Alanı, r = Yarıçap ve V = Hacimdir.

$A = 4x\ \pi\ x\ r^2$

$A = 12.566371\ x\ r^2 = \pi\ x\ D^2$

$V = \frac{4\ x\ \pi\ x\ r^3}{3} = 4.188\ \ 790\ x\ r^3 = \frac{\pi}{6}\ D^3\ = 0.5236\ x\ D^3$

İÇİ BOŞ KÜRE



V = Hacim, A = Kürenin Tüm Alanı,

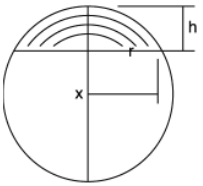
D ve d = Dış ve İç Çaplar,

R ve r = Dış ve İç Yarıçaplar

$V = \frac{4}{3} = \pi\ (R^3 - r^3)$

$V = 4\ x\ \pi\ (R^2 + r^2)$

KÜRE PARÇASI



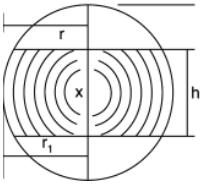
R = Kürenin Yarıçapı, r = Küre Parçasının Yarıçapı

$V = \frac{\pi\ x\ h}{6} = (3\ r^2 + h^2)$ ya da

$V = 0.523598\ x\ h\ (3\ r^2 + h^2)$

$A = 2\ x\ \pi\ \ Rh$ veya $A = 2\ x\ \pi\ x\ R\ (R - \sqrt{R^2 - r^2})$

KÜRESEL BÖLGE

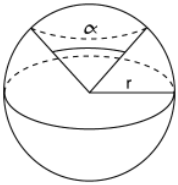


$V = \frac{\pi\ x\ h}{6} = \left[\ 3\ (r^2 + r_1^2) + h^2\ \right]$ ya da

$V = 0.5236\ x\ h\ \left[\ 3\ (r^2 + r_1^2) + h^2\ \right]$

Alan - Hacim

KÜRESEL KAMA

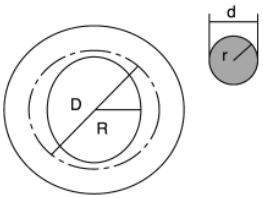


A = Küresel Kamanın Alanı, V = Küresel Kamanın Hacmi

$$V = \frac{\alpha}{360} \times \frac{4 \times \pi \times r^3}{3} = 0.0116 \times \alpha \times r^3$$

$$A = \frac{\alpha}{360} \times 4 \times \pi r^2 = \frac{\alpha}{90} \pi \times r^2 = 0.0348 \times \pi \times r^2$$

DAİRESEL KESİTLİ HALKA

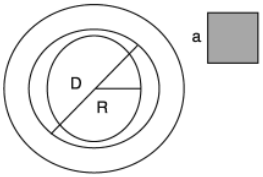


A = Halka Yüzeyinin Alanı, V = Halkanın Hacmi

$V = 4 \times \pi^2 \times R \times r = 19.739\ Rr^2$

$A = 4 \times \pi^2 \times Rr = 39.478418 \times Rr$

KARE KESİTLİ HALKA

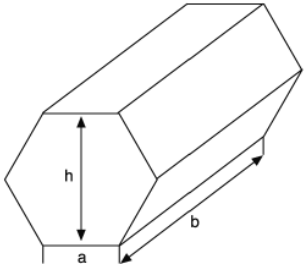


A = Halka Yüzeyinin Alanı, V = Halkanın Hacmi

$V = 4 \times \pi \times D \times a = 12.566 \times D \times a$

$V = \pi \times D \times a^2 = 3.1416 \times D \times a^2$

ALTIGEN PRİZMA



A = Yanal Yüzeyinin Alanı, V = Altıgen Prizmanın Alanıdır

$A = 6 \times a\ b$ ya da $A = 3.46 \times h\ b$

$V = 2.6 \times a^2 b$ ya da

$V = 0.866 \times h^2 b$