

Parlem de tangrams!

De la Xina a Egipte passant per Cornellà...

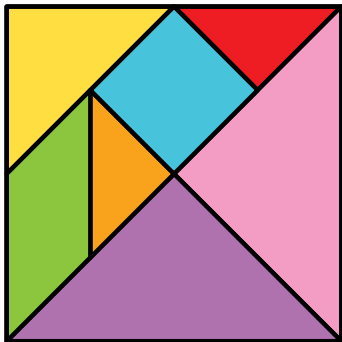


© Carlos Luna-Mota
29 de gener de 2020

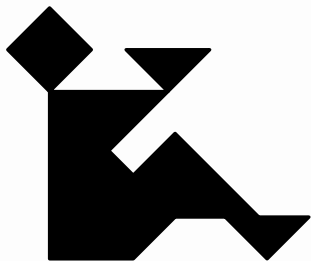
mmaca

Què és un tangram?

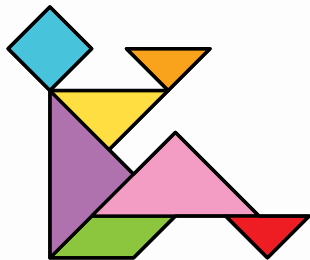
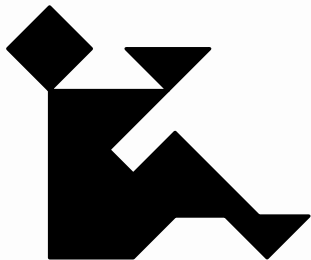
Tangram xinès - Dinastia Song (960-1279)



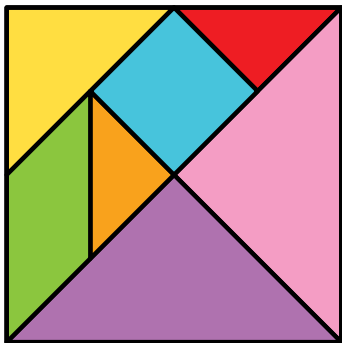
Tangram xinès - Siluetes realistes



Tangram xinès - Siluetes realistes



Tangram xinès - Propietats matemàtiques

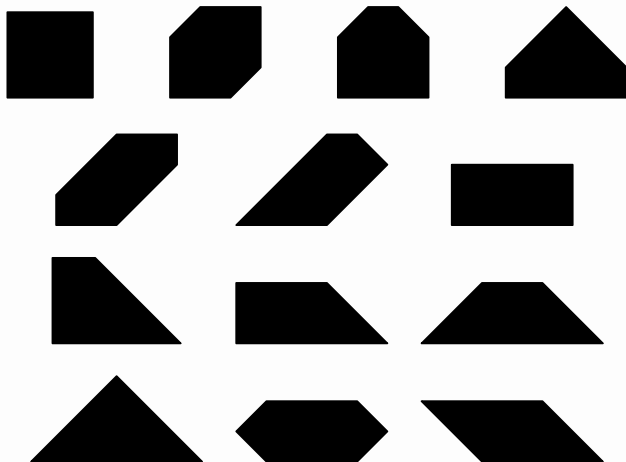


Costats: Múltiples d'1 i d' $\sqrt{2}$

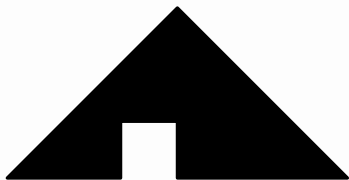
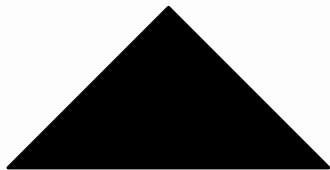
Angles: Múltiples de 45°

Àrees: Múltiples d' $1/2$

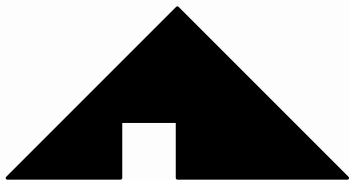
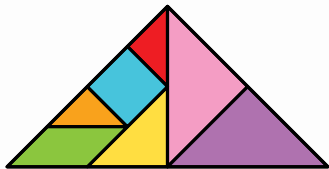
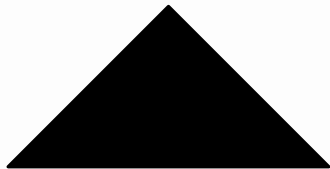
Tangram xinès - Els 13 polígons convexos



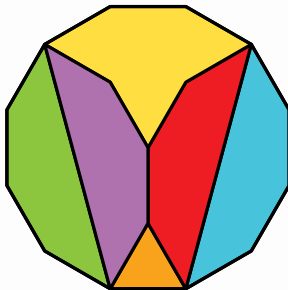
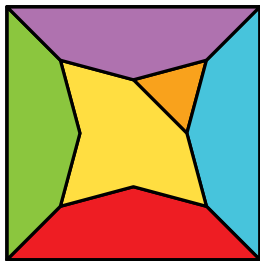
Tangram xinès - Paradoxes



Tangram xinès - Paradoxes $(2\sqrt{2}/3)^2 = 8/9$

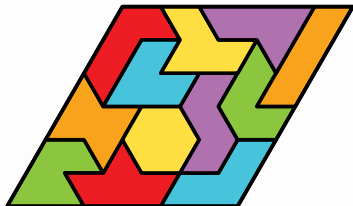
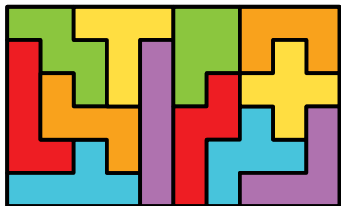


Altres disseccions



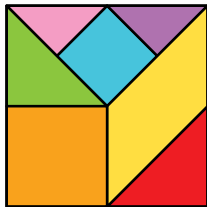
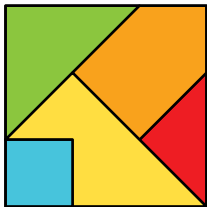
L'àrea del dodecàgon és $3R^2$

Altres empaquetaments

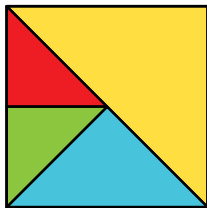
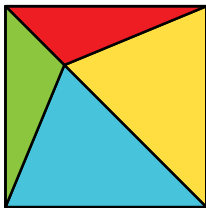


Els dotze pentòminos i els dotze hexamants

Tangrams quadrats

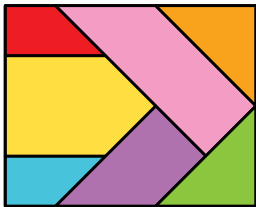


Tangram japonès, *Double Square* i tangram Fletcher

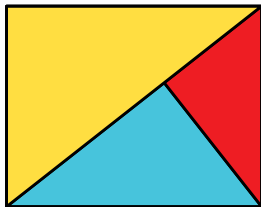
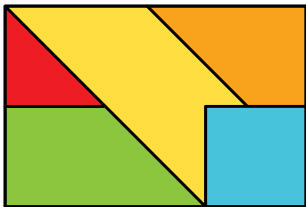


Tangram DiDi i altres tangrams de 4 triangles

Tangrams rectangulars

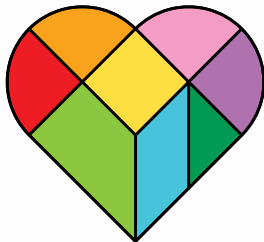
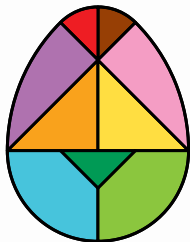


Tangram pitagòric (4:5) i tangram *V & Diamond* ($\sqrt{3}:2$)

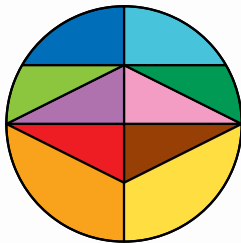
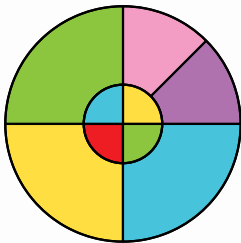


Tangram de la T (2:3) i tangram de Brügner ($1:\sqrt{\phi}$)

Tangrams amb corbes

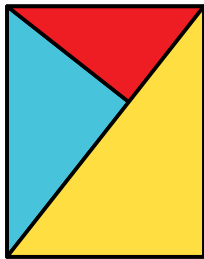
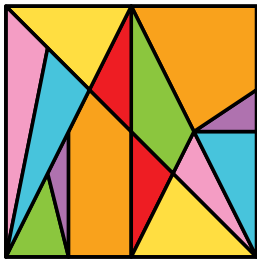


Tangram de l'ou, tangram del cor i tangrams circulars



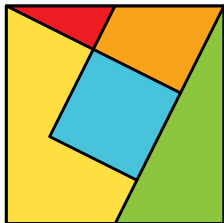
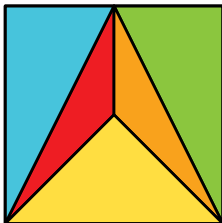
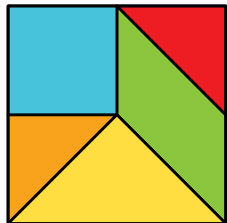
Com és un bon tangram?

Nombre de peces



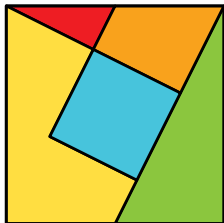
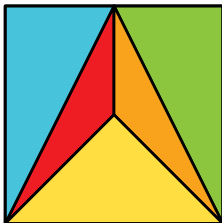
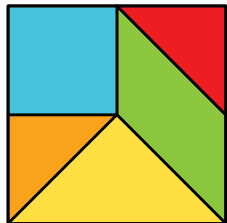
Ostomachion d'Arquimedes i tangram de Brügner

Nombre de peces - Tangrams de 5 peces!



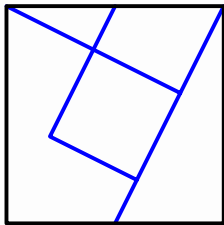
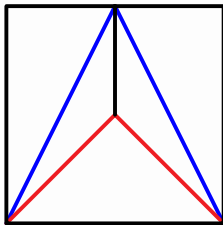
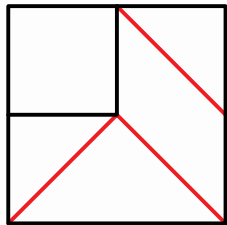
Subtangram xinès, tangram dels cinc triangles
i tangram de la creu de Sam Loyd

Tipus de peces

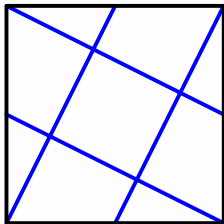
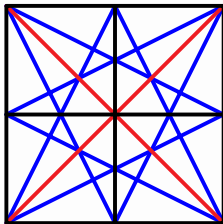
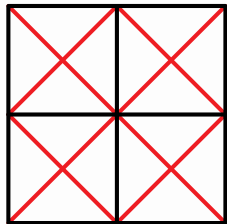
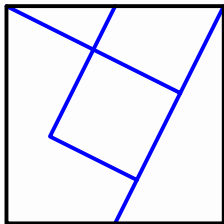
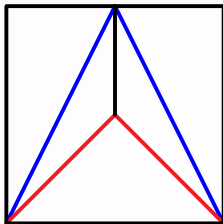
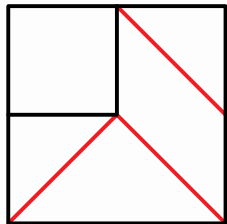


- Peces senzilles
- Peces diferents
- Peces asimètriques
- Peces d'àrea similar

Tipus de peces - Costats i angles compatibles



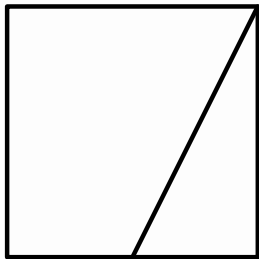
Tipus de peces - Costats i angles compatibles



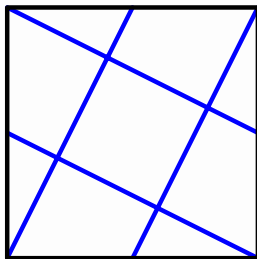
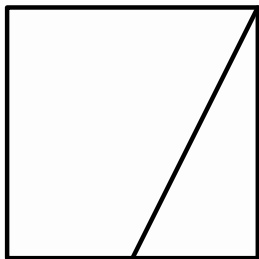
El tangram egipci

un nou tangram *made in* MMACA

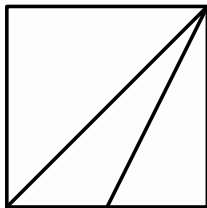
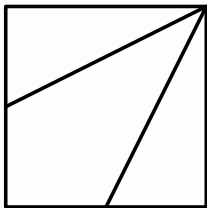
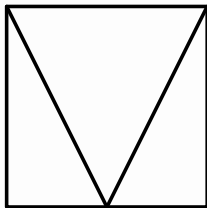
Tangram de dues peces



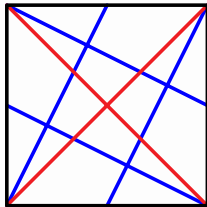
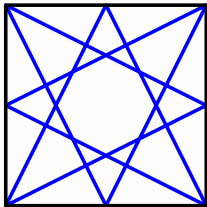
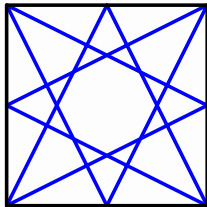
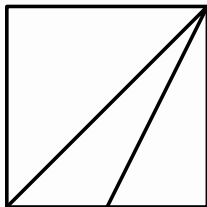
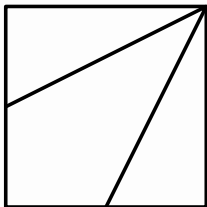
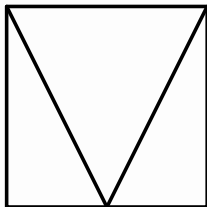
Tangram de dues peces



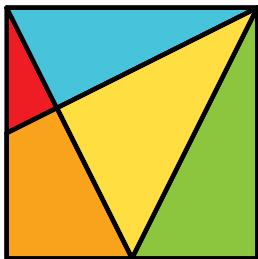
Tres tangrams de tres peces



Tres tangrams de tres peces



Tangram egipci



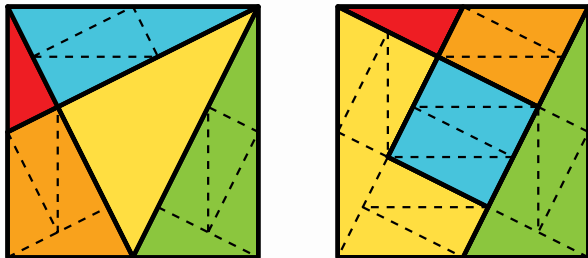
Peces: Cinc polígons asimètrics diferents

Costats: Múltiples d'1 i d' $\sqrt{5}$

Angles: Combinacions de 90° i de $26,565^\circ$

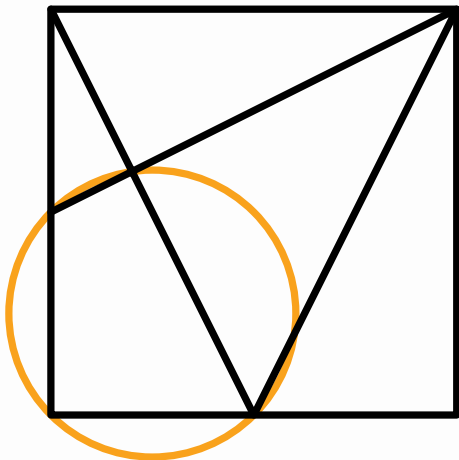
Àrees: 1, 4, 4, 5 i 6

Tangram egipci - Molts $\{1:2:\sqrt{5}\}$ i un $\{3:4:5\}$

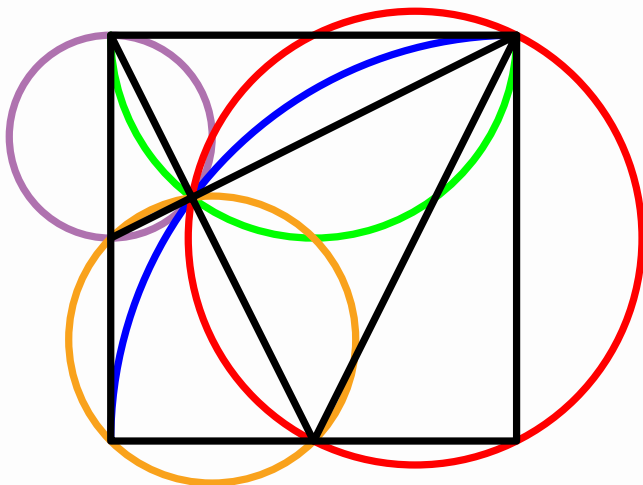


Descomposició de les peces del tangram egipci
i del tangram de la creu en triangles congruents

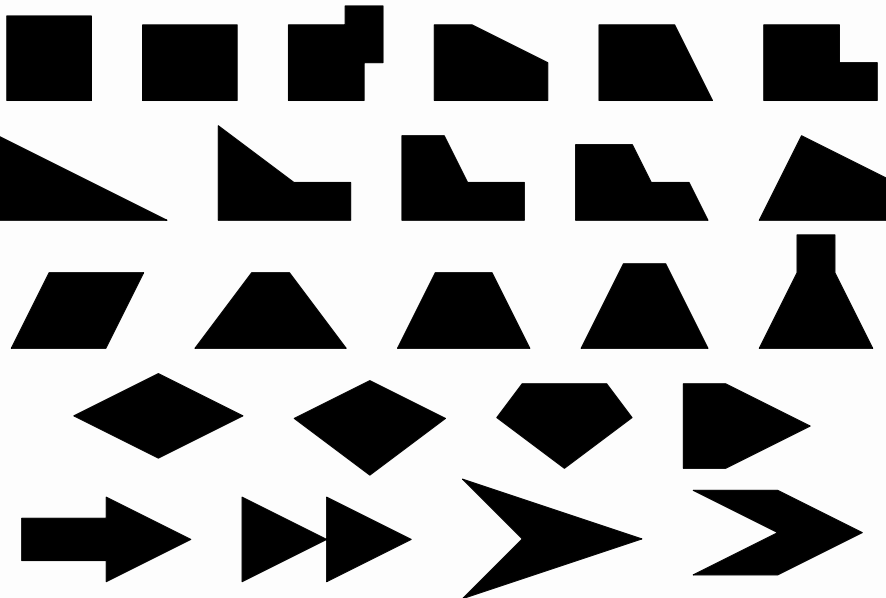
Tangram egipci - El quadrilàter és cíclic



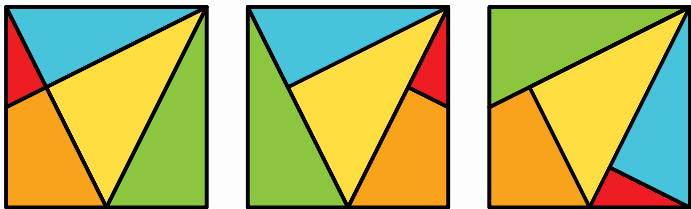
Tangram egipci - Cinc cercles notables



Tangram egipci - Algunes figures

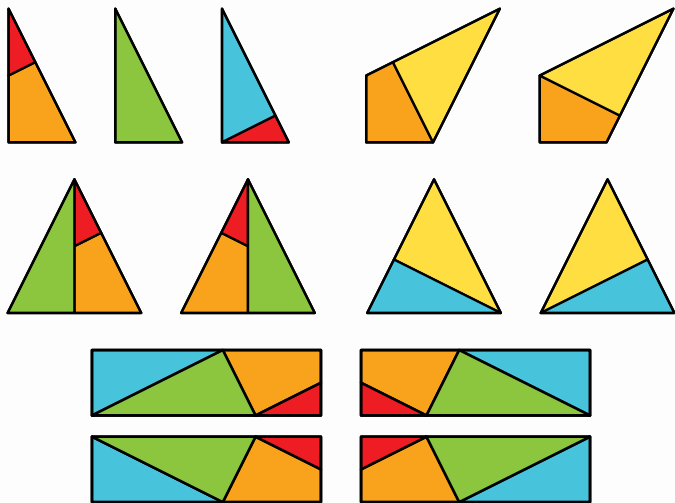


Tangram egipci - Les tres solucions del quadrat



Quatre angles rectes a l'interior i només dos a la perifèria!

Tangram egipci - Equivalències i simetries



Tangram egipci - Suma de figures semblants

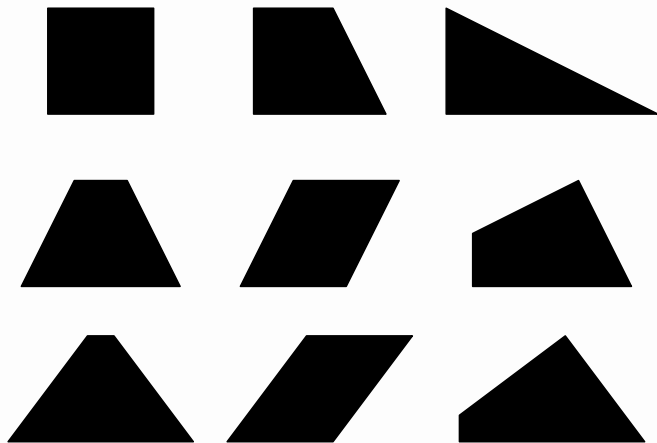


Tangram egipci - Sis triangles semblants



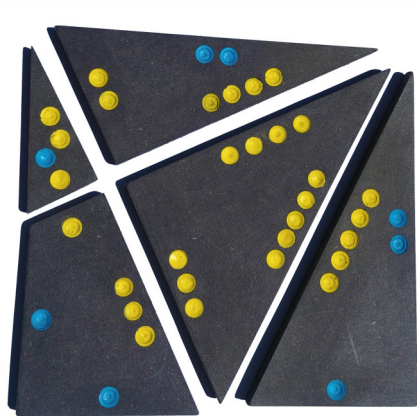
Triangles semblants d'àrees: 20, 16, 9, 5, 4 i 1

Subtangram egipci - Figures amb els 4 triangles



I ara què?

Adaptar el tangram egipci al MMACA



$$2 + 3 = 1 + 4 = 5$$

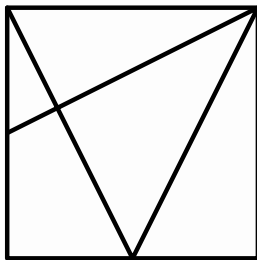
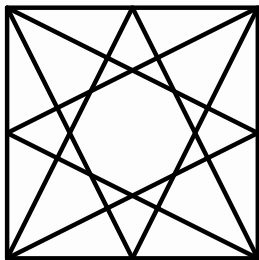
Adaptar el tangram egipci a casa i a l'aula

- Paradoxes?
- Figures realistes?
- Tots els quadrilàters?
- Tots els polígons convexos?
- Altres activitats didàctiques?
- Altres propietats matemàtiques?
- ...

Ajudeu-nos!

(carlos.luna@mmaca.cat)

Antecedents històrics?



- Brunés – *“The Secrets of Ancient Geometry”* (1967)
- Bankoff & Trigg – *“The Ubiquitous 3:4:5 Triangle”* (1974)
- Detemple & Harold – *“A Round-Up of Square Problems”* (1996)

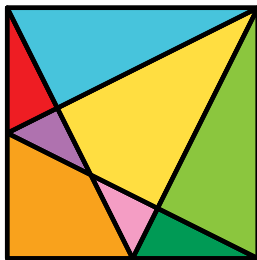
Ajudeu-nos!

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Antecedents històrics?



Puzzle egipci



Tangents

Ajudeu-nos!

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Moltes gràcies!

