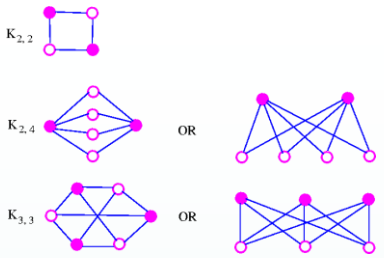
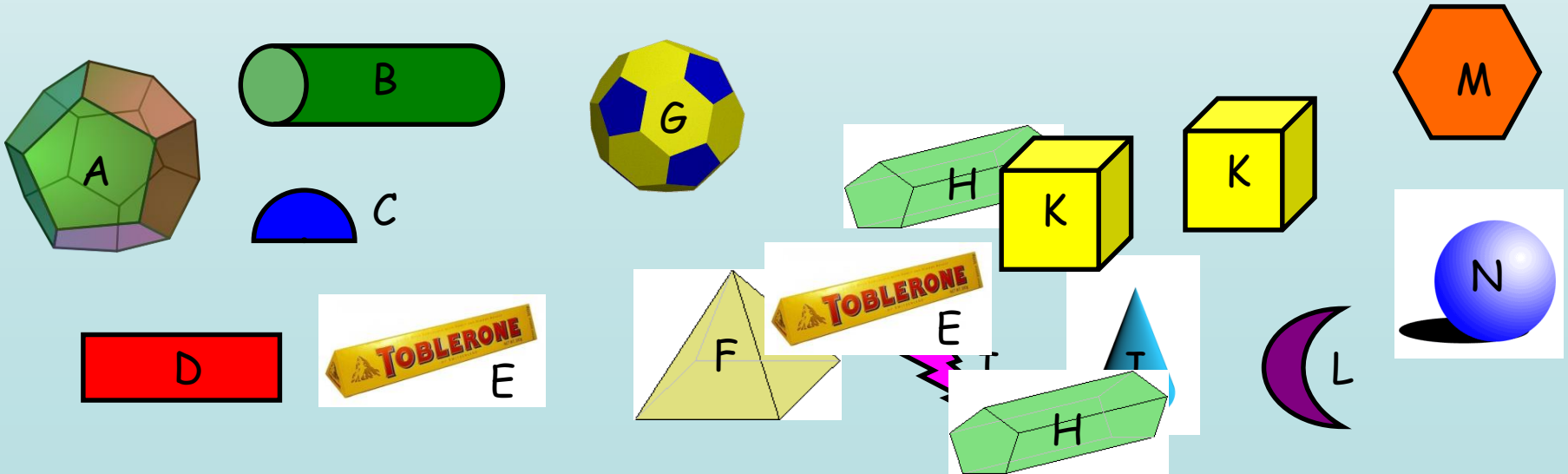
Faces, Edges and Vertices

Starter



Which of the following shapes are:

Polygons?	Prisms?	Polyhedra?	None of these?
→ A 2D shape with only straight sides	→ A 3D shape with a consistent cross-section (Some prisms are also polyhedra!)	→ A 3D shape with flat faces and straight edges	



Faces, Edges and Vertices

Face:

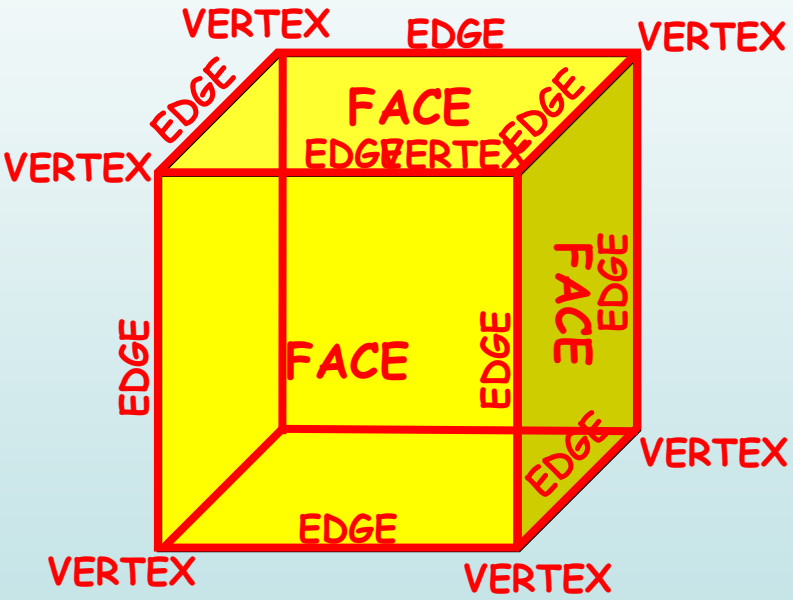
→ The faces of a shape are its 'sides'. They are areas

Edge:

→ The edges of a shape are the lines that make it's 'skeleton'

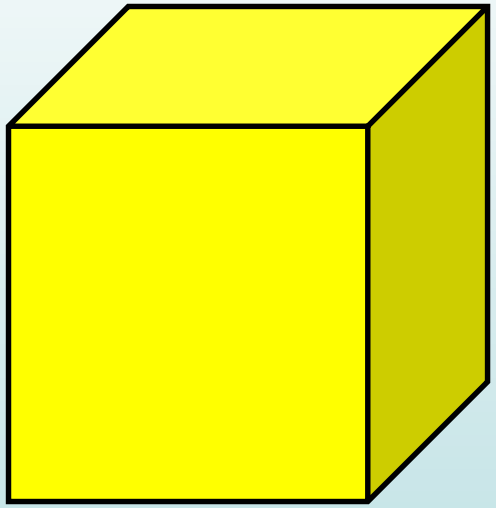
Vertex/Vertices:

→ The vertices of a shape are its 'corners'



Faces, Edges and Vertices

So how many Faces, Edges and Vertices does this cube have?



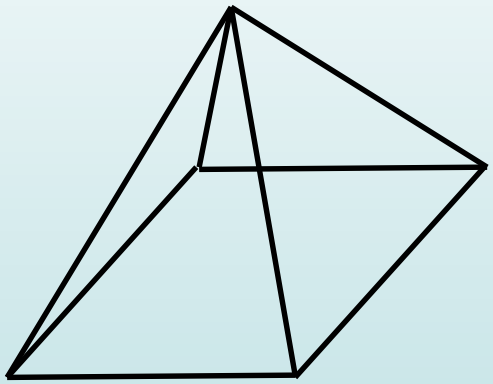
Faces: 6

Edges: 12

Vertices: 8

Faces, Edges and Vertices

So how many Faces, Edges and Vertices does this Square-based Pyramid have?



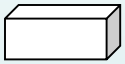
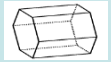
Faces: 5

Edges: 8

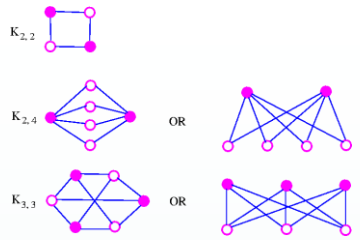
Vertices: 5

Faces, Edges and Vertices

Complete the following table:

Shape	Sketch	Faces	Edges	Vertices
Cube		6	12	8
Cuboid		6	12	8
Tetrahedron		4	6	4
Square-based Pyramid		5	8	5
Pentagonal-based Pyramid		6	10	6
Triangular Prism		5	9	6
Hexagonal Prism		8	18	12
Cylinder		3	2	0
Cone		2	1	1
Sphere		1	0	0
Frustum		6	12	8

Plenary



What is the link between Faces , Edges and Vertices in the **Polyhedra**?

Shape	Faces	Edges	Vertices
Cube	6	12	8
Cuboid	6	12	8
Tetrahedron	4	6	4
Square-based Pyramid	5	8	5
Pentagonal-based Pyramid	6	10	6
Triangular Prism	5	9	6
Hexagonal Prism	8	18	12
Frustum	6	12	8

$$Faces + Vertices - Edges = 2$$

Cube

$$6+8-12=2$$

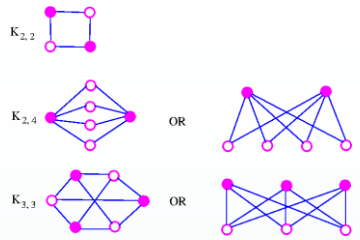
Square-based Pyramid

$$5+5-8=2$$

Hexagonal Prism

$$8+12-18=2$$

Plenary



$$Faces + Vertices - Edges = 2$$

$$F + V - E = 2 \quad \text{or} \quad F + V = E + 2$$

This formula was discovered by Leonhard Euler, a Swiss mathematician considered to be one of the most prolific of all time…

Leonhard Euler (1707-1783)

Knowing this formula allowed mathematicians to further investigate the properties of 3D objects.

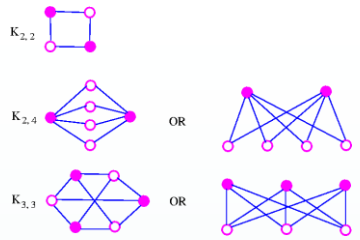
You can also set people impossible 'trick' tasks!

"Draw a polyhedron with 5 faces, 8 vertices and 10 edges"

This is impossible as the numbers do not fit the formula!

(Possible money making opportunity?!)

Summary



- We have learnt the names of some 3D shapes
- We have investigated a link between their Faces, Edges and Vertices
- We have aseen a formula linking these together…