

The Football

The familiar panelled football consists of 20 identical hexagons and 12 identical pentagons. Its mathematical name is "truncated icosahedron".



A hexagon drawn flat on the ground has internal angles all equal to 120 degrees, and a pentagon flat on the ground has internal angles all equal to 108 degrees. Because the internal angles of a hexagon divide 360 ($360/120=3$) we can cover the plane with regular hexagons leaving no gaps. In other words we can tessellate the plane. We cannot tessellate the plane with pentagons because the internal angle of a regular flat pentagon is 108 degrees, and $360/108$ is not an integer.

We cannot cover a football with identical hexagons because a football is not flat. At each point on a flat surface the angle at the centre of a surface is 360. The angle at each point on a football is less than this. We can take the point on a football where two hexagons and a pentagon meet. The angle is $2 \times 120 + 108 = 348$ degrees.