HW 18 Kishan Patel 11/21/21

1)

Solid	Vertices	Edges	Faces
Tetrahedron	4	6	4
Cube	8	12	6
Octahedron	6	12	8
Dodecahedron	20	30	12
Icosahedron	12	30	20

2)

We say that

$$e' = e - 1, f' = f - 1, v' = v$$
$$v - e + f = v' - e' + f'$$

F cannot be 0, thus must me at least 1 vertex.

$$v - e - 1 + f - 1 + v - e + f = 1$$

3)

a)

If we have a cube with V=8, E=12, F=4, and using a and b for vertices connected by edges and edges around each face, we can determine a relation for V and F using E, a, and b.

Since this is a perfect platonic solid, we can see that each vertex has 3 edges(a) and each face has 4 edges adjacent(b). The total amount of vertexes can then be equated by the amount total of edges and the number of edges per vertex, and since each edge connects 2 vertexes, we can say that 2*E/a to get the total amount of vertexes on the solid, netting us 8 vertexes. Using the same logic, if we know the total amount of edges touching each face and the total amount of edges, and since each edge will be touching 2 different faces, 2*E/b will net us 6 faces.

b)

by using the equations above, and the formula V-E+F=2, we can combine and make this equation in terms of E:

$$\frac{2E}{a} - E + \frac{2E}{b} = 2$$
$$E\left(\frac{2}{a} - 1 + \frac{2}{b}\right) = 2$$
$$E\left(\frac{2b + 2a - ab}{ab}\right) = 2$$
$$E = \frac{2ab}{2b + 2a - ab}$$

c)

for a=3, b=5,4,3 the corresponding shapes are dodecahedron, cube, and the tetrahedron.

For a= 4,b=3, we have a octahedron.

For a=5,b=3, we have a icosahedron.

4) a soccer ball is truncated which meants it is not the full shape, where it is partly cut off to make a ball.

V=60,F=32,E=90

60-90+32=2