

## 3.29 Platonic Solids

Edge:  $a$

Radius of inscribed circle:  $r$

Radius of circumscribed circle:  $R$

Surface area:  $S$

Volume:  $V$

### 308. Five Platonic Solids

The platonic solids are convex polyhedra with equivalent faces composed of congruent convex regular polygons.

Solid	Number of Vertices	Number of Edges	Number of Faces	Section
Tetrahedron	4	6	4	3.25
Cube	8	12	6	3.22
Octahedron	6	12	8	3.27
Icosahedron	12	30	20	3.27
Dodecahedron	20	30	12	3.27

## Octahedron

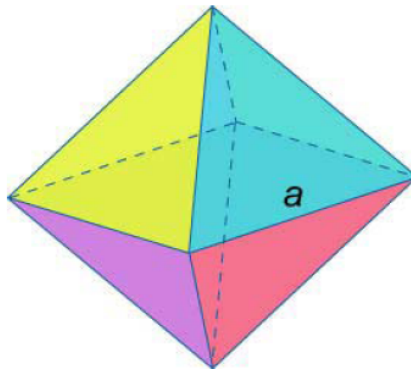


Figure 44.

$$309. \quad r = \frac{a\sqrt{6}}{6}$$

$$310. \quad R = \frac{a\sqrt{2}}{2}$$

$$311. \quad S = 2a^2\sqrt{3}$$

$$312. \quad V = \frac{a^3\sqrt{2}}{3}$$

## Icosahedron

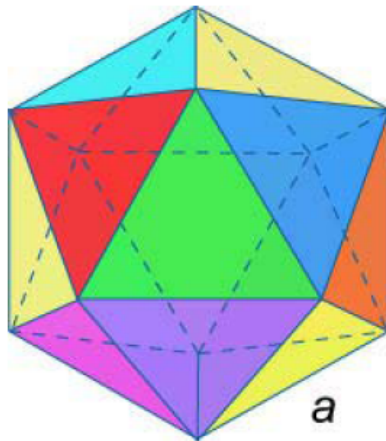


Figure 45.

$$313. \quad r = \frac{a\sqrt{3}(3+\sqrt{5})}{12}$$

$$314. \quad R = \frac{a}{4}\sqrt{2(5+\sqrt{5})}$$

$$315. \quad S = 5a^2\sqrt{3}$$

$$316. \quad V = \frac{5a^3(3+\sqrt{5})}{12}$$

Dodecahedron

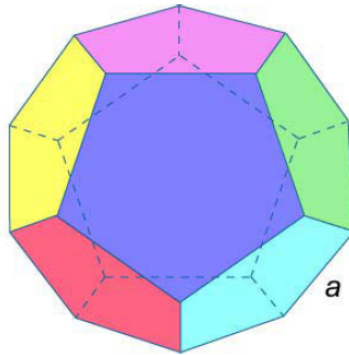


Figure 46.

$$317. \quad r = \frac{a\sqrt{10(25+11\sqrt{5})}}{2}$$

$$318. \quad R = \frac{a\sqrt{3}(1+\sqrt{5})}{4}$$

$$319. \quad S = 3a^2\sqrt{5(5+2\sqrt{5})}$$

$$320. \quad V = \frac{a^3(15+7\sqrt{5})}{4}$$