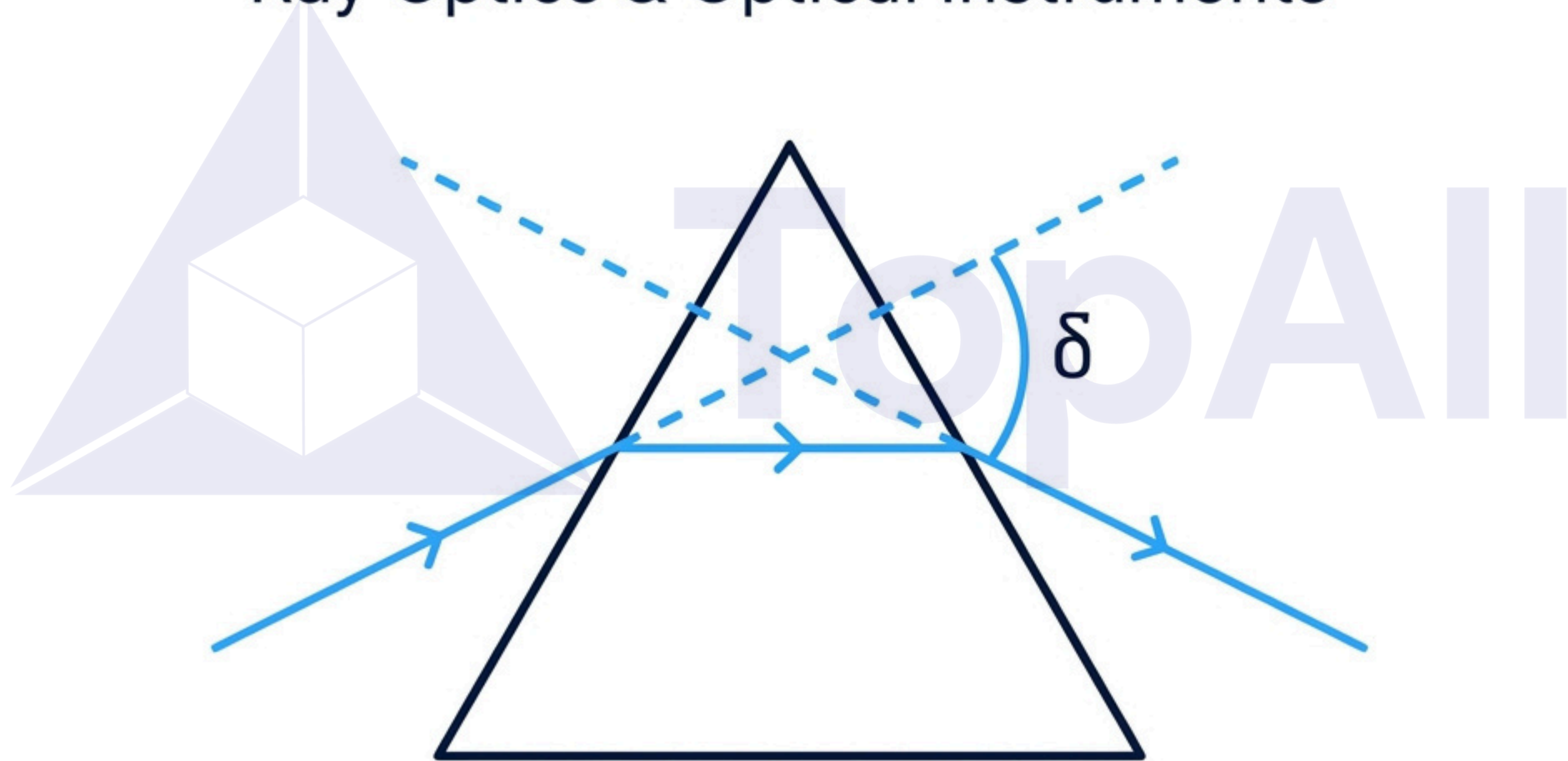


Prism and Minimum Deviation

Ray Optics & Optical Instruments



Anatomy of a Prism

A Angle of Prism

The angle between the two refracting faces.

i Angle of Incidence

The angle between the incident ray and the normal at the first face.

r_1 Angle of Refraction

The internal angle at the first face.

r_2 Internal Incidence

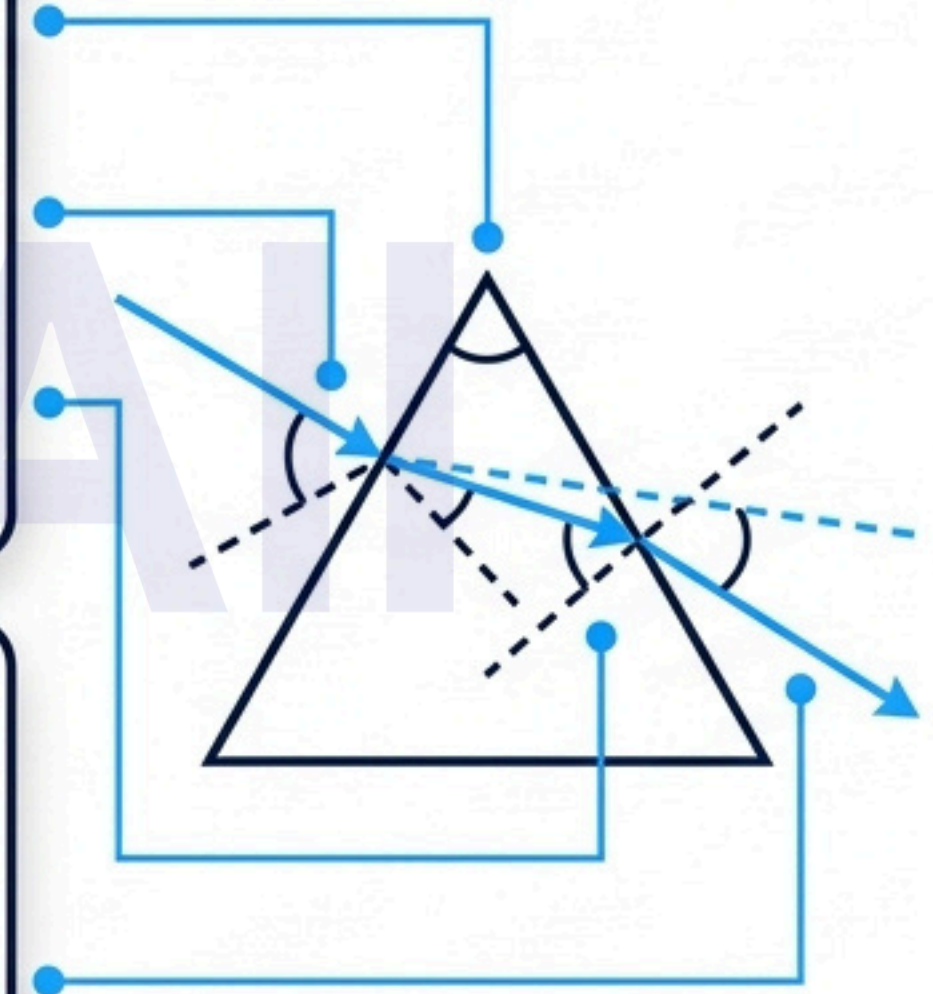
The internal angle at the second face.

e Angle of Emergence

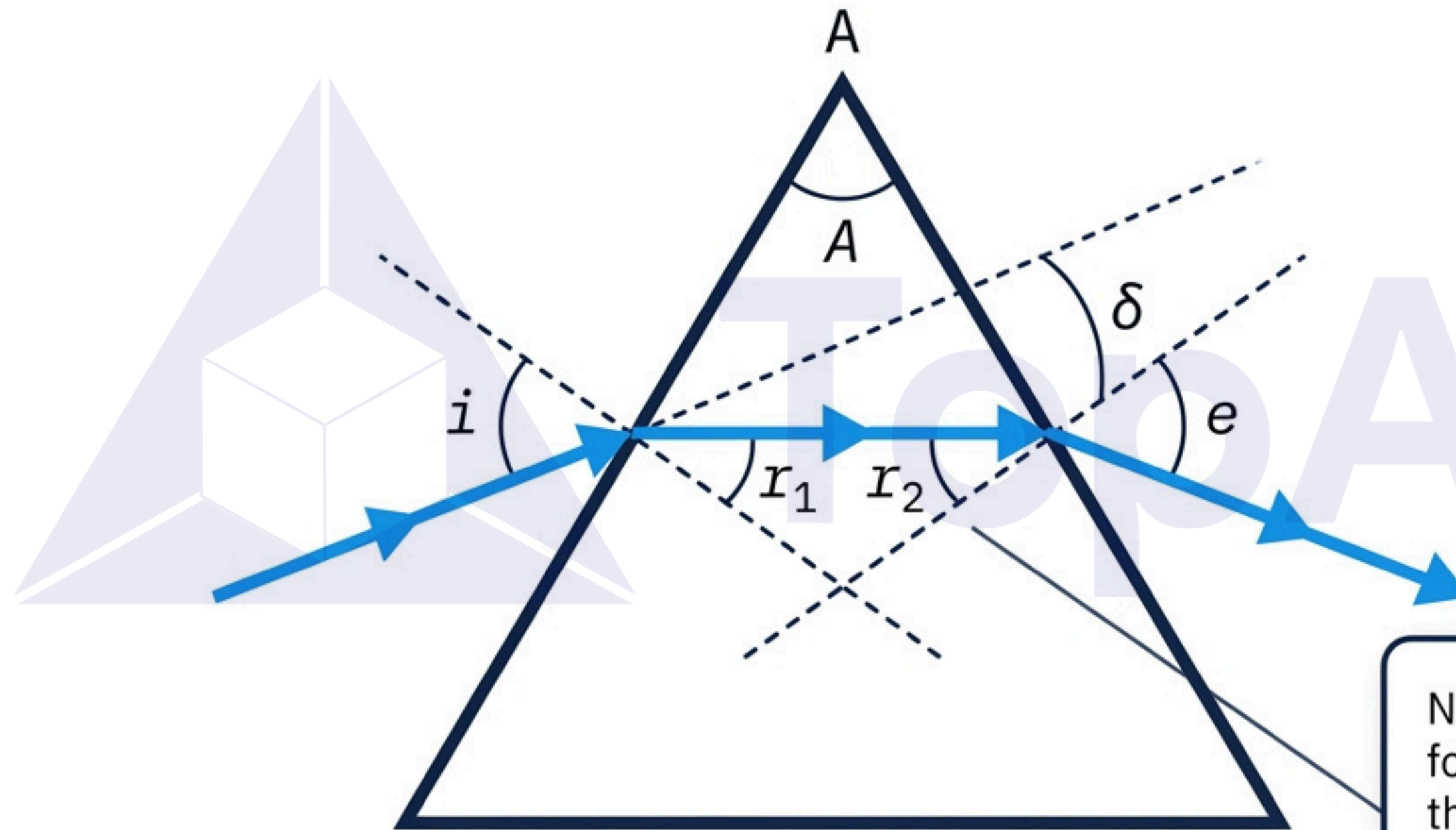
The angle between the emergent ray and the normal at the second face.

δ Angle of Deviation

The total bending of the ray (the angle between the incident and emergent paths).



Refraction Through a Triangular Prism



Notice the quadrilateral formed by the normals and the prism apex A . This geometry dictates the entire formula framework.



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Essential Prism Equations

Internal Angles

$$r_1 + r_2 = A$$

Links the internal refraction angles to the prism's apex angle.

Total Deviation

$$\delta = i + e - A$$

The sum of deviations at both faces.

Refractive Index at Minimum Deviation

$$n_{21} = \sin[(A + D_m)/2] / \sin(A/2)$$

Determines the refractive index of the prism material based on measurable angles.

JEE Trap Alert!

The refractive-index formula $n = \sin((A+D_m)/2) / \sin(A/2)$ is frequently misused for any deviation angle.



This formula ONLY applies when the prism is in the unique state of Minimum Deviation (D_m). If an exam problem gives a random, non-minimum angle of deviation δ , you cannot use this equation!

General Case

$$\delta \neq D_m$$

Action: Use Snell's law at each interface sequentially.

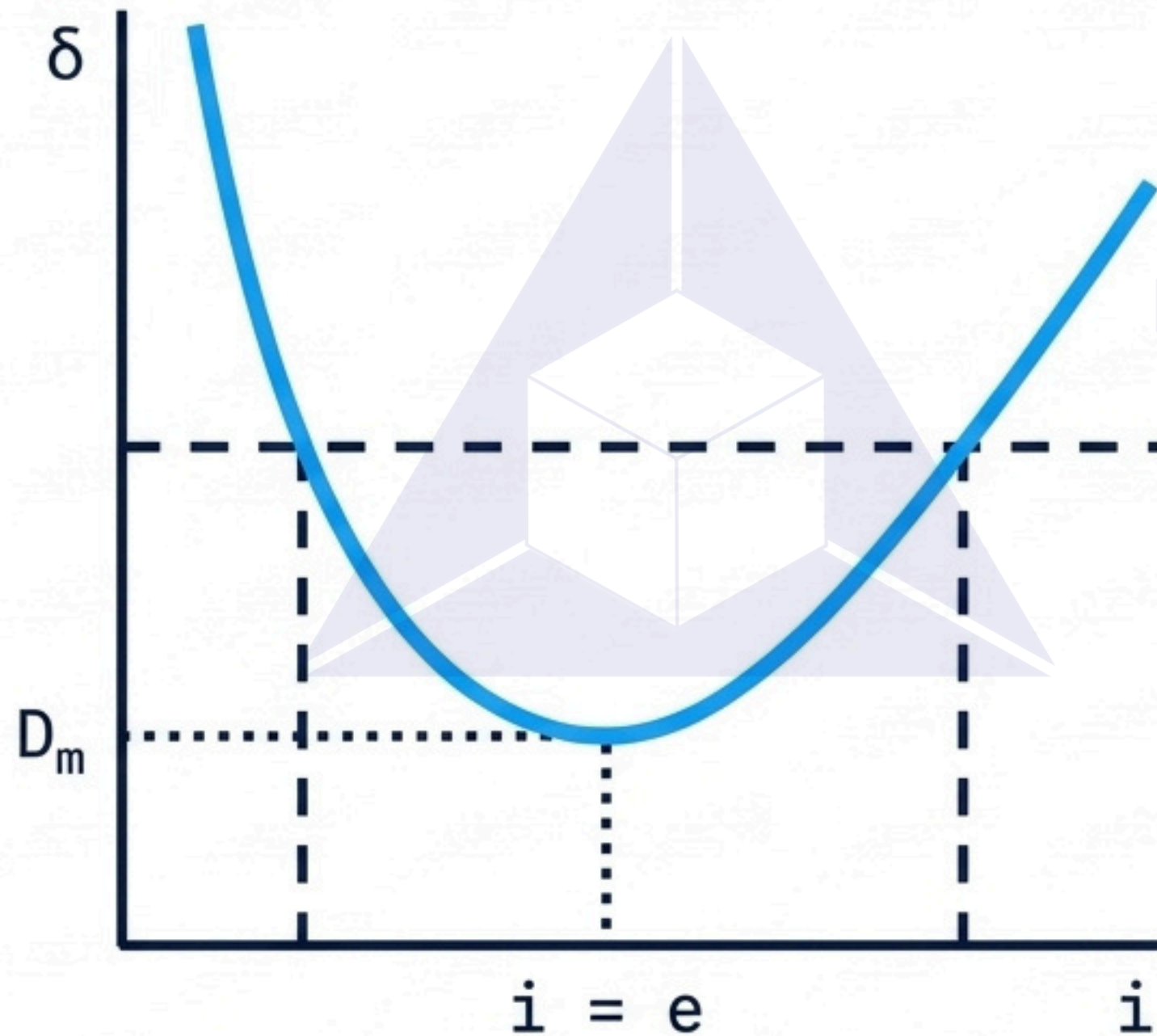
Special Case

$$\delta = D_m$$



Action: Safe to use the master Refractive Index formula.

Deviation vs. Angle of Incidence



Symmetry of Deviation

For any given deviation δ , there are two possible angles of incidence (i and e), due to the principle of reversibility. The exception is the absolute minimum deviation (D_m), which occurs at exactly one unique point at the trough of the curve.

The Minimum Deviation State (D_m)

1. The emergent ray is completely symmetrical to the incident ray.

$$i = e$$

2. The internal refracted ray travels exactly parallel to the base of the prism.

$$r_1 = r_2 = A/2$$

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