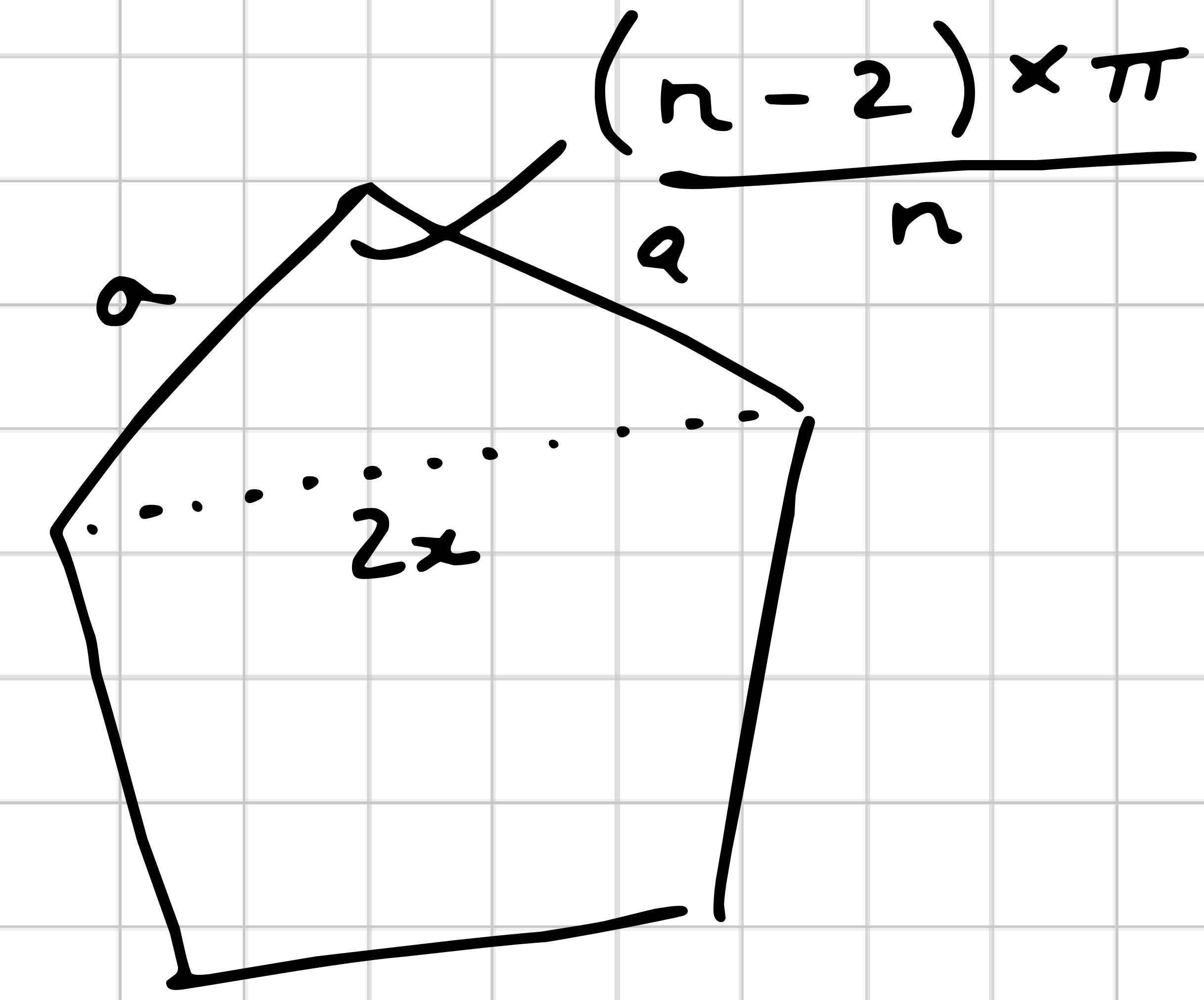
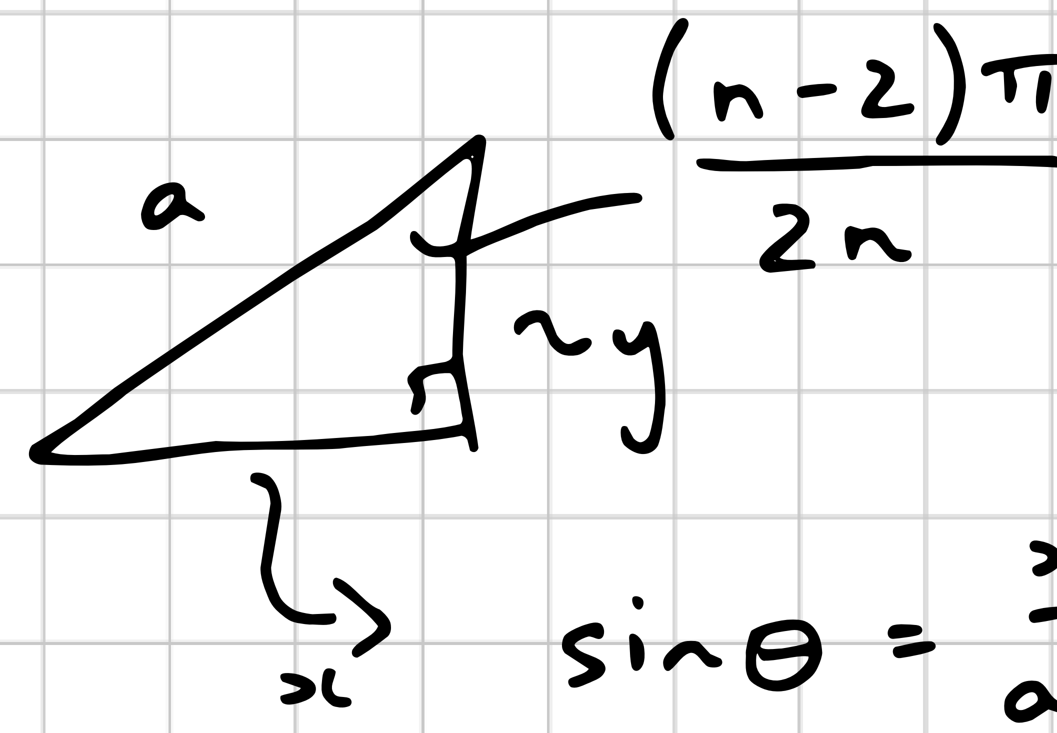
Reference	Calculations





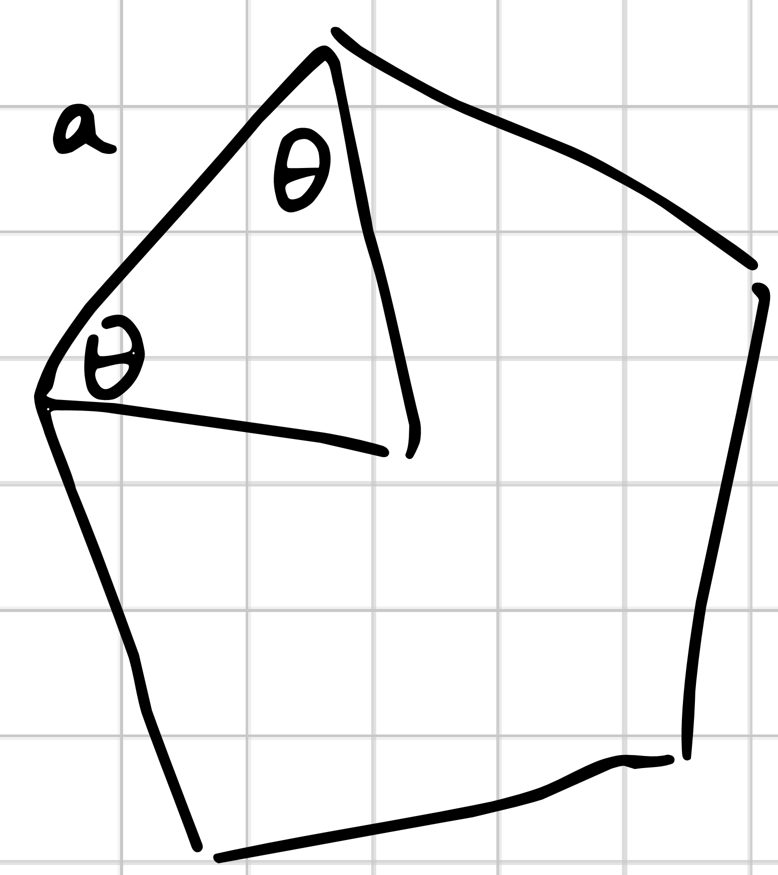
$$\sin\theta = \frac{x}{a}.$$

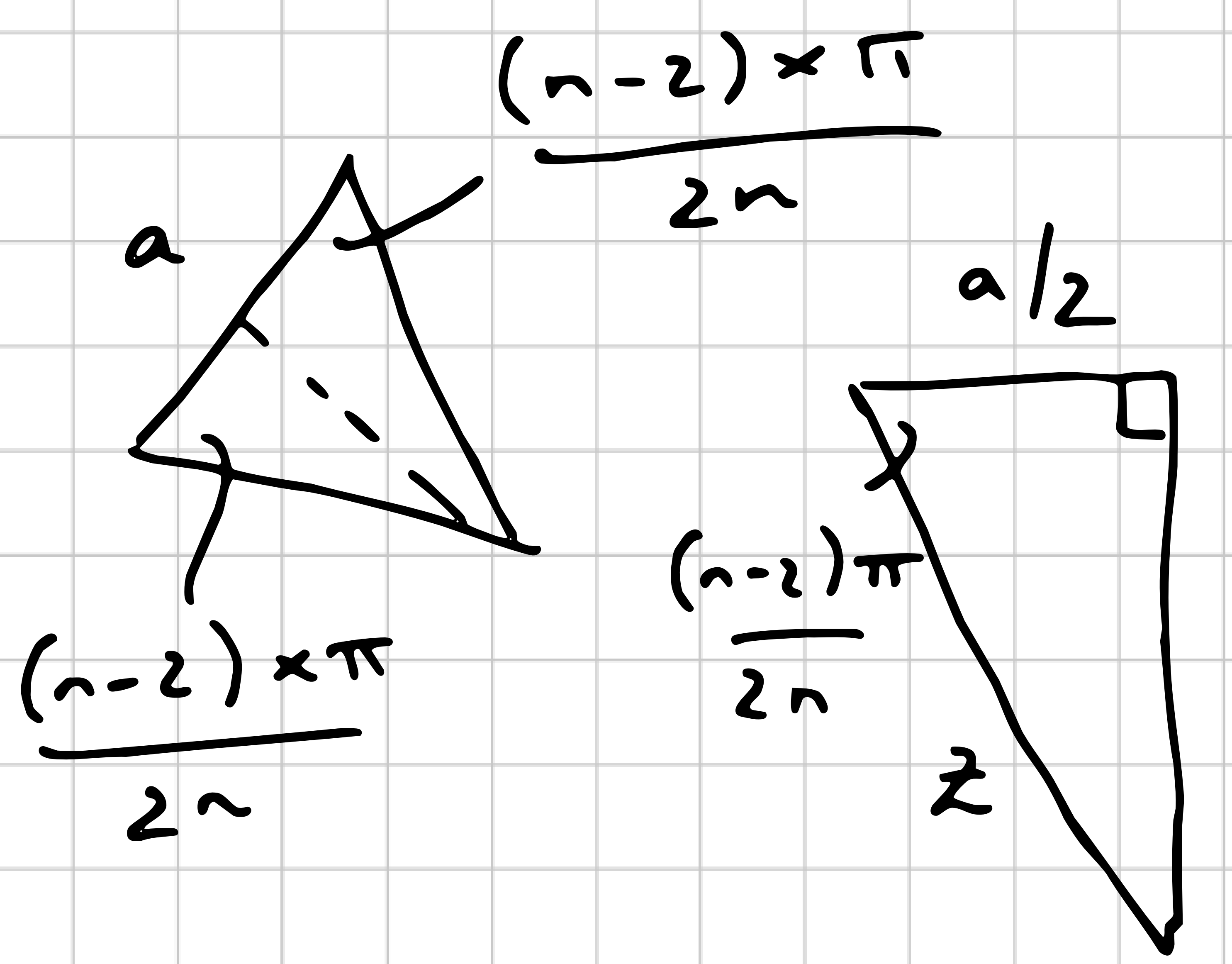
$$x = a\sin\left\{\frac{(n-2)\pi}{2n}\right\}.$$

$$\cos\theta = \frac{y}{a}.$$

$$y = a\cos\left\{\frac{(n-2)\pi}{2n}\right\}.$$

Reference	Calculations





$$\cos\theta = \frac{a/2}{z}$$

$$z = \frac{a/2}{\cos\theta}$$

$$= \frac{a}{2\cos\left\{\frac{(n-2)\pi}{2n}\right\}}$$

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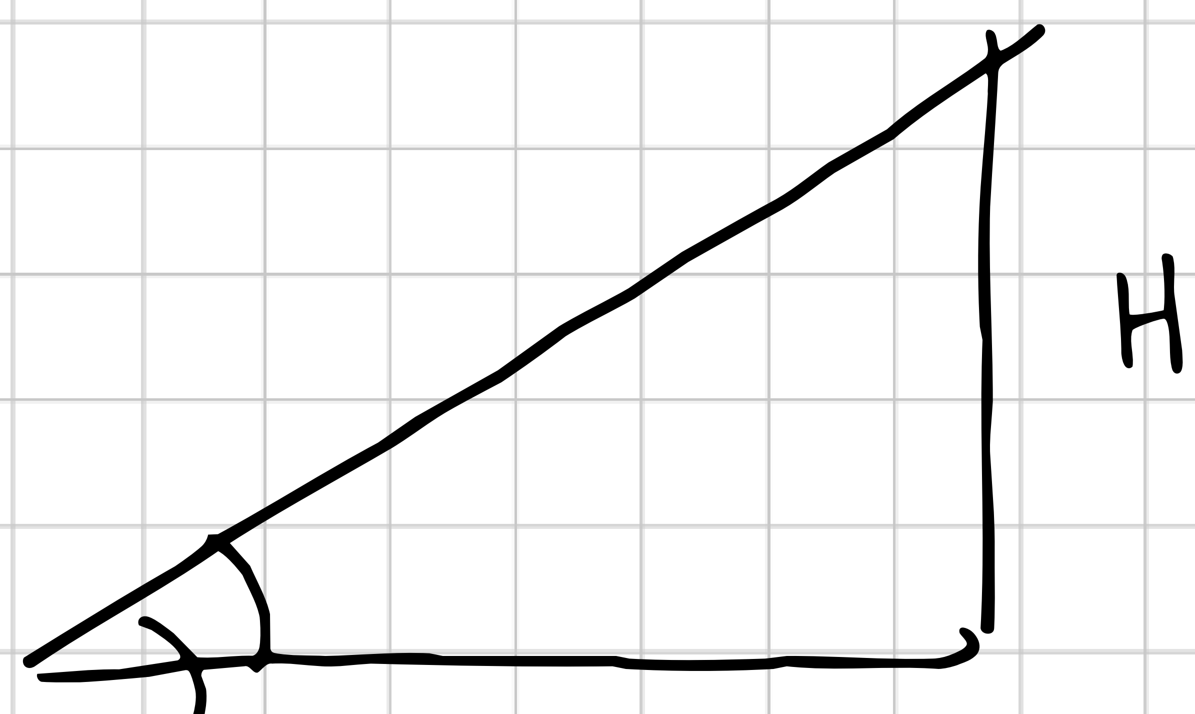


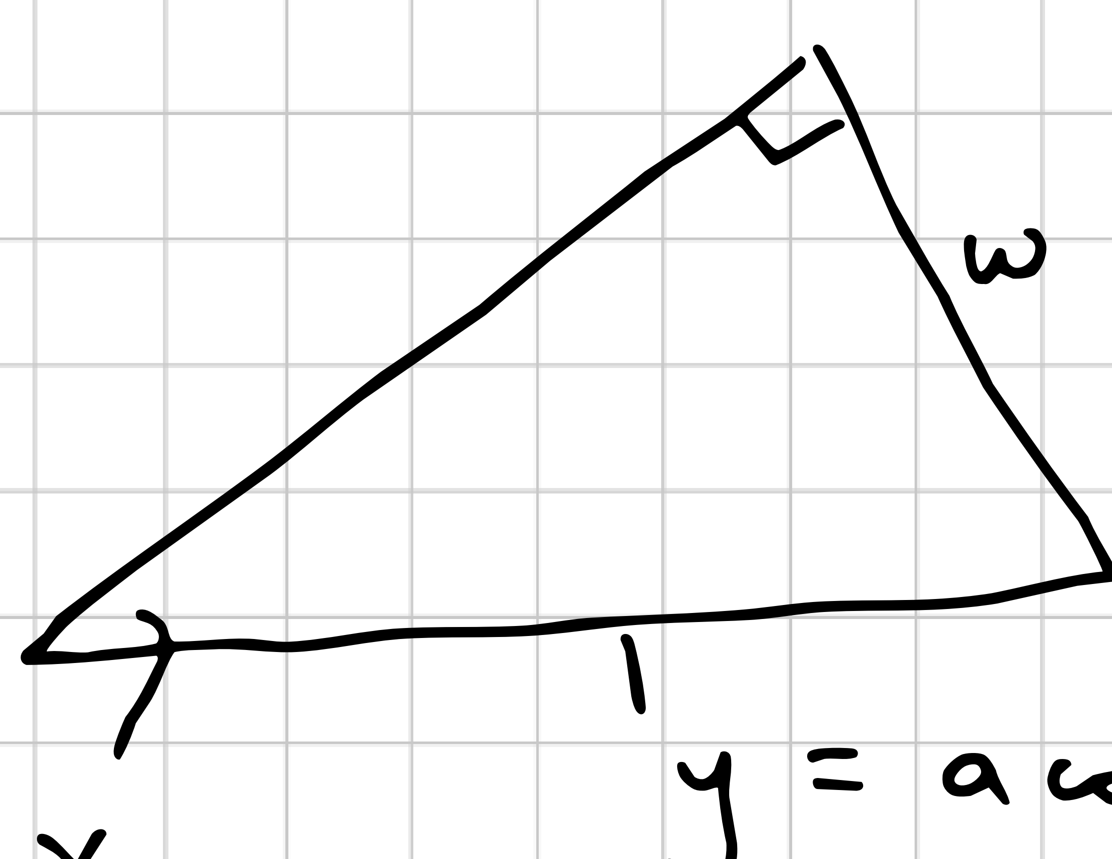
$$z = \frac{a}{2\cos\theta}.$$

$$\gamma = \tan^{-1}\left(\frac{H}{z}\right)$$

$$= \tan^{-1}\left(\frac{2H\cos\left\{\frac{(n-2)\pi}{2n}\right\}}{a}\right).$$

$$\sin\gamma = \frac{w}{y}$$

$$w = y\sin\gamma$$

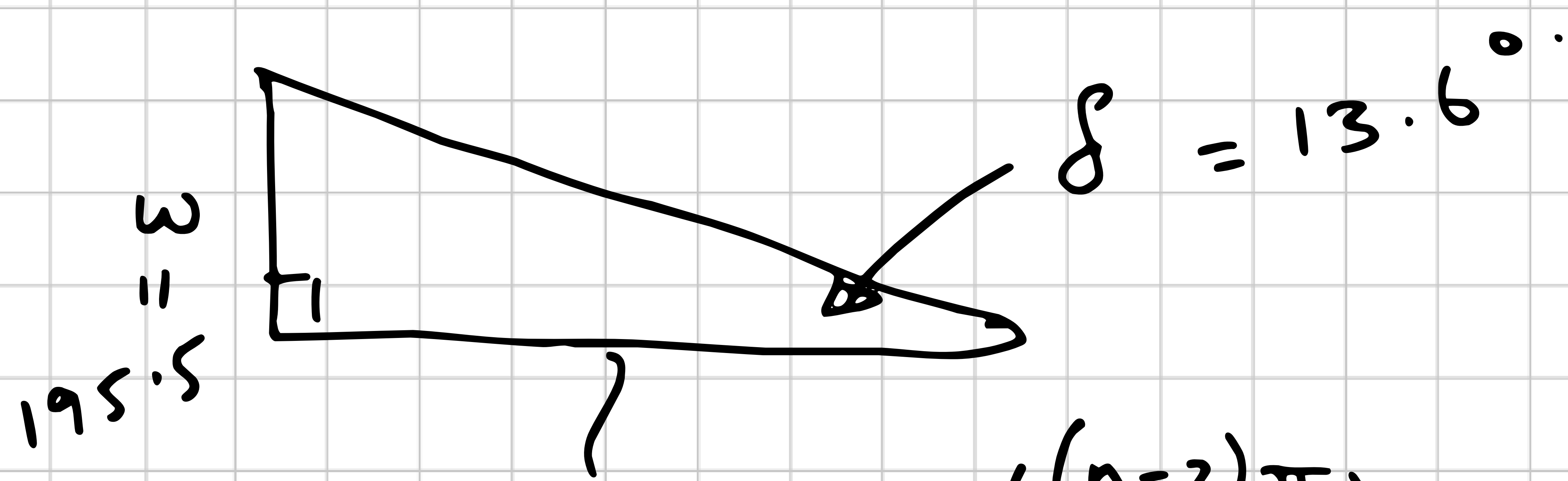


$$y = a\cos\left\{\frac{(n-2)\pi}{2n}\right\}$$

$$w = a\cos\left\{\frac{(n-2)\pi}{2n}\right\}\sin\tan^{-1}\left\{\frac{2H\cos\left\{\frac{(n-2)\pi}{2\pi}\right\}}{a}\right\}$$

$$= \frac{2aH\cos^2(\ldots)}{\sqrt{a^2+4H^2\cos^2(\ldots)}}$$

Reference	Calculations



$$x = a\sin\left(\frac{(n-2)\pi}{2n}\right) = 809.0$$

$$\delta = \tan^{-1}\left(\frac{w}{x}\right)$$

$$= \tan^{-1}\left(\frac{2H\cos^2(\ldots)}{\sqrt{a^2+4H^2\cos^2(\ldots)} \times \sin(\ldots)}\right)$$

∴ Angle between two slant faces is equal to 2δ

$$= 2\tan^{-1}\left\{\frac{2H\cos^2(\ldots)}{\sin(\ldots)\sqrt{a^2+4H^2\cos^2(\ldots)}}\right\}$$

where $(\ldots) = \frac{(n-2)\pi}{2n}$ (e.g. $54°$)

Reference	Calculations

Internal work done:

$$W = n \times r \times \beta \times M_u$$

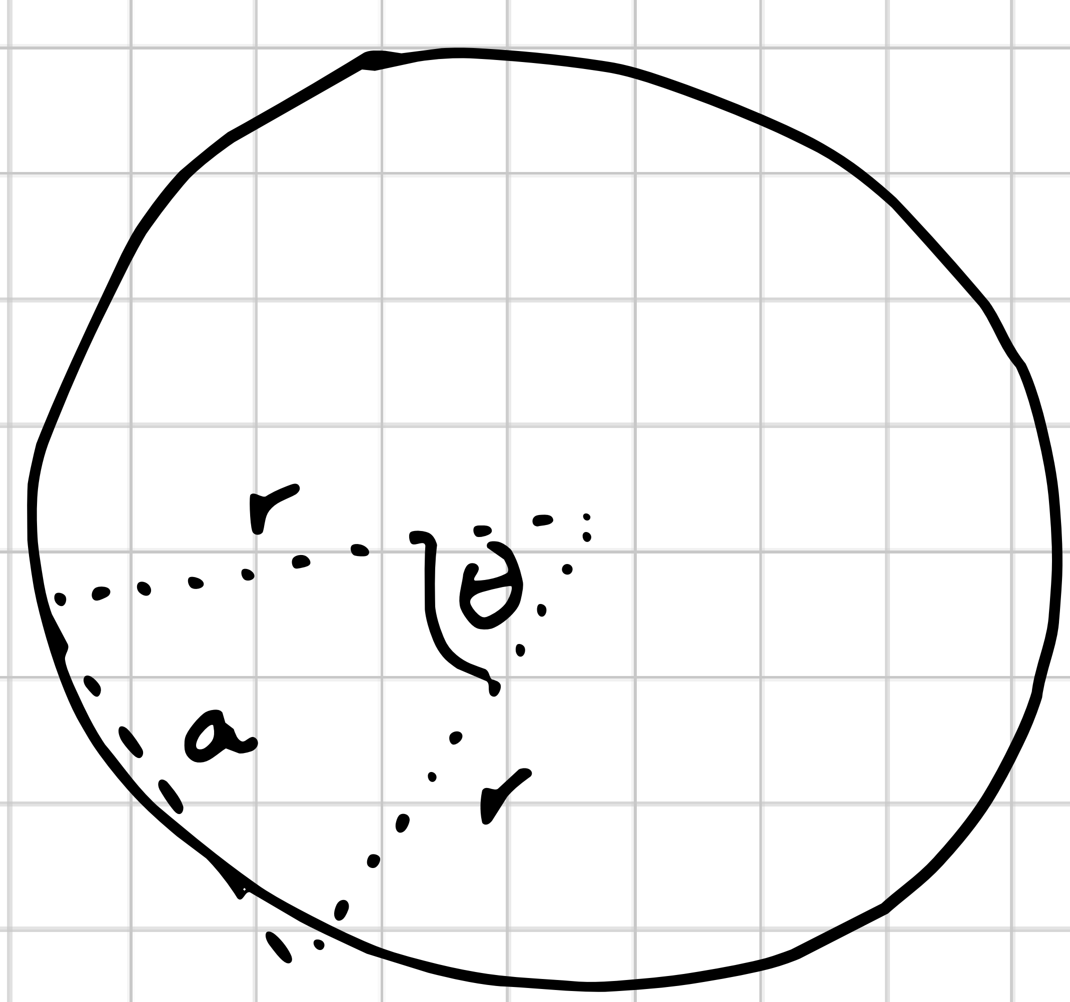
$$\beta = 2\tan^{-1}\left\{\frac{2\Delta\cos^2(\dots)}{\sin(\dots) \times \sqrt{4r^2\sin^2\left(\frac{\pi}{n}\right) + 4\Delta^2\cos^2(\dots)}}\right\}$$

External work done:

$W = p \times (\pi r^2) \times$ avg displacement at centroid of sector.

$$= p(\pi r^2) \times \Delta \times \frac{2\sin(\alpha)}{3\alpha}$$

$$= p(\pi r^2)\Delta \times \frac{2\sin(\pi/n)}{3(\pi/n)} \quad \left(\text{goes to } \tfrac{2}{3}r \text{ for large } n\right).$$



$$a = 2r\sin\left(\frac{\theta}{2}\right).$$

$$\theta = \frac{360}{n} = \frac{2\pi}{n}$$

$$a = 2r\sin\left(\frac{\pi}{n}\right)$$

$$\therefore r = \frac{a}{2\sin\left(\frac{\pi}{n}\right)}$$

Reference	Calculations

Critical pressure:

$$p(\pi r^2)\Delta \times \frac{2\sin(\pi/n)}{3(\pi/n)} = nr\beta M_u$$

$$\therefore\ p = \frac{3\beta M_u}{2r\Delta \times \sin(\pi/n)}$$

$$= \frac{3M_u \tan^{-1}\left(\frac{\Delta \tan(\pi/n)}{\sqrt{\Delta^2+r^2}}\right)}{\Delta r \sin(\pi/n)}$$

As $n \to \infty$, $p \to \frac{3M_u}{r\sqrt{\Delta^2+r^2}}$

For small Δ, $\sqrt{\Delta^2+r^2} \approx r$

$$\therefore\ p_{crit} = \frac{3M_u}{r^2}$$

e.g. $M_u = 16000$ Nmm/mm for 16 R at Grade 250.

$r = 26.5$ mm.

$p_{crit} = 68.4$ MPa.