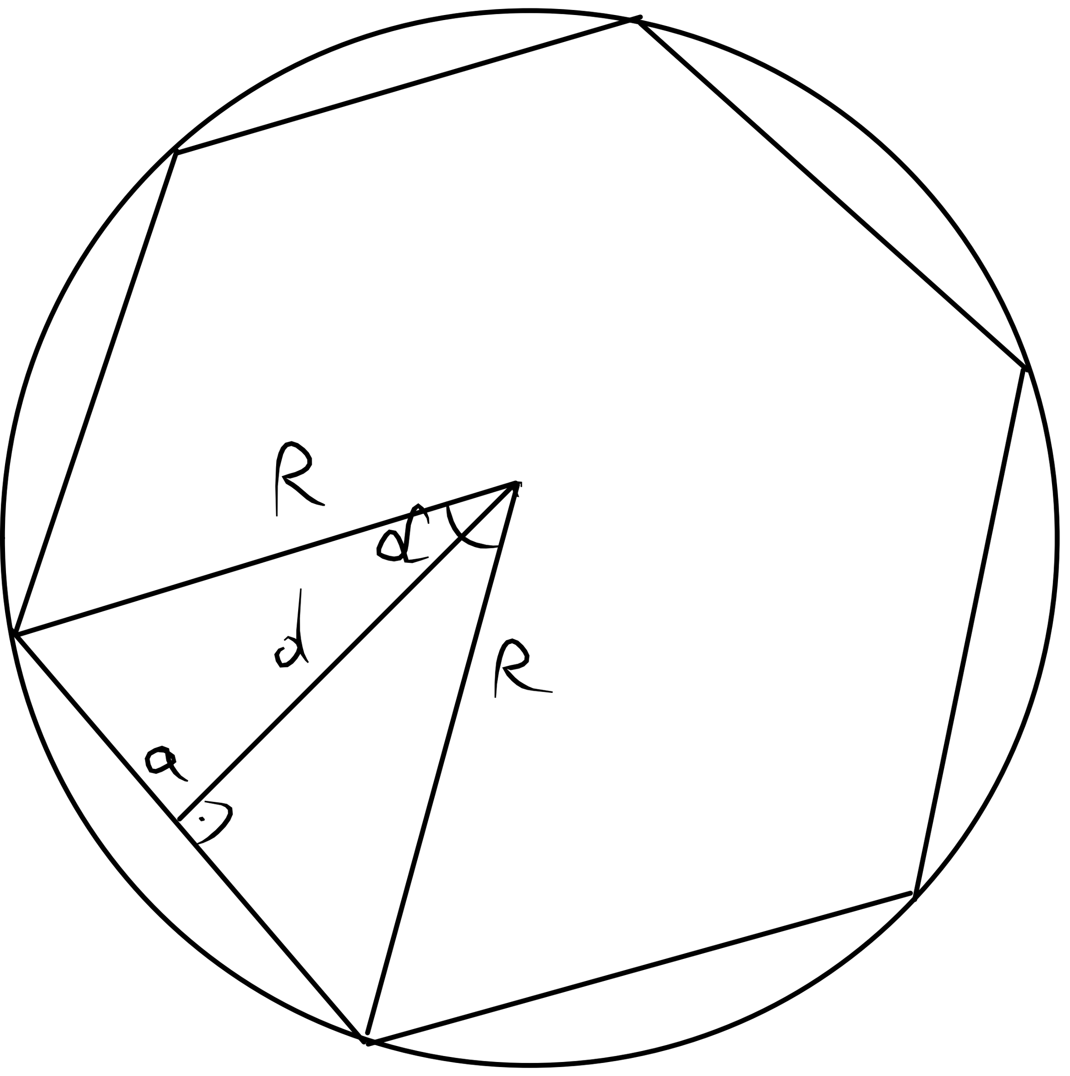
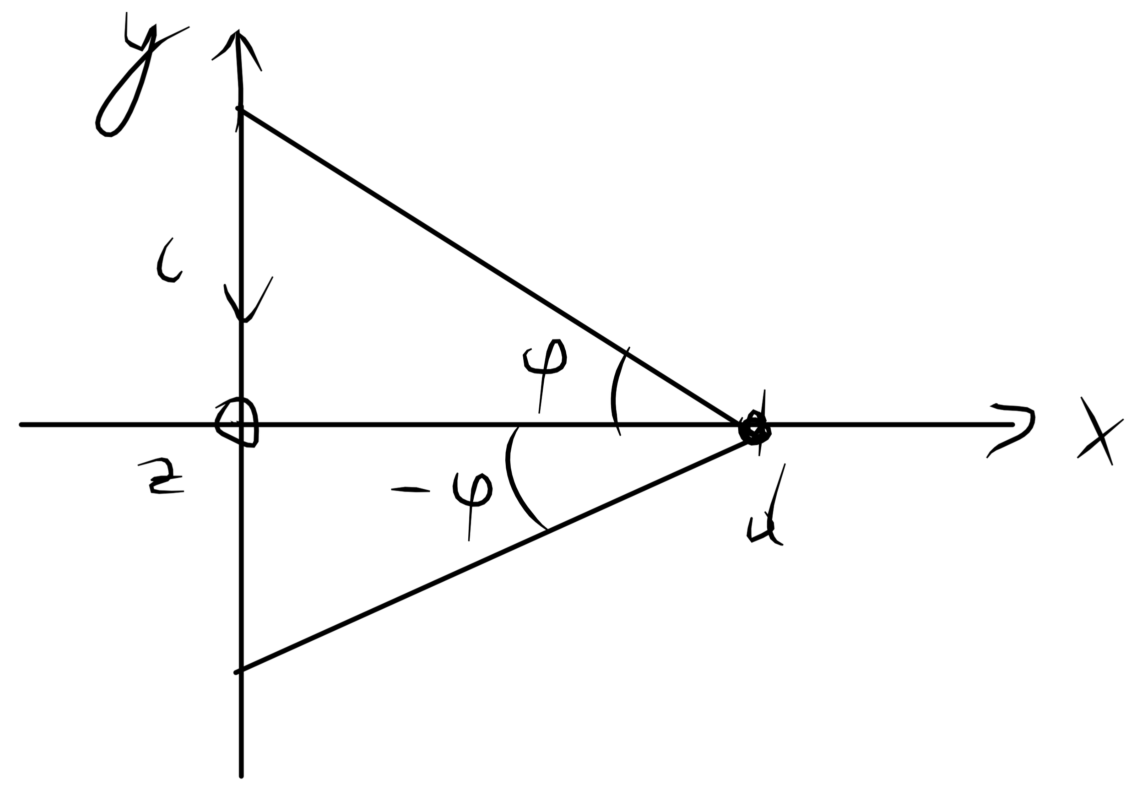


$$\alpha = \frac{2\pi}{n}$$

$$d = R\cos\left(\frac{\alpha}{2}\right) = R\cos\left(\frac{\pi}{n}\right)$$



$$\tan\varphi = \frac{l}{d}$$

$$d\bar{l} = -d\sec^2\varphi\, d\varphi\, \hat{e}_y$$

$$r = [\,d\,;\, -d\tan\varphi\,;\, 0\,]$$

$$d\bar{l} \times \bar{r} = \begin{bmatrix} 0 \\ -d\sec^2\varphi\, d\varphi \\ 0 \end{bmatrix} \times \begin{bmatrix} d \\ -d\tan\varphi \\ 0 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ d^2\sec^2\varphi\, d\varphi \end{bmatrix}$$

$$d\bar{B} = \frac{\mu_0 I}{4\pi}\frac{d\bar{l}\times\bar{r}}{r^3} \qquad \bar{B} = \frac{\mu_0 I}{4\pi}\int_{-\varphi}^{\varphi}\frac{d^2\sec^2\varphi\, d\varphi}{d^3\sec\varphi}\,\hat{e}_z = \frac{\mu_0 I}{4\pi d}\int_{-\varphi}^{\varphi}\cos\varphi\, d\varphi\ \hat{e}_z =$$

$$r = \sqrt{d^2 + d^2\tan^2\varphi} = d\sec\varphi$$

$$= \frac{\mu_0 I}{4\pi d}\Big[\sin\varphi - \sin(-\varphi)\Big] = \frac{\mu_0 I}{2\pi d}\sin\varphi \rightarrow \frac{\mu_0 I}{2\pi d}\sin\left(\frac{\alpha}{2}\right)$$

$$\bar{B}(n) = \frac{\mu_0 I}{2\pi d}\sin\left(\frac{\pi}{n}\right) n\,\hat{e}_z = \frac{n\mu_0 I}{2\pi R}\tan\left(\frac{\pi}{n}\right)\hat{e}_z$$

$$B(3) = \frac{3\mu_0 I}{2\pi R}\tan\left(\frac{\pi}{3}\right) = \frac{3\sqrt{3}\,\mu_0 I}{2\pi R}$$

$$B(4) = \frac{4\mu_0 I}{2\pi R}\tan\left(\frac{\pi}{4}\right) = \frac{2\mu_0 I}{\pi R}$$

$$\lim_{n\to\infty} B(n) = \frac{\mu_0 I}{2\pi R}\lim_{n\to\infty} n\tan\left(\frac{\pi}{n}\right) = \frac{\mu_0 I}{2\pi R}\lim_{n\to\infty} \overbrace{\sec\left(\frac{\pi}{n}\right)}^{1}\pi\ \overbrace{\frac{\sin\left(\frac{\pi}{n}\right)}{\frac{\pi}{n}}}^{1} =$$

$$= \frac{\mu_0 I}{2R}$$