$mzon := 1.98 \cdot 10^{30}$ $G := 6.67 \cdot 10^{-11}$ $c := 3 \cdot 10^{8}$ $rzon := 680 \cdot 10^{6}$

$$g(r) := \frac{mzon \cdot G}{r^2}$$

$g(rzon) = 285.61$

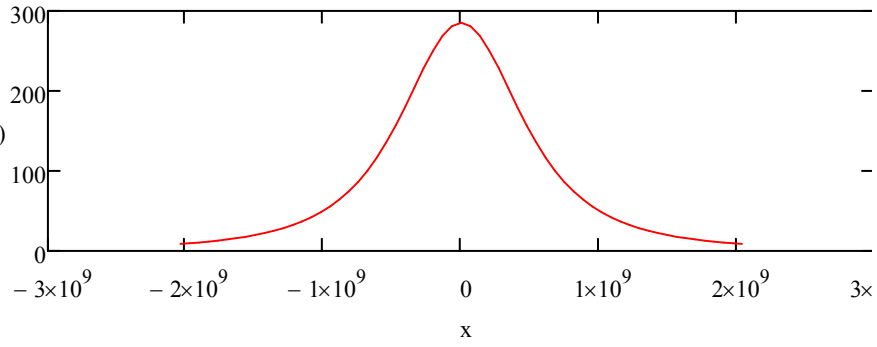
$$g\_alpha\_r(\alpha, rzon) := \begin{pmatrix} \frac{mzon \cdot G}{rzon^2} \cdot \sin(\alpha) \\ \frac{mzon \cdot G}{rzon^2} \cdot \cos(\alpha) \end{pmatrix}$$

$$\sin\alpha(x, rzon) := \sqrt{\frac{rzon^2}{x^2 + rzon^2}} \qquad \cos\alpha(x, rzon) := \sqrt{\frac{x^2}{x^2 + rzon^2}}$$

$$gxy(x, rzon) := \begin{bmatrix} \frac{mzon \cdot G}{x^2 + rzon^2} \cdot \sqrt{\frac{rzon^2}{\left(x^2 + rzon^2\right)}} \\ \frac{mzon \cdot G}{x^2 + rzon^2} \cdot \sqrt{\frac{x^2}{\left(x^2 + rzon^2\right)}} \end{bmatrix}$$

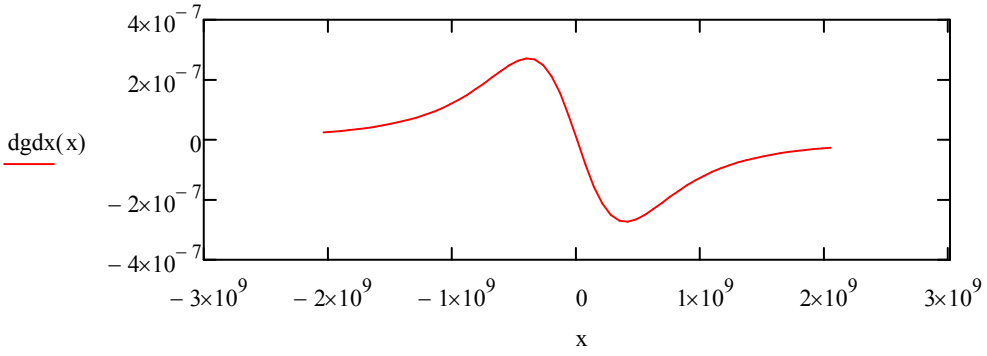
$x := -3 \cdot rzon, -2.9 \cdot rzon .. 3 \cdot rzon$

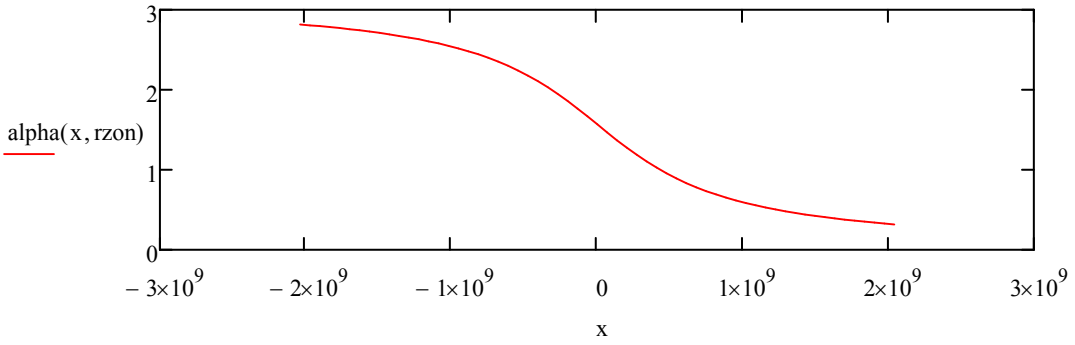
$|gxy(x, rzon)| \cdot \sin\alpha(x, rzon)$



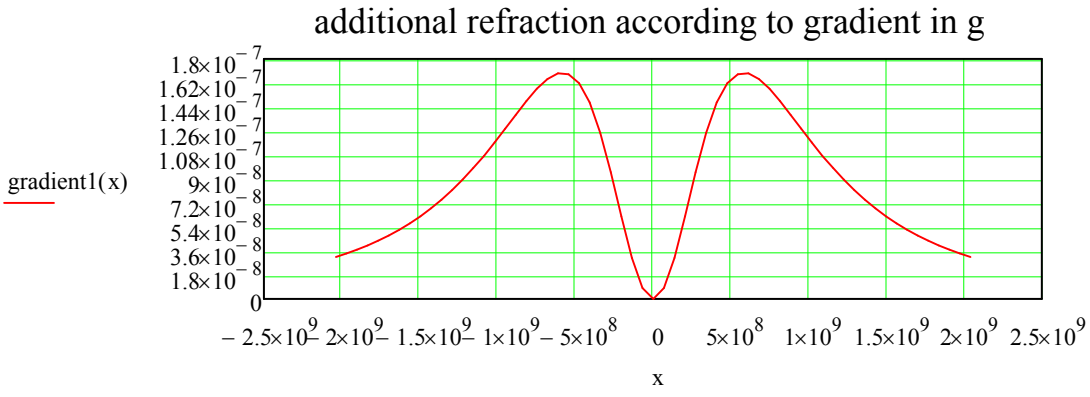
$$alpha(x, r) := \operatorname{acos}\left(\frac{x}{\sqrt{x^2 + rzon^2}}\right)$$

$$dgdx(x) := \frac{d}{dx}\left|gxy(x, rzon)\right|$$



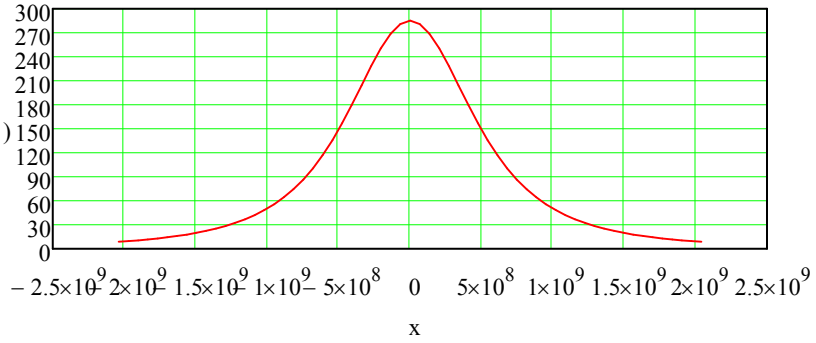


$$gradient1(x) := dgdx(x)\cdot\left(alpha(x, rzon) - \frac{\pi}{2}\right)$$



refraction according to equivalence principle

$(|gxy(x, rzon)| \cdot \sin\alpha(x, rzon))$

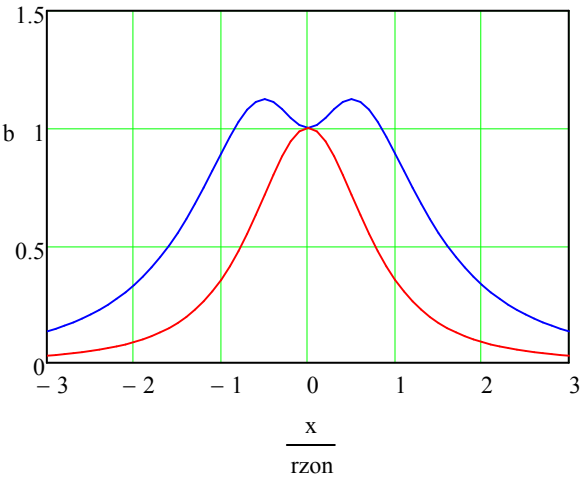


$a := 1$ $b := 0.2$

total refraction

$$\frac{(|gxy(x, rzon)| \cdot \sin\alpha(x, rzon))}{285} \cdot a + \frac{gradient1(x)}{6.12 \cdot 10^{-8}} \cdot b$$

$$\frac{(|gxy(x, rzon)| \cdot \sin\alpha(x, rzon))}{285}$$



10^9