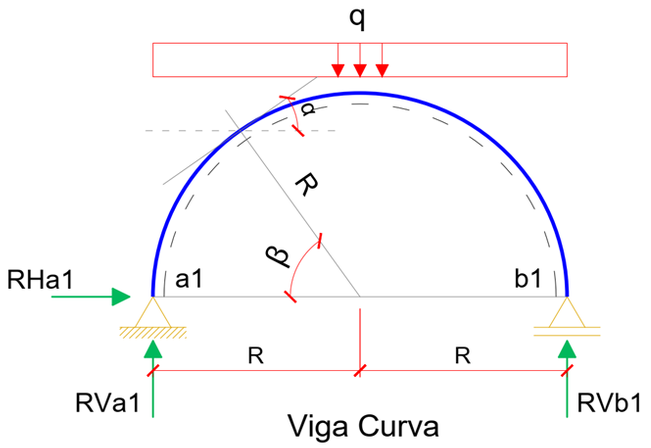
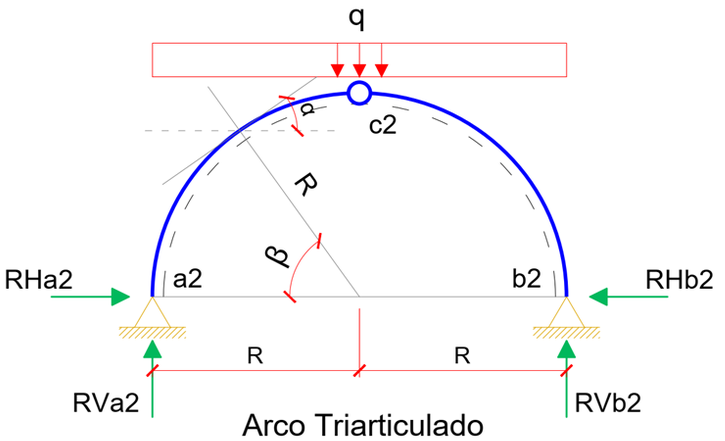
B2T4NB0506E1

Proceder os traçados dos diagramas de Momentos Fletores, Esforços Cortantes e Esforços Axiais para os dois modelos estruturais abaixo .

Dados comuns aos dois modelos: $q := 25\ \frac{kN}{m}$ $R := 4\ m$



Viga Curva Semicircular



Arco Triarticulado Semicircular

Reações de Apoio:

Para a Viga Curva:

$Rha1 := 0$ $RVa1 := \frac{q \cdot 2 \cdot R}{2} = 100,0\ kN$ $RVb1 := \frac{q \cdot 2 \cdot R}{2} = 100,0\ kN$ $RHa1 := 0\ kN$

Para o Arco Triarticuldo:

ΣMb2 = 0 (+) horário: RVa2. 2.R - q.(2.R)^2/2 =0 $RVa2 := \frac{q \cdot (2 \cdot R)^2}{2 \cdot 2 \cdot R} = 100,0\ kN$

ΣMa2 = 0 (+) antihorário: RVb2. 2.R - q.(2.R)^2/2 =0 $RVb2 := \frac{q \cdot (2 \cdot R)^2}{2 \cdot 2 \cdot R} = 100,0\ kN$

ΣMc2 = 0 (+) horário: RVa2.R - RHa2.R - q.R^2/2 = 0 $RHa2 := \frac{1}{R} \cdot \left(RVa2 \cdot R - \frac{q \cdot R^2}{2} \right) = 50,00\ kN$

ΣFh = 0 (+) para direita: RHa2- RHb2 = 0 $RHb2 := RHa2 = 50,00\ kN$

Equações de Momentos Fletores:

$x := R - R \cdot \cos(\beta)$ $y := R \cdot \sin(\beta)$

$M1h(\beta) := RVa1 \cdot x - \frac{q \cdot x^2}{2}$

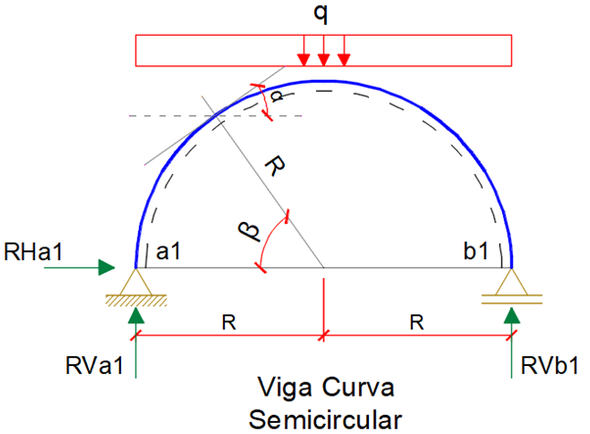
$M1v(x) := -RHa1 \cdot y$

$M1(\beta) := M1h(\beta) + M1v(\beta)$

$M1(\beta) = 200 \cdot (1 - \cos(\beta)) \cdot (-1 + \cos(\beta) + 2)\ kN\ m$

$M1(0) = 0,0000$ $M1\left(180 \cdot \frac{\pi}{180}\right) = 0,0000$

$M1\left(90 \cdot \frac{\pi}{180}\right) = 200,00\ kN\ m$



Viga Curva Semicircular

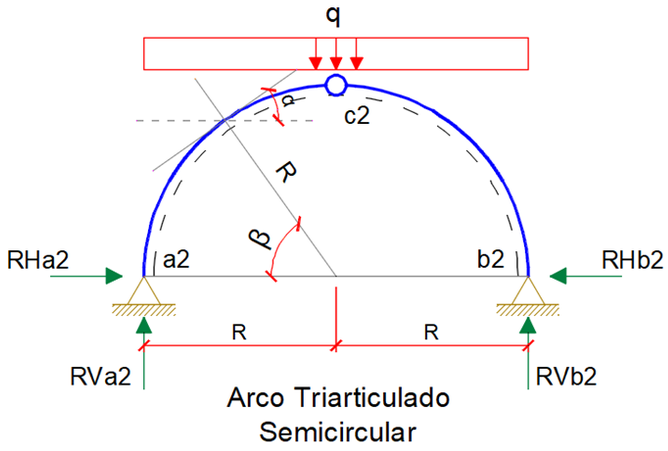
$$M2h(\beta) := RVa2 \cdot x - \frac{q \cdot x^2}{2}$$

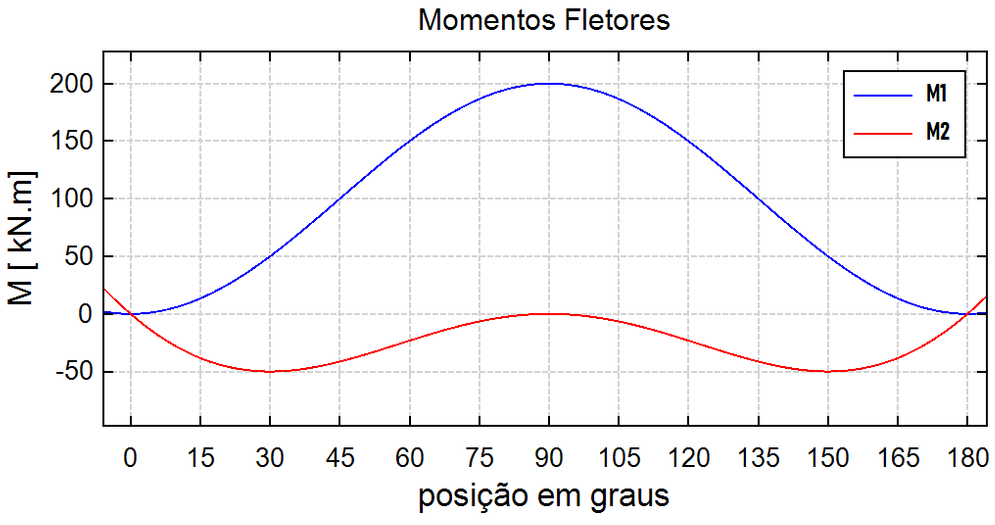
$$M2v(\beta) := -RHa2 \cdot y$$

$$M2(\beta) := M2h(\beta) + M2v(\beta)$$

$$M2(0) = 0,0000$$

$$M2\left(90 \cdot \frac{\pi}{180}\right) = 0 \qquad M2\left(180 \cdot \frac{\pi}{180}\right) = 0$$





Equações de Cortantes e Axiais:

$$\alpha(\beta) := \frac{\pi}{2} - \beta$$

$$V(\beta) = FV(\beta).cos\ \alpha(\beta) + FH(\beta).sen\ \alpha(\beta)$$
$$N(\beta) = -FV(\beta).sen\ \alpha(\beta) + FH(\beta).cos\ \alpha(\beta)$$

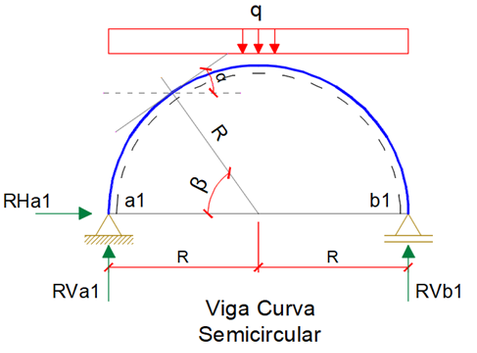
$$FV1(\beta) := RVa1 - q \cdot x = 100 \cdot \cos(\beta)\ \text{kN}$$
$$FH1(\beta) := -RHa1 = 0\ \text{kN}$$

$$V1(\beta) := FV1(\beta) \cdot \cos(\alpha(\beta)) + FH1(\beta) \cdot \sin(\alpha(\beta))$$

$$V1(\beta) = 100 \cdot \cos(\beta) \cdot \cos\left(\frac{-2 \cdot \beta + \pi}{2}\right)\ \text{kN}$$

$$N1(\beta) := (-FV1(\beta)) \cdot \sin(\alpha(\beta)) + FH1(\beta) \cdot \cos(\alpha(\beta))$$

$$N1(\beta) = -100 \cdot \cos(\beta) \cdot \sin\left(\frac{-2 \cdot \beta + \pi}{2}\right)\ \text{kN}$$



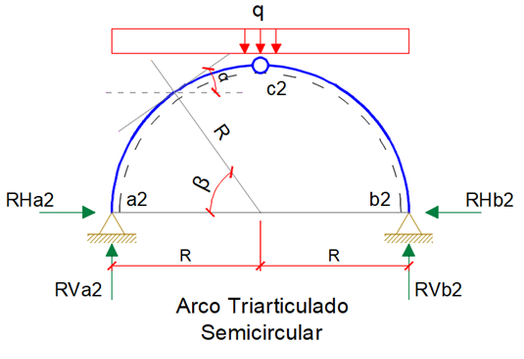
$$FV2(\beta) := RVa2 - q \cdot x = 100 \cdot \cos(\beta)\ \text{kN}$$
$$FH2(\beta) := -RHa2 = -50\ \text{kN}$$

$$V2(\beta) := (FV2(\beta)) \cdot \cos(\alpha(\beta)) + FH2(\beta) \cdot \sin(\alpha(\beta))$$

$$V2(\beta) = 50 \cdot \left(2 \cdot \cos(\beta) \cdot \cos\left(\frac{\pi - 2 \cdot \beta}{2}\right) - \sin\left(\frac{\pi - 2 \cdot \beta}{2}\right)\right)\ \text{kN}$$

$$N2(\beta) := (-FV2(\beta)) \cdot \sin(\alpha(\beta)) + FH2(\beta) \cdot \cos(\alpha(\beta))$$

$$N2(\beta) = -50 \cdot \left(2 \cdot \cos(\beta) \cdot \sin\left(\frac{\pi - 2 \cdot \beta}{2}\right) + \cos\left(\frac{\pi - 2 \cdot \beta}{2}\right)\right)\ \text{kN}$$



$V1\,(0) = 0$ kN

$V2\,(0) = -50{,}000$ kN

$N1\,(0) = -100$ kN

$N2\,(0) = -100$ kN

$V1\,(\pi) = 0$ kN

$V2\,(\pi) = 50$ kN

$N1\,(\pi) = -100$ kN

$N2\,(\pi) = -100$ kN

$V1\left(\frac{\pi}{2}\right) = 0{,}0000$ kN

$V2\left(\frac{\pi}{2}\right) = 0{,}000$ kN

$N1\left(\frac{\pi}{2}\right) = 0{,}000$ kN

$N2\left(\frac{\pi}{2}\right) = -50{,}00$ kN

