



higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NASIENRIGLYN

NASIONALE SERTIFIKAAT

MEGANOTEGNIEK N6

27 November 2025

Hierdie nasienriglyn bestaan uit 9 bladsye.

VRAAG 1: KOPPELAARS

$$\begin{aligned}
 1.1 \quad P &= \frac{2\pi NT}{60} \\
 18,5 \times 10^3 &= \frac{2\pi(650).T}{60} \\
 T &= 271,79 \text{ Nm} \checkmark \\
 T &= \mu(F_c - s)R \times \text{aantal skoene} \checkmark \\
 (F_c - s) &= \frac{T}{\mu \times R \times n} \\
 (F_c - s) &= \frac{271,79}{0,25 \times 0,15 \times 4} \checkmark \\
 (F_c - s) &= 1\,811,9 \text{ N} \checkmark \\
 (F_c - s) &= (m \times \omega_1^2 \times r) - m \times \omega_2^2 \times r \checkmark \\
 1\,811,9 &= \left[m \left(\frac{2\pi \times 650}{60} \right)^2 \times 0,12 \right] - \left[m \left(\frac{2\pi \times 350}{60} \right)^2 \times 0,12 \right] \checkmark \\
 1\,811,9 &= 555,99m - 161,2 \text{ m} \checkmark \\
 m &= 4,6 \text{ kg} \checkmark
 \end{aligned} \tag{8}$$

$$\begin{aligned}
 1.2 \quad s &= (m \times \omega_1^2 \times r) \quad \checkmark \\
 s &= 4,6 \times \left(\frac{2\pi \times 350}{60} \right)^2 \times 0,12 \quad \checkmark \\
 s &= 741,54 \text{ N} \checkmark
 \end{aligned} \tag{3}$$

[11]

VRAAG 2: REMME

$$\begin{aligned}
 2.1 \quad \theta &= 360^\circ - (90^\circ + 60^\circ) \\
 &= 210^\circ \checkmark \\
 \frac{T_1}{T_2} &= e^{\mu\theta} \\
 &= e^{(0,2)\left(\frac{210}{57,3}\right)} \checkmark \\
 T_1 &= 2,08T_2 \checkmark \\
 \text{Neem momente om die draagpunt, O} \\
 T_2 \times 120 &= 100 \times 300 \\
 T_2 &= 250 \text{ N} \checkmark \\
 T_1 &= 2,08T_2 = 2,08(250) \\
 T_1 &= 520 \text{ N} \\
 T_B &= (T_1 - T_2)r \\
 (520 - 250) \times 0,12 & \\
 &= 32,4 \text{ Nm} \checkmark
 \end{aligned} \tag{5}$$

$$\begin{aligned}
 2.2 \quad E_k &= \frac{1}{2} I \times \omega^2 \\
 &= \frac{1}{2} (mk^2) \times \omega^2 \\
 &= \frac{1}{2} \times 400(0,45)^2 \times (31,42)^2 \checkmark \\
 &= 40\,000 \text{ J } \checkmark
 \end{aligned}$$

$$\begin{aligned}
 40\,000 &= T_B \times 2\pi N \\
 40\,000 &= 32,4 \times 2\pi(N) \checkmark \\
 N &= 196,5 \text{ r/min} \checkmark
 \end{aligned} \tag{4}$$

$$\begin{aligned}
 2.3 \quad T_{yd}(s) &= \frac{n}{N} \\
 &= \frac{196,5}{300} \checkmark \\
 &= 0,65 \text{ min} \checkmark \\
 &= 39,3 \text{ sek } \checkmark
 \end{aligned} \tag{3}$$

[12]

VRAAG 3: LYNASTE

$$\begin{aligned}
 3.1 \quad F_t &= \frac{2 \times T}{\frac{PCD}{2 \times 160}} \\
 &= \frac{2 \times 160}{0,1} \\
 &= 3\,200 \text{ Nm } \checkmark
 \end{aligned} \tag{1}$$

$$\begin{aligned}
 3.2 \quad F_r &= F_t \times \tan \phi \\
 &= 3\,200 \times \tan 20^\circ \\
 &= 1\,165 \checkmark
 \end{aligned} \tag{1}$$

3.3 Vir vertikale reaksies

$$\begin{aligned}
 (F_R \times 0,45) + (R_2 \times 0,8) &= (mg \times 0,1) + [(T_1 + T_2) \times 1] \checkmark \\
 (1\,165 \times 0,45) + (R_2 \times 0,8) &= (200 \times 9,81 \times 0,1) + [(2\,800 + 1\,825) \times 1] \checkmark \\
 R_2 &= 5\,371 \text{ N } \checkmark
 \end{aligned}$$

Opwaartse kragte = Afwaartse kragte

$$\begin{aligned}
 R_1 + R_2 + F_r &= mg + T_1 + T_2 \\
 R_1 + 5\,371 + 1\,165 &= (200 \times 9,81) + 2\,800 + 1\,825 \\
 R_1 &= 51 \text{ N } \checkmark
 \end{aligned} \tag{4}$$

3.4 Vir horisontale reaksies

Kloksgewyse momente = Teenkloksgewyse momente

$$R_2 \times 0,8 = F_t \times 0,45 \checkmark$$

$$R_2 = 1\,800\,N \checkmark$$

$$F_t = R_1 + R_2 \checkmark$$

$$3\,200 = R_1 + 1\,800$$

$$R_1 = 1\,400\,N \checkmark$$

(4)
[10]

VRAAG 4: Vliegwiele

4.1

$$E_k = \frac{\text{arbeid verrig}}{\text{rendement}}$$

$$= \frac{1,5 \times 10^6 \times 0,02}{0,75} \checkmark$$

$$= 40\,000\,J \checkmark$$

$$E_k = \frac{1}{2} I (\omega_1^2 - \omega_2^2)$$

$$40\,000 = \frac{1}{2} I \left[\left(\frac{2\pi \times 200}{60} \right)^2 - \left(\frac{2\pi \times 120}{60} \right)^2 \right] \checkmark$$

$$I = 284,97\,kgm^2 \checkmark$$

$$= 142,48\,kgm^2 \text{ vir elke vliegwiel} \checkmark$$

(5)

4.2

$$P = E_k \times \text{drukkings} \checkmark$$

$$= 40 \times 10^3 \times \left(\frac{12}{60} \right) \checkmark$$

$$= 8\,kW \checkmark$$

(3)
[8]

VRAAG 5: REDUKSIERATKASTE

5.1

$$PCD = m \times T \checkmark$$

$$= 12 \times 40$$

$$= 480\,mm \checkmark$$

(2)

5.2

$$CD = \frac{PCD_A + PCD_B}{2} \checkmark$$

$$= \frac{48 + 480}{2}$$

$$= 264\,mm \checkmark$$

(2)

$$\begin{aligned} 5.3 \quad p &= m \times \pi \\ &= 12 \times \pi \\ &= 37,699 \text{ mm} \checkmark \end{aligned}$$

$$\begin{aligned} \theta &= \tan \theta = \frac{\text{lead}}{\pi \times d} \\ &= \frac{3 \times 37,699}{\pi \times 48} \\ &= 0,75 \checkmark \end{aligned}$$

$$\begin{aligned} \theta &= \tan^{-1}(0,75) \\ &= 36,9^\circ \checkmark \end{aligned}$$

$$\begin{aligned} \eta &= \frac{\tan \theta}{\tan(\theta + \phi)} \\ 0,75 &= \frac{\tan 36,9}{\tan(36,9 + \phi)} \checkmark \\ \tan(36,9^\circ + \phi) &= 1,001 \\ 36,9^\circ + \phi &= \tan^{-1}(1,001) \\ \phi &= 45^\circ - 36,9^\circ \\ \phi &= 8,1 \checkmark \end{aligned}$$

$$\begin{aligned} \mu &= \tan \phi \\ &= \tan 8,1^\circ \\ \mu &= 0,14 \checkmark \end{aligned}$$

(6)
[10]

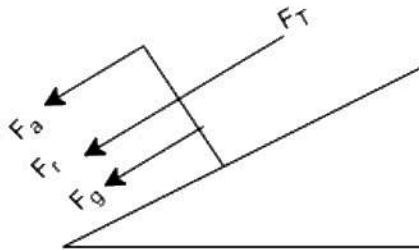
VRAAG 6: SPOORTREKKRAG EN VOERTUIGDINAMIKA

$$\begin{aligned}
 6.1 \quad F_r &= mR \\
 &= (95 + 310) \times 10^3 \times 0,04 \quad \checkmark \\
 &= 16\,200 \, N \quad \checkmark
 \end{aligned}$$

$$\begin{aligned}
 F_g &= ma \times \text{helling} \\
 &= (405 \times 10^3) \times 9,81 \times \frac{1}{80} \quad \checkmark \\
 &= 49\,663,125 \, N \quad \checkmark
 \end{aligned}$$

$$\begin{aligned}
 F_a &= ma \\
 &= (405 \times 10^3) \times 0,15 \quad \checkmark \\
 &= 60\,750 \, N \quad \checkmark
 \end{aligned}$$

$$\begin{aligned}
 F_T &= F_r + F_g + F_a \quad \checkmark \\
 &= 16\,200 + 49\,663,125 + 60\,750 \quad \checkmark \\
 &= 126\,613,125 \quad \checkmark
 \end{aligned}$$



versnelling

(9)

$$\begin{aligned}
 6.2 \quad T_\omega &= F_T + r \quad \checkmark \\
 &= 126\,613 \times 0,7 \quad \checkmark \\
 &= 88\,629,188 \, Nm \quad \checkmark
 \end{aligned}$$

$$\begin{aligned}
 GR &= \frac{T_\omega}{T_E \times \eta} \quad \checkmark \\
 &= \frac{88\,629,188}{25 \times 10^3 \times 0,75} \quad \checkmark \\
 &= 4,72 : 1 \quad \checkmark
 \end{aligned}$$

(6)
[15]

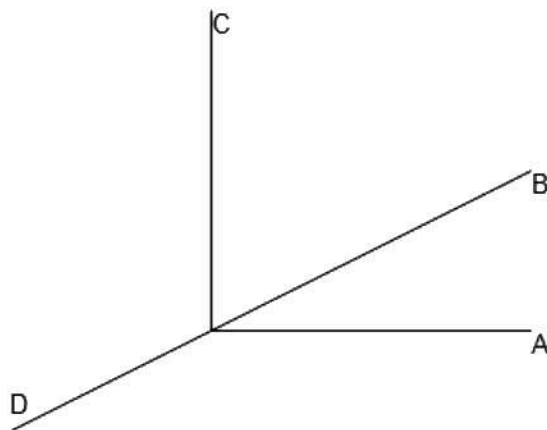
VRAAG 7: BALANSERING

7.1

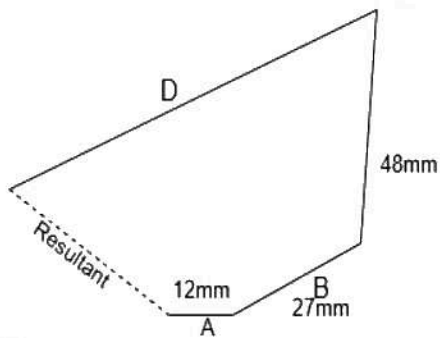
Vlak	Massa (kg)	r (m)	mr (kg.m)
A	2	0,6	1,2
B	3	0,9	2,7
C	4	1,2	4,8
D	5	1,5	7,5

✓✓✓✓

Skaal: 10 mm = 1 kgm



Ruimtediagram



Kragteveelhoek

✓✓✓✓

$$\begin{aligned}
 \text{Resultant} &= 3,8 \text{ kgm} \checkmark \\
 F_{\text{resultant}} &= mr\omega^2 \\
 &= (3,8)(2\pi \times 12)^2 \checkmark \\
 &= 21\,602,59 \text{ N} \\
 &= 21,6 \text{ kN} \checkmark
 \end{aligned}$$

$$\begin{aligned}
 mr &= 3,8 = 10 r = 3,8 \\
 r &= 0,38 \\
 &= 380 \text{ mm} \checkmark \checkmark
 \end{aligned}$$

(12)

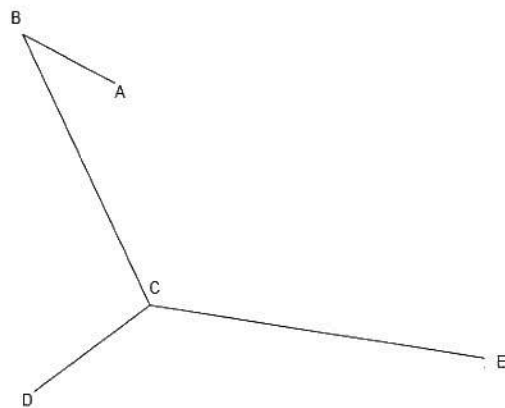
7.2 Hoekposisie: 320° teenklokgewys vanaf A.

(2)
[15]

VRAAG 8: KINEMATIKA

8.1

Skaal: $30 \text{ mm} = 1 \text{ m/s}$
 $= 0,37$



Ruimtediagram

(3)

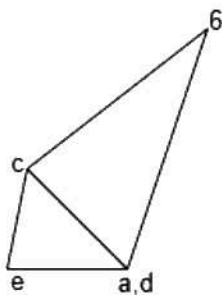
8.2

$$\begin{aligned} V &= \omega r \\ &= \frac{(2\pi \times 120)}{60} \times 0,03 \checkmark \\ &= 0,37 \text{ m/s} \checkmark \end{aligned}$$

(2)

8.3

Skaal: $100 \text{ mm} = 1 \text{ m/s}$



Snelheiddiagram

(4)

8.4

$$V_{ed} = 0,13 \text{ m/s} \checkmark \checkmark$$

(2)

$$\begin{aligned} 8.5 \quad \omega_{BC} &= \frac{v_{bc}}{BC} & \omega_{CD} &= \frac{v_{cd}}{CD} & \omega_{CE} &= \frac{v_{ce}}{CE} \\ &= \frac{0,32}{0,08} & &= \frac{0,185}{0,045} & &= \frac{0,016}{0,12} \\ &= 4 \text{ rad/s} \quad \checkmark\checkmark & &= 4,1 \text{ rad/s} \quad \checkmark\checkmark & &= 0,13 \text{ rad/s} \quad \checkmark\checkmark \end{aligned} \quad (6)$$

$$\begin{aligned} 8.6 \quad \text{sentripetale versnelling} &= \frac{v^2}{r} \\ &= \frac{(0,185)^2}{0,045} \checkmark \\ &= 0,76 \text{ m/s}^2 \checkmark \end{aligned} \quad \begin{array}{l} (2) \\ [19] \end{array}$$

TOTAAL: 100