



higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NASIENRIGLYN

NASIONALE SERTIFIKAAT

MEGANOTEGNIEK N6

1 April 2026

Hierdie nasienriglyn bestaan uit 9 bladsye.

VRAAG 1: KOPPELAARS

$$P = \frac{2\pi NT}{60}$$

$$T = \frac{30 \times 10^3 \times 60}{2\pi \times 800}$$

$$= 358,1 \text{ Nm} \quad \checkmark$$

$$\omega = \frac{2\pi N}{60}$$

$$= \frac{2\pi(800)}{60}$$

$$\omega = 83,75 \text{ rad/s} \quad \checkmark$$

$$F_c = \text{mass} \times \omega^2 \times r$$

$$= m \times (83,75)^2 \times 0,13 \quad \checkmark$$

$$F_c = 912,39 \times \text{mass} \quad \checkmark$$

Veerkrag

$$s = \text{mass} (\% \text{ of operating speed} \times \omega^2) \times r \quad \checkmark$$

$$s = \text{mass} \times (0,7 \times 83,75)^2 \times 0,13 \quad \checkmark$$

$$s = 446,8 \text{ m} \quad \checkmark$$

$$T = \mu(F_c - s) \times R \times n$$

$$358,1 = 0,39(912,39 - 446,8) \text{ m} \times 0,1625 \times 4 \quad \checkmark$$

$$358,1 = 90,9 \times m$$

$$m = 3,9 \text{ kg} \quad \checkmark$$

[9]

VRAAG 2: REMME

2.1

$$T = \frac{60P}{2\pi N}$$

$$= \frac{60 \times 80 \times 10^3}{2\pi \times 200} \quad \checkmark$$

$$= 3820 \text{ Nm} \quad \checkmark$$

(2)

2.2

$$\theta_{\text{block}} = \frac{270^\circ}{12+11} \quad \checkmark$$

$$= 11,74^\circ \quad \checkmark$$

$$\frac{T_1}{T_2} = \left[\frac{1 + \mu \tan \theta}{1 - \mu \tan \theta} \right]^n$$

$$= \left[\frac{1 + 0,28 \tan 11,74^\circ}{1 - 0,28 \tan 11,74^\circ} \right]^{12} \quad \checkmark$$

$$= 4,028$$

$$\therefore T_1 = 4,028 T_2 \quad \checkmark$$

(4)

$$\begin{aligned}
 2.3 \quad T &= (T_1 - T_2) \times R \\
 3820 &= (4,028T_2 - T_2) \times 0,19 \quad \checkmark \\
 3820T_2 &= 20\,105 \\
 T_2 &= 6640\,N \quad \checkmark \\
 T_2 &= 26746 \quad \checkmark
 \end{aligned} \tag{3}$$

2.4 Kloksgewyse momente = Antikloksgewyse momente

$$\begin{aligned}
 F \times 0,44 &= T_1 \times 0,08 \quad \checkmark \\
 &= 26746 \times 0,08 \\
 F &= 4863\,N \quad \checkmark
 \end{aligned} \tag{2}$$

[11]

VRAAG 3: LYNAS

$$\begin{aligned}
 3.1 \quad P &= 2\pi NT \\
 T &= \frac{30 \times 10^3 \times 60}{2\pi \times 1400} \\
 &= 204,6\,Nm \quad \checkmark
 \end{aligned} \tag{1}$$

$$\begin{aligned}
 3.2 \quad T_s &= \frac{T_p \times PCD_\omega}{PCD_{pinion}} \\
 &= \frac{204,6 \times 380}{150} \quad \checkmark \\
 &= 518,32\,Nm \quad \checkmark
 \end{aligned} \tag{2}$$

$$\begin{aligned}
 3.3 \quad F_t &= \frac{T \times 2}{PCD} \\
 &= \frac{204,6 \times 2}{0,15} \\
 &= 2728\,N \quad \checkmark
 \end{aligned} \tag{1}$$

$$\begin{aligned}
 3.4 \quad F_r &= F_t \tan \phi \\
 &= 2728 \tan 20^\circ \\
 &= 992,9\,N \quad \checkmark
 \end{aligned} \tag{1}$$

$$\begin{aligned}
 3.5 \quad T_s &= (T_1 - T_2) \times R \\
 518,32 &= (T_1 - T_2) \times 0,215 \quad \checkmark \\
 (T_1 - T_2) &= 2411\,N \\
 \frac{T_1}{T_2} &= e^{\mu\theta} \\
 \frac{T_1}{T_2} &= e^{(0,3 \times \frac{210^\circ}{57,3^\circ})} \\
 T_1 &= 3T_2 \quad \checkmark \\
 (3T_2 - T_2) &= 2411 \\
 T_2 &= 1205\,N \quad \checkmark \\
 T_1 &= 3616,5\,N \quad \checkmark
 \end{aligned} \tag{4}$$

VRAAG 4: Vliegwiele

4.1 Massa van die buitenste silinder

$$\begin{aligned} m &= \text{density} \times \text{volume} \\ &= 7500 \times \pi R^2 \times \text{width} \\ &= 7500 \times \pi (0,5)^2 \times 0,2 \quad \checkmark \\ &= 1178 \text{ kg} \quad \checkmark \end{aligned}$$

Massa van die binneste silinder

$$\begin{aligned} m_2 &= \text{density} \times \text{volume} \\ &= 7500 \times \pi (0,35)^2 \times 0,2 \quad \checkmark \\ &= 577,3 \text{ kg} \quad \checkmark \end{aligned}$$

Traagheidsmoment

$$\begin{aligned} I &= m \left(\frac{R^2 + r^2}{2} \right) \\ &= \frac{1}{2} (m_1 - m_2) (R^2 + r^2) \quad \checkmark \\ &= \frac{1}{2} (1178 - 577,8) [(0,5)^2 + (0,35)^2] \quad \checkmark \\ &= 300,35 (0,372) \\ &= 112 \text{ kgm}^2 \quad \checkmark \end{aligned} \tag{7}$$

4.2

$$\begin{aligned} E_k &= \frac{1}{2} I (\omega_2^2 - \omega_1^2) \\ &= \frac{1}{2} \times 112 [(2\pi \times 4)^2 - (2\pi \times 3,5)^2] \quad \checkmark \\ &= 8,294 \text{ kJ} \quad \checkmark \end{aligned} \tag{2}$$

4.3

$$\begin{aligned} \alpha &= \frac{\omega_2 - \omega_1}{t} \\ t &= \frac{60}{20} - 0,9 \\ &= 2,1 \quad \checkmark \\ \alpha &= \frac{(2\pi \times 4) - (2\pi \times 3,5)}{2,1} \quad \checkmark \\ &= 1,5 \text{ rad/s}^2 \quad \checkmark \end{aligned}$$

Wringkrag

$$\begin{aligned} T &= I \times \alpha \\ &= 112 \times 1,5 \\ &= 167,6 \text{ Nm} \quad \checkmark \end{aligned} \tag{4}$$

[13]

VRAAG 5: REDUKSIERATKASTE

$$\begin{aligned}
 5.1 \quad I &= mk^2 \\
 &= 110 \times 0,25^2 \\
 &= 6,875 \text{ kgm}^2 \quad \checkmark
 \end{aligned} \tag{1}$$

$$\begin{aligned}
 5.2 \quad T_2 &= T_a \times VR \\
 &= \frac{4,5 \times 42 \times 56}{24 \times 32} \quad \checkmark \\
 &= 13,781 \text{ Nm} \quad \checkmark
 \end{aligned}$$

$$\begin{aligned}
 I_{D(TOTAL)} &= [(I_A \times VR^2) + (I_B + I_C) \times VR^2] + I_D + I_{drum} \quad \checkmark \\
 &= \left[0,25 \times \left(\frac{24 \times 32}{42 \times 56} \right)^2 \right] + \left[(0,78 + 0,32) \times \left(\frac{32}{56} \right)^2 \right] + 1,22 + 6,875 \quad \checkmark \\
 &= 9 \text{ kgm}^2 \quad \checkmark
 \end{aligned}$$

$$\begin{aligned}
 T &= I\alpha \\
 \alpha &= \frac{T}{I} = \frac{13,78}{9} \quad \checkmark \\
 &= 1,53 \text{ rad/s}^2 \quad \checkmark
 \end{aligned}$$

$$\begin{aligned}
 \omega_2 &= 0 + (1,53 \times 35) \\
 &= 53,6 \text{ rad/s} \quad \checkmark
 \end{aligned}$$

$$\begin{aligned}
 N &= \frac{\omega \times 60}{2\pi} \\
 &= \frac{53,6 \times 60}{2\pi} \quad \checkmark \\
 &= 511,78 \text{ r/min} \quad \checkmark
 \end{aligned}$$

(10)
[11]

VRAAG 6: SPOORTRAKSIE

$$\begin{aligned}
 6.1 \quad F_R &= mR \\
 &= 5000 \times 0,125 \quad \checkmark \\
 &= 625 \text{ N} \quad \checkmark
 \end{aligned} \tag{2}$$

$$\begin{aligned}
 6.2 \quad \alpha &= \frac{v-u}{t} \\
 &= \frac{33,33-25}{3} \\
 &= 1,667 \text{ m/s} \quad \checkmark
 \end{aligned}$$

$$\begin{aligned}
 F_a &= m \times a \\
 &= 5000 \times 1,667 \\
 &= 8333,33 \text{ N} \quad \checkmark
 \end{aligned}$$

$$\begin{aligned}
 F_T &= F_r + F_a \quad \checkmark \\
 &= 625 + 8333,33 \\
 &= 8958 \text{ N} \quad \checkmark
 \end{aligned}$$

(4)

6.3

$$a = \frac{u^2 - v^2}{25}$$

$$= \frac{33,33^2 - 0^2}{2 \times 50}$$

$$= 11,11 \text{ m/s}^2 \checkmark$$

$$F_a = m \times a$$

$$= 5000 \times 11,11$$

$$= 55\,555,56 \checkmark$$

$$F_b = F_a - F_r \checkmark$$

$$= 55\,555,56 - 625$$

$$= 54,93 \text{ kN} \checkmark$$

(4)

6.4

$$F_a = F_r = 625 \checkmark$$

$$a = \frac{F_a}{m}$$

$$= \frac{625}{5000}$$

$$= 0,125 \text{ m/s}^2 \checkmark$$

$$s = \frac{u^2 - v^2}{29}$$

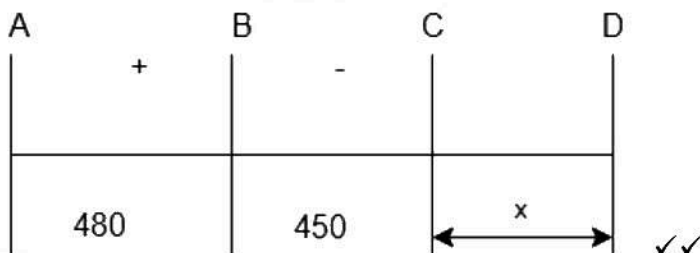
$$= \frac{33,333^2 - 0^2}{2 \times 0,125}$$

$$= 4,44 \text{ km} \checkmark$$

(3)
[13]

VRAAG 7: BALANSERING

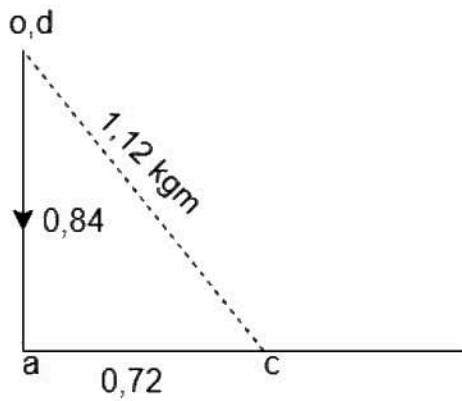
7.1



Vlak	M	r	Mnr	ℓ	Mnr ℓ
A	7	0,3	2,1	-0,4	-0,84
B	MB	0,42	0,42 MB	0	0
C	4	0,4	1,61,35	0,45	0,72
D	3	0,45		0,45 + x	0,6075 + 1,35x

✓✓✓✓

Scale: 1mm = 0,02 kgm



Couple polygon

✓✓✓

$$0,6075 + 1,35x = 1,12$$

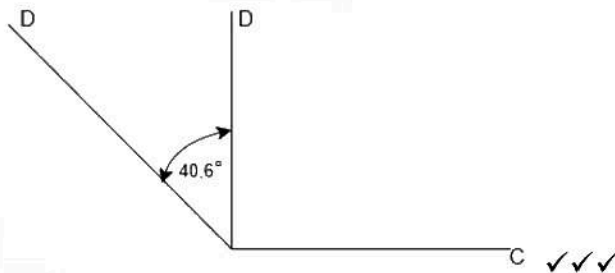
$$x = 0,3796$$

$$x = 379,63 \text{ mm} \checkmark \checkmark$$

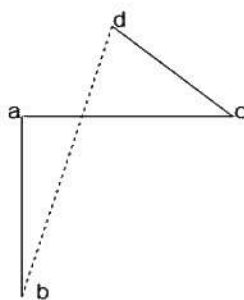
In ACD Δ

$$\tan \theta = \frac{cd}{ac} = \frac{0,72}{0,84}$$

$$\tan^{-1} \left(\frac{0,72}{0,84} \right) = 40,6^\circ \checkmark \checkmark \checkmark$$



Scale: 1mm = 0,05 kgm



Force polygon

✓✓✓

Resultant = 66 mm
 $bd = 3,3 \text{ kgm (scale) } \checkmark$

Dus:

$$0,42 M_B = 3,3$$

$$M_B = 7,86 \text{ kg}$$

$$\phi = 13,5^\circ$$

Angular position between A and D = $40,6^\circ$

188° and 319° clockwise from A (17)

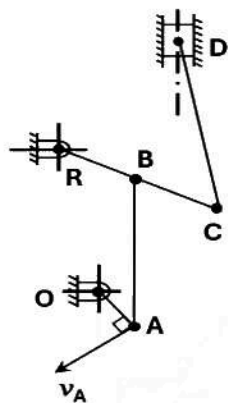
7.2 Afstand tussen C en D = 379,63 mm ✓✓ (2)

7.3 Massa = 7,8 kg ✓✓ (2)

[21]

VRAAG 8: KINEMATIEK

8.1



Ruimtediagram ✓✓✓✓

(4)

8.2

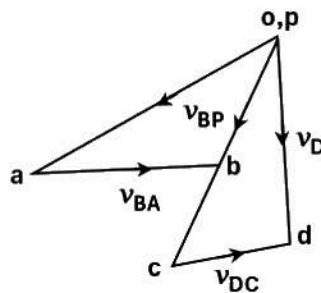
$$v = \omega r$$

$$= \frac{2\pi (180)}{60} \times 0,15$$

$$= 2,83 \text{ m/s } \checkmark$$

(1)

8.3



Snelheidsdiagram ✓✓✓✓✓✓

(6)

8.4

$$\begin{aligned}V_d &= 2,36 \text{ m/s} \\V_{dc} &= 1,2 \text{ m/s} \\V_{ba} &= 1,8 \text{ m/s} \\V_{bp} &= 1,5 \text{ m/s}\end{aligned}$$

Hoekversnelling van CD

$$\begin{aligned}a_{DC} &= \frac{v_{dc}^2}{CD} \\&= \frac{(1,2)^2}{0,66} \\&= 2,2 \text{ m/s}^2 \checkmark\end{aligned}$$

(2)
[13]

TOTAAL: 100