higher education
& training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NASIENRIGLYN

NASIONALE SERTIFIKAAT

## MEGANOTEGNIEK N6

9 April 2021

Hierdie nasienriglyn bestaan uit 10 bladsye.

VRAAG 1: REMME

1.1
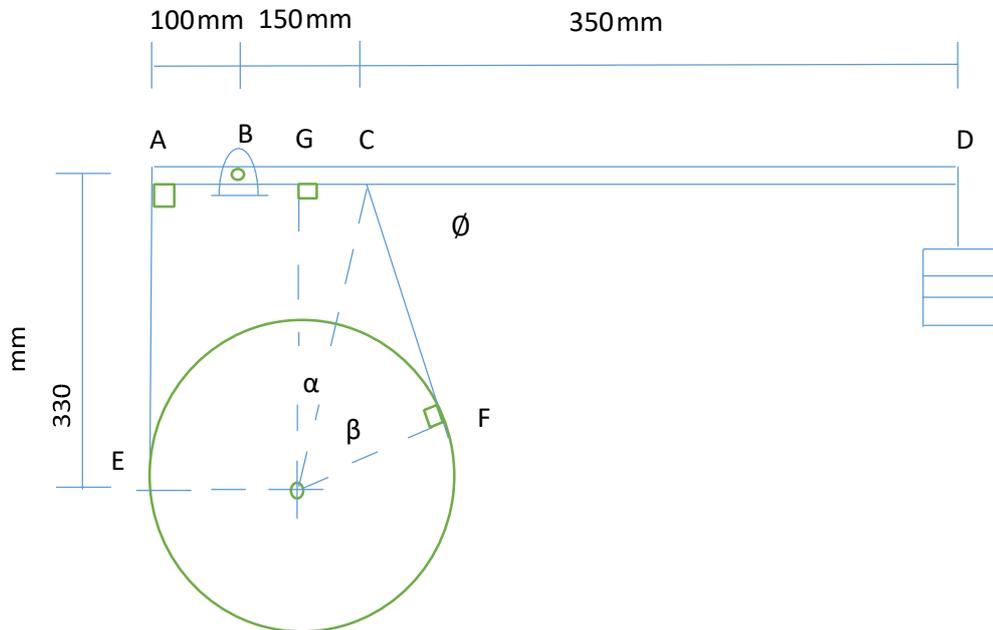
$$tan \propto= \frac{CG}{GO} \qquad\qquad GC = 250 - 160 = 90 \text{ mm}✓$$

$$\propto= tan^{-1}\left(\frac{90}{330}\right)✓ = 15,26°✓$$

$$OC^2 = GC^2 + GO^2$$

$$OC^2 = 90^2 + 330^2$$

$$OC = 342,052 \text{ mm}✓$$

$$cos\beta = \frac{OF}{OC}$$

$$\beta = cos^{-1}(\frac{160}{342,052})✓$$

$$\beta = 62,11°✓$$

$$\theta = 360 - (90+\propto +\beta)$$

$$= 360 - (90 + 15,26 + 62,11)$$

$$= 192,63°✓ \qquad\qquad\qquad\qquad\qquad (7)$$

1.2

$$T = \frac{P}{2\pi N} = \frac{16\,965}{2\pi(16,667)} \checkmark = 162 \text{ Nm}\checkmark$$

$$\frac{T_1}{T_2} = e^{\mu\theta}$$

$$\frac{T_1}{T_2} = e^{(0,3)(3,362)}\checkmark$$

$$T_1 = 2,742T_2\checkmark$$

$$T = (T_1 - T_2)R$$

$$162 = (2,742T_2 - T_2)0,16\checkmark$$

$$T_2 = 581,228 \text{ N}\checkmark$$

$$T_1 = (2,742)(581,228) = 1\,592,727 \text{ N}\checkmark$$

Die hoek tussen die band en die horisontale hefboom:

$$\emptyset = \propto + \beta = 77,37°\checkmark$$

$$W \times BD + T_2\sin\emptyset \times BC = T_1 \times AB$$

$$W \times 0,5 + (581,228S\sin77,37°)\checkmark(0,15) = 1\,592,727 \times 0,1\checkmark$$

$$W = 148,397 \text{ N}\checkmark$$

$$\therefore W = mg$$

$$M = \frac{148,397}{9,81} = 15,127 \text{ kg}\checkmark$$

(12)
[19]

VRAAG 2: KOPPELAARS

$$w_1 = \frac{2\pi N}{60} = \frac{2\pi(600)}{60} = 62{,}832 \text{ rad/s} \checkmark$$

$$F_c = m(w_1{}^2)r$$

$$= 3{,}6(62{,}832)^2(0{,}15)$$

$$= 2\ 131{,}845 \text{ N} \checkmark$$

$$w_2 = \frac{2\pi N}{60} = \frac{2\pi(0{,}75 \times 600)}{60} = 47{,}124 \text{ rad/s} \checkmark$$

$$S = m(w_2{}^2)r$$

$$= 3{,}6(47{,}124)^2(0{,}15)$$

$$= 1\ 199{,}163 \text{ N} \checkmark$$

$$F_c - S = 2\ 131{,}845 - 1\ 199{,}163$$

$$= 932{,}682 \text{ N} \checkmark$$

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

$$= 0{,}3(932{,}682)(0{,}175)(4) \checkmark$$

$$= 195{,}863 \text{ Nm} \checkmark$$

$$P = \frac{2\pi NT}{60} = \frac{2\pi(600)(195{,}863)}{60} \checkmark$$

$$= 12{,}306 \text{ kW} \checkmark$$ **[9]**

VRAAG 3: LYNASSE

3.1 $\quad N_A D_A = N_B D_D$

$\quad\quad (600)(0{,}12) = N_B(0{,}3) \checkmark$

$\quad\quad N_B = 240 \text{ r/min} \checkmark$ (2)

3.2 $\quad T = \dfrac{60P}{2\pi N} = \dfrac{60(12 \times 10^3)}{2\pi(240)} \checkmark = 477{,}46 \text{ Nm} \checkmark$

(2)

3.3 $F_t = \dfrac{T \times 2}{PCD} = \dfrac{(477,465)2}{240}$ ✓ $= 3\,978,875$ N✓

         $F_n = \dfrac{F_t}{cos\emptyset} = \dfrac{3\,978,875}{cos20°}$ ✓ $= 4\,234,23$ N✓

         $F_v = F_n sin50°$

           $= 4\,234,23 sin60°$✓

           $= 3\,674,75$ N✓   (6)

3.4 $\dfrac{T_1}{T_2} = e^{\mu\theta}$

         $\dfrac{T_1}{T_2} = e^{(0,3)(\pi)}$ ✓

         $T_1 = 2,566 T_2$ ✓

         $T = (T_1 - T_2)R$

         $477,465 = (2,566 T_2 - T_2)0,16$ ✓

         $T_2 = 1\,905,591$ N✓

         $T_1 = 1\,905,591 \times 2,566 = 4\,889,747$ N✓   (5)

3.5 $\Sigma Cwm = \Sigma Acwm$

           $0 = (4\,889,747 + 1\,905,591)0,16 + (3\,674,75)0,6 + Rr \times 1,2$ ✓

           $0 = 1\,087,255 + 2\,204,4 + 1,2Rr$

         Rr $= -2\,743,045$ N

           $= -2\,743,045$ N af✓

       $\Sigma F_{op} = \Sigma F_{af}$

     $R_L + F_V = R_R + T_1 + T_2$

     Rl $+ 3\,243,609 = 2\,743,045 + 4\,889,747 + 1\,905,591$ ✓

     Rl $= 6\,294,775$ N✓   (4)

                                                                 [19]

VRAAG 4: VLIEGWIELE

4.1 $A = \dfrac{\pi}{4}(D^2 - d^2)$

$A = \dfrac{\pi}{4}(0{,}4^2 - 0{,}15^2)$ ✓

$A = 107{,}992 \times 10^{-3} \text{ m}^2$ ✓

$m = \delta A w$

$m = (7\,500)(107{,}992 \times 10^{-3})(0{,}12)$ ✓

$m = 97{,}193 \text{ kg}$ ✓

$I = m(\dfrac{R^2 + r^2}{2})$

$I = 97{,}193(\dfrac{0{,}2^2 + 0{,}075^2)}{2})$ ✓

$I = 2{,}217 \text{ kg.m}^2$ ✓ (6)

4.2 $\Delta E_K = \dfrac{1}{2}I(w_2{}^2 - w_1{}^2)$

$3{,}98 \times 10^3 = \dfrac{1}{2}(2{,}217)(w_2{}^2 - 0^2)$ ✓

$w_2 = 59{,}92 \text{ rad/s}$ ✓

$w_2 = w_1 + \propto t$

$59{,}92 = 0 + \propto (1{,}8)$ ✓

$\propto = 33{,}29 \text{ rad/s}^2$ ✓ (4)

[10]

VRAAG 5: BALANSERING

5.1

	m (kg)	r (mm)	mr (kg.mm)	ℓ (m)	mrℓ (kg.mm.m)
A	8	120	960√	-3x	-2 880x√
B	10	100	1 000√	-2x	-2 000x√
C	7	r	7r√	0	0√
D	9	90	810√	x	810x√
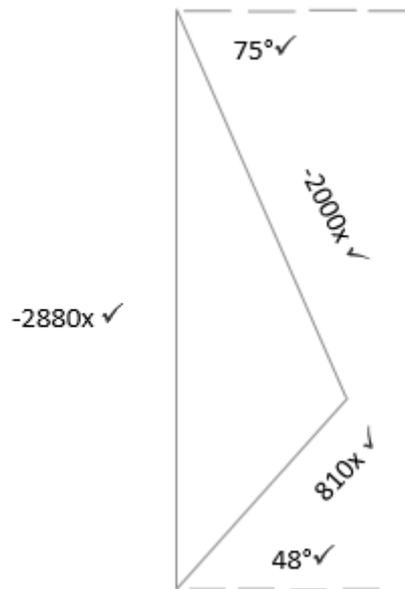
Hoek tussen A en B is 75° + 90° = 165°✓
Hoek tussen A en D is 48° + 90° = 138°✓   (11)

5.2
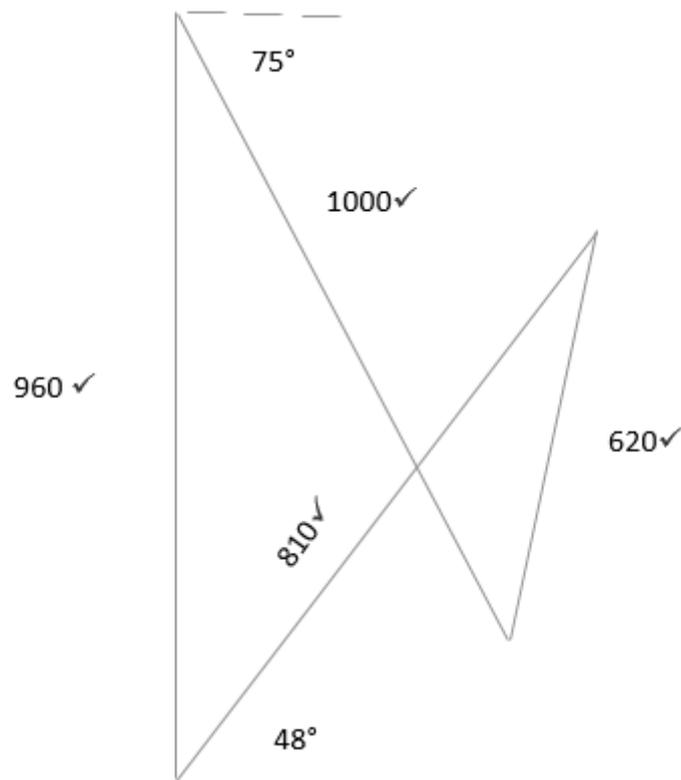
$7r = 620$✓
$r = 88,6 \text{ mm} = 89 \text{ mm}$✓ (6)

[17]

VRAAG 6: DINAMIKA

6.1 $F_g = W_T(\dfrac{4\%}{100\%})$

$= (30 \times 10^3 + 300 \times 10^3)\dfrac{1}{25}$ ✓

$= 13,2 \text{ kN}$✓

$F_R = R_L + R_T$

$= 30 \times 25 + 300 \times 30$

$= 750 + 9\,000$✓

$= 9,75 \text{ kN}$✓

$F_e = F_R + F_g$

$F_e = 9,75 + 13,2$

$F_e = 22,95 \text{ kN}$✓ (5)

6.2 $v = u + at$

$\dfrac{72}{3,6} = 0 + a(60 \times 1,5)$ ✓

$a = 0,222 \text{ m/s}^2$ ✓

$F_a = m_T a$

$= (330 \times 10^3)(0,222)$ ✓

$= 73,333 \text{ kN}$ ✓

$F_e = F_R + F_g + F_a$

$= 7,95 + 13,2 + 73,333$

$= 96,283 \text{ kN}$ ✓   (5)
[10]

VRAAG 7: KINEMATIKA

7.1
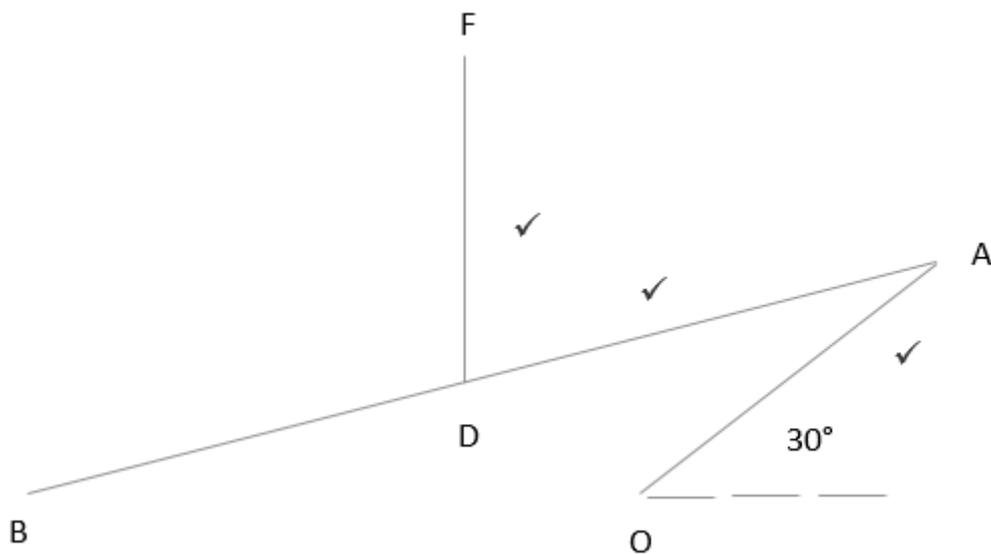
(3)

7.2 $v_{OA} = \dfrac{\pi ND}{60} = \dfrac{\pi(60)(0,2)}{60}$ ✓ $= 0,628 \text{ m/s}$ ✓

(2)

7.3 Skaal: 0,1 m/s = 10 mm
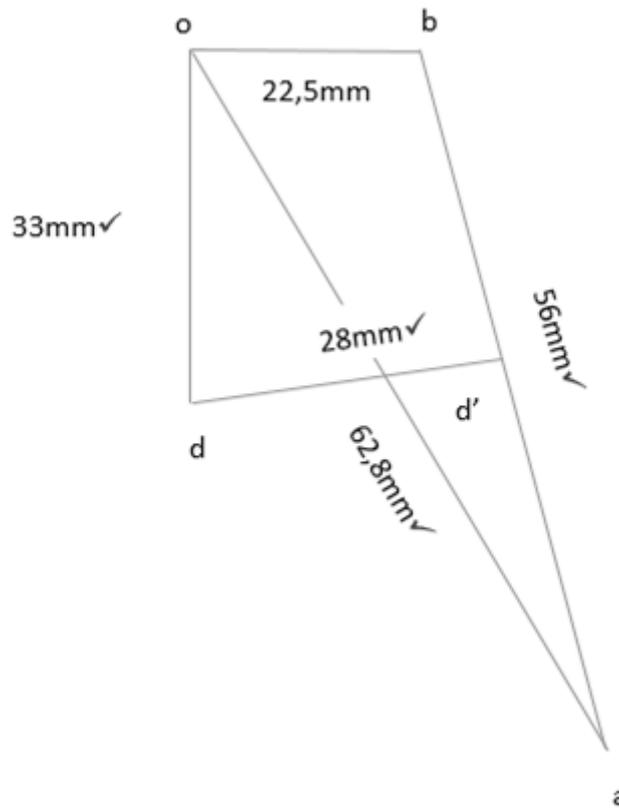
(1 punt vir elke snelheidstekening) (5)

7.4
$$v_{DE} = \frac{33}{100} \checkmark = 0,33 \text{ m/s} \checkmark$$
(2)

7.5 7.5.1
$$a = \frac{v^2}{r} = \frac{(0,628)^2}{0,1} \checkmark = 3,944 \text{ m/s}^2 \checkmark$$

7.5.2
$$a = \frac{v^2}{r} = \frac{(\frac{56}{100})^2}{0,3} \checkmark = 1,045 \text{ m/s}^2 \checkmark$$

(2 × 2) (4)

[16]

TOTAAL: 100