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**NATIONAL SENIOR  
CERTIFICATE/*NASIONALE  
SENIORSERTIFIKAAT***

**GRADE/*GRAAD* 12**

**SEPTEMBER 2023**

**TECHNICAL MATHEMATICS P2/*TEGNIESE WISKUNDE V2*  
MARKING GUIDELINE/*NASIENRIGLYN***

**MARKS/*PUNTE*: 150**

This marking guideline consists of 16 pages./  
*Hierdie nasienriglyn bestaan uit 16 bladsye.*

**NOTE:**

- Continuous accuracy (CA) applies only where indicated in this marking guideline.
- Assuming values/answers in order to solve a problem is unacceptable.

**LET WEL:**

- *Volgehoue akkuraatheid (CA) is slegs van toepassing soos aangedui in hierdie nasienriglyn.*
- *Aanvaarding van waardes/antwoorde om 'n probleem op te los, is onaanvaarbaar.*

| MARKING CODES / NASIENKODES |                                                                                                |
|-----------------------------|------------------------------------------------------------------------------------------------|
| <b>M</b>                    | <b>Method / Metode</b>                                                                         |
| <b>A</b>                    | <b>Accuracy / Akkuraatheid</b>                                                                 |
| <b>AO</b>                   | <b>Answer only / Slegs antwoord</b>                                                            |
| <b>CA</b>                   | <b>Consistent accuracy / Deurlopende akkuraatheid</b>                                          |
| <b>F</b>                    | <b>Formula / Formule</b>                                                                       |
| <b>I</b>                    | <b>Identity / Identiteit</b>                                                                   |
| <b>R</b>                    | <b>Rounding / Afronding</b>                                                                    |
| <b>S</b>                    | <b>Simplification / Vereenvoudiging</b>                                                        |
| <b>ST</b>                   | <b>Statement / Bewering</b>                                                                    |
| <b>RE</b>                   | <b>Reason / Rede</b>                                                                           |
| <b>ST RE</b>                | <b>Statement and correct reason / Bewering en korrekte rede</b>                                |
| <b>SF</b>                   | <b>Substitution correctly in correct formula / Korrekte vervanging in die korrekte formule</b> |
| <b>NPU</b>                  | <b>No penalty for omitting units / Geen penaliserings vir eenhede uitgelaat</b>                |



## QUESTION/VRAAG 1

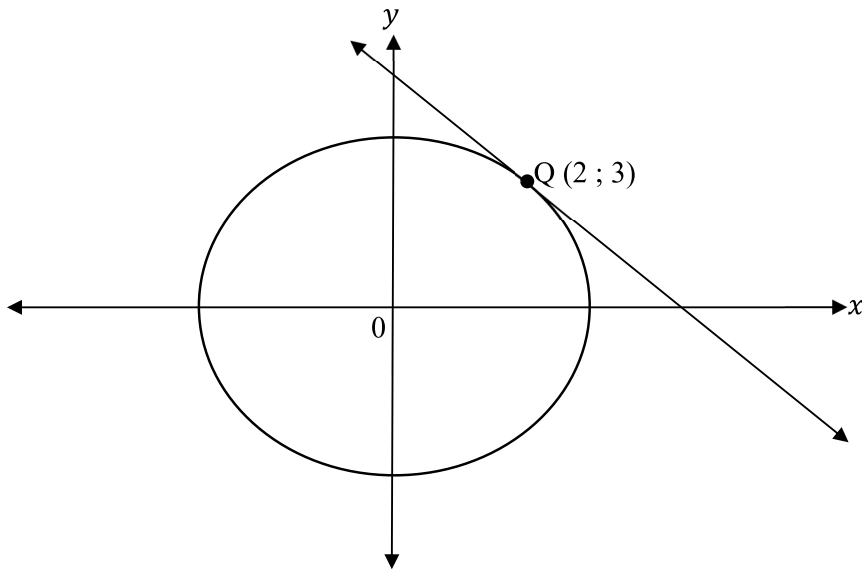
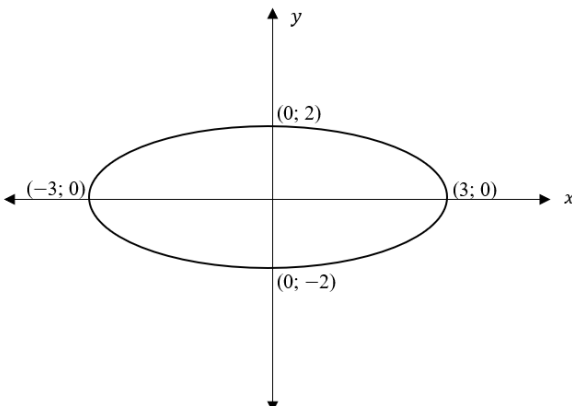
|                           |                                                                                                                                                             |                                                                                                                                                                                                                  |                                                                  |
|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|
|                           |                                                                                                                                                             |                                                                                                                                                                                                                  |                                                                  |
| 1.1                       | $m_{AD} = \frac{6-4}{3-(-1)}$<br>$m_{AD} = \frac{1}{2}$                                                                                                     | ✓ SF<br>✓ $\frac{1}{2}$                                                                                                                                                                                          | A<br>CA<br>(2)                                                   |
| AO: Full marks / Volpunte |                                                                                                                                                             |                                                                                                                                                                                                                  |                                                                  |
| 1.2                       | $P\left(\frac{3+4}{2}; \frac{6+1}{2}\right)$<br>$P\left(\frac{7}{2}; \frac{7}{2}\right)$                                                                    | ✓ SF<br>✓ $\left(\frac{7}{2}; \frac{7}{2}\right)$                                                                                                                                                                | A<br>CA<br>(2)                                                   |
| 1.3                       | $m_{AB} = m_{CD} = \frac{1}{2}$ (   lines / lyne)                                                                                                           | ✓ $m = \frac{1}{2}$                                                                                                                                                                                              | CA                                                               |
|                           | $\therefore y = \frac{1}{2}x + c$<br>$(4; 1): 1 = \frac{1}{2}(4) + c$<br>$\therefore 1 = 2 + c$<br>$\therefore -1 = c$<br>$\therefore y = \frac{1}{2}x - 1$ | OR<br>$\therefore y - y_1 = \frac{1}{2}(x - x_1)$<br>$(4; 1): y - 1 = \frac{1}{2}(x - 4)$<br>$\therefore y - 1 = \frac{1}{2}x - 2$<br>$\therefore y = \frac{1}{2}x - 2 + 1$<br>$\therefore y = \frac{1}{2}x - 1$ | ✓ sub/verv (4; 1)<br>CA<br><br>✓ $y = \frac{1}{2}x - 1$ A<br>(3) |
| 1.4                       | $0 = \frac{1}{2}x - 1$<br>$1 = \frac{1}{2}x$<br>$2 = x$<br>$\therefore E(2; 0)$                                                                             | ✓ $y = 0$<br><br>✓ (2; 0)                                                                                                                                                                                        | A<br><br>CA<br>(2)                                               |



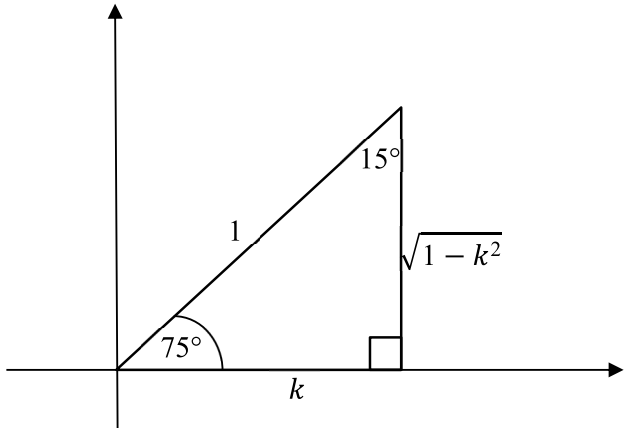
|     |                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                     |
|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.5 | $m_{AE} = \frac{4-0}{-1-2}$<br>$m_{AE} = \frac{4}{-3}$<br>$\tan \theta = m_{AE}$<br>$\tan \theta = \frac{4}{-3}$<br>$\therefore \text{ref. } \angle = \tan^{-1} \left( \frac{4}{3} \right) = 53,13^\circ$<br>$\therefore \theta = 180^\circ - 53,13^\circ$<br>$\therefore \theta = 126,87^\circ$ | $\checkmark m_{AE} = \frac{4}{-3} \quad \text{CA}$<br><br>$\checkmark \text{SF} \quad \text{CA}$<br><br>$\checkmark \text{ref. } \angle \quad \text{CA}$<br><br>$\checkmark \theta = 126,87^\circ \text{CA}$<br>(4) |
| 1.6 | $m_{CE} = \frac{1}{2}$<br>$\tan \alpha = m_{CE}$<br>$\tan \alpha = \frac{1}{2}$<br>$\alpha = \tan^{-1} \left( \frac{1}{2} \right) = 26,57^\circ$<br>$\therefore \widehat{AED} = 126,87^\circ - 26,57^\circ = 100,30^\circ$                                                                       | $\checkmark m_{CE} = \frac{1}{2} \quad \text{A}$<br><br>$\checkmark \text{SF} \quad \text{CA}$<br><br>$\checkmark \alpha = 26,57^\circ \text{CA}$<br><br>$\checkmark \widehat{AED} = 100,30^\circ$<br>CA<br>(4)     |
|     |                                                                                                                                                                                                                                                                                                  | [17]                                                                                                                                                                                                                |



## QUESTION/VRAAG 2

|                                  |                                                                                                                                                                                                                         |                                                                                                                                                       |                                                                                                                                                                                                                                                 |
|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2.1                              |                                                                                                                                       |                                                                                                                                                       |                                                                                                                                                                                                                                                 |
| 2.1.1                            | $m_{OQ} = \frac{3-0}{2-0}$<br>$m_{OQ} = \frac{3}{2}$                                                                                                                                                                    | <b>✓SF</b><br><b>✓<math>m_{OQ}</math></b>                                                                                                             | <b>A</b><br><b>CA</b><br><b>(2)</b>                                                                                                                                                                                                             |
| <b>AO: Full marks / Volpunte</b> |                                                                                                                                                                                                                         |                                                                                                                                                       |                                                                                                                                                                                                                                                 |
| 2.1.2                            | $m_{tan} = -\frac{2}{3}$<br>$\therefore y = -\frac{2}{3}x + c$<br>$(2;3): 3 = -\frac{2}{3}(2)+c$<br>$\therefore 3 = -\frac{4}{3} + c$<br>$\therefore \frac{13}{3} = c$<br>$\therefore y = -\frac{2}{3}x + \frac{13}{3}$ | <b>OR/OF</b><br>$\therefore y - y_1 = -\frac{2}{3}(x - x_1)$<br>$(2;3): y - 3 = -\frac{2}{3}(x - 2)$<br>$\therefore y = -\frac{2}{3}x + \frac{13}{3}$ | <b>✓ <math>m = -\frac{2}{3}</math></b> <b>CA</b><br><b>✓ sub/verv (2 ; 3)</b> <b>CA</b><br><b>✓ equation/vergelyking</b> <b>CA</b>                                                                                                              |
|                                  | <b>OR/OF</b><br>$xx_1 + yy_1 = r^2$<br>$\therefore x(2) + y(3) = 13$<br>$\therefore y = -\frac{2}{3}x + \frac{13}{3}$                                                                                                   |                                                                                                                                                       | <b>OR/OF</b><br><b>✓ F</b> <b>A</b><br><b>✓ SF</b> <b>A</b><br><b>✓ equation/vergelyking</b> <b>CA</b><br><b>(3)</b>                                                                                                                            |
| 2.2                              |                                                                                                                                      |                                                                                                                                                       | <b>✓ elliptical shape with horizontal axis as major axis /</b><br><b>Elliptiese vorm met groter-as as die horisontale-as</b> <b>A</b><br><b>✓ x-intercepts/ x-afsnitte</b> <b>A</b><br><b>✓ y-intercepts/ y-afsnitte</b> <b>A</b><br><b>(3)</b> |
|                                  |                                                                                                                                                                                                                         |                                                                                                                                                       | <b>[8]</b>                                                                                                                                                                                                                                      |

## QUESTION/VRAAG 3

|       |                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                    |                                               |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| 3.1.1 | $\cos(128,2^\circ + 204,7^\circ) \approx 0,89$<br><br><b>AO: Full marks / Volpunte</b>                                                                                                                                                                                                                                                                              | ✓ SF<br>✓ 0,89<br><br><b>(2)</b>                                                                                                                                                                   | A<br>A<br><br>A                               |
| 3.1.2 | $\operatorname{cosec}(204,7^\circ - 128,2^\circ)$<br>$= \frac{1}{\sin(76,5^\circ)}$<br>$\approx 1,03$<br><br><b>AO: Full marks / Volpunte</b>                                                                                                                                                                                                                       | ✓ SF<br>✓ reciprocal ratio /<br><i>resiprook verh.</i><br>✓ 1,03<br><br><b>(3)</b>                                                                                                                 | A<br>A<br>A<br><br>A                          |
| 3.2.1 | <br>$\therefore \sin 15^\circ = k$                                                                                                                                                                                                                                                 | ✓ Diagram<br><br><br><br><br><br>$\checkmark \sqrt{1 - k^2}$<br><br><br><br>$\checkmark k$                                                                                                         | A<br><br><br><br><br><br><br>CA<br><b>(3)</b> |
| 3.2.2 | $\tan 255^\circ = \tan(180^\circ + 75^\circ)$<br><br>$\therefore \tan 75^\circ = \frac{\sqrt{1 - k^2}}{k}$                                                                                                                                                                                                                                                          | ✓ Reduction/ <i>reduksie</i><br><br>✓ numerator/ <i>teller</i><br>✓ denominator/ <i>noemer</i><br><br><b>(3)</b>                                                                                   | A<br>CA<br>CA<br><br>CA                       |
| 3.3   | $\sec \theta = -1,583$<br>$\frac{1}{\cos \theta} = -1,583$<br>$1 = -1,583 \times \cos \theta$<br><br>$\frac{1}{-1,583} = \cos \theta$<br>$50,82 \dots^\circ = \text{ref. } \angle$<br>$\therefore \text{Q2: } \theta = 180^\circ - 50,82^\circ = 129,18^\circ$<br><br><b>AND/EN</b><br><br>$\therefore \text{Q3: } \theta = 180^\circ + 50,82^\circ = 230,82^\circ$ | $\checkmark \frac{1}{-1,583} = \cos \theta$<br><br><br>$\checkmark \text{ref. } \angle$<br><br><br>$\checkmark \text{Quadrants/kwadrante}$<br><br>$\checkmark \text{Both answers/beide antwoorde}$ | A<br>A<br><br>A<br><br>CA<br><b>(4)</b>       |
|       |                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                    | <b>[15]</b>                                   |

## QUESTION/VRAAG 4

|     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                              |
|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4.1 | $\operatorname{cosec}^2(180^\circ + \theta) + \frac{\sin(180^\circ - \theta) \cdot \cot^2(180^\circ + \theta) \cdot \sin 270^\circ}{\cos(360^\circ - \theta) \cdot \tan(180^\circ + \theta)}$ $= \operatorname{cosec}^2 \theta + \frac{(\sin \theta) \cdot (\cot^2 \theta) \cdot (-1)}{(\cos \theta) \cdot (\tan \theta)}$ $= \operatorname{cosec}^2 \theta - \frac{\tan \theta \cdot \cot^2 \theta}{\tan \theta}$ $= \operatorname{cosec}^2 \theta - \cot^2 \theta$ $= 1$ | $\checkmark \operatorname{cosec}^2 \theta$ A<br>$\checkmark \sin \theta$ A<br>$\checkmark \cot^2 \theta$ A<br>$\checkmark -1$ A<br>$\checkmark \cos \theta$ A<br>$\checkmark \tan \theta$ A<br>$\checkmark \tan \theta$ I A<br>$\checkmark S$ A<br>$\checkmark 1$ I A<br>(9) |
| 4.2 | $\frac{1}{(1 - \sin \theta)(1 + \sin \theta)} = \sec^2 \theta$ $\therefore \text{LHS} = \frac{1}{(1 - \sin \theta)(1 + \sin \theta)}$ $\therefore \text{LHS} = \frac{1}{1 - \sin^2 \theta}$ $\therefore \text{LHS} = \frac{1}{\cos^2 \theta}$ $\therefore \text{LHS} = \sec^2 \theta = \text{RHS}$                                                                                                                                                                         | $\checkmark 1 - \sin^2 \theta$ A<br>$\checkmark \frac{1}{\cos^2 \theta}$ A<br>(2)                                                                                                                                                                                            |
|     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | [11]                                                                                                                                                                                                                                                                         |



## QUESTION/VRAAG 5

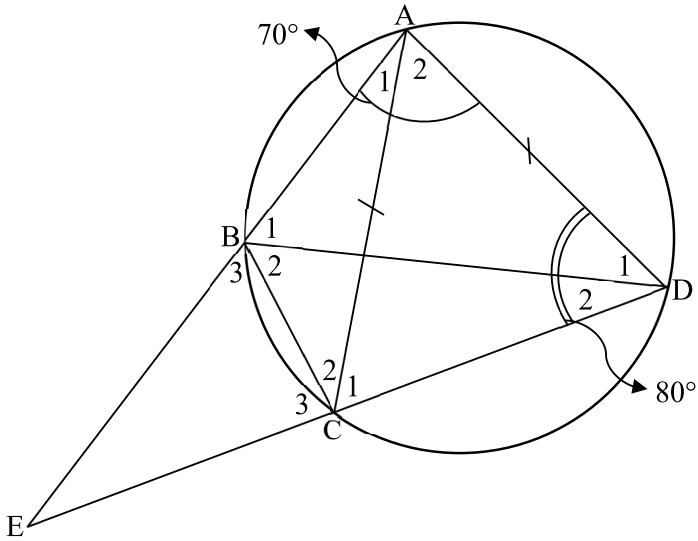
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|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| 5.1 | <div></div> <p>✓ <math>f</math> and <math>g</math> start points and end points / <i>beginpunte en eindpunte</i>      <b>A</b></p> <p><b><math>g</math>:</b></p> <ul style="list-style-type: none"><li>✓ shape/<i>vorm</i>      <b>A</b></li><li>✓ turning points/<i>draaipunte</i>      <b>A</b></li><li>✓ <math>y</math>-intercept/<i>y-afsnit</i>      <b>A</b></li></ul> <p><b><math>f</math>:</b></p> <ul style="list-style-type: none"><li>✓ shape/<i>vorm</i>      <b>A</b></li><li>✓ <math>x</math>-intercepts/<i>x-afsnitte</i>      <b>A</b></li><li>✓ Asymptotes/<i>Asimptote</i>      <b>A</b></li></ul> | (7)                                                                                                                            |
| 5.2 | <div><math>y \in [-2 ; 0]</math><br/><math>-2 \leq y \leq 0</math><br/><b>OR/OF</b></div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <div>✓ Notation/<i>notasie</i>      <b>A</b><br/>✓ start and endpoints/<i>begin- en eindpunte</i>      <b>CA</b><br/>(2)</div> |
| 5.3 | <div><math>180^\circ</math></div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <div>✓ Answer/<i>Antw.</i>      <b>A</b><br/>(1)</div>                                                                         |
| 5.4 | <div><math>x \in (180^\circ ; 270^\circ)</math><br/><math>180^\circ &lt; x &lt; 270^\circ</math><br/><b>OR/OF</b></div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <div>✓ endpoints / <i>eindpunte</i>      <b>CA</b><br/>✓ notation /<i>notasie</i>      <b>CA</b><br/>(2)</div>                 |
|     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | [12]                                                                                                                           |

## QUESTION/VRAAG 6

|     |                                                                                                                                                                                                                                                                                                           |                                                                                        |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|
|     |                                                                                                                                                                                                                                                                                                           |                                                                                        |
| 6.1 | $\tan 35^\circ = \frac{20}{BC}$<br>$BC \times \tan 35^\circ = 20$<br>$BC = \frac{20}{\tan 35^\circ}$<br>$BC = 28,56 \text{ units/eenhede}$                                                                                                                                                                | ✓ SF      A<br><br>✓ BC Subj<br>londerwerp      CA<br><br>✓ answer/antw      CA<br>(3) |
| 6.2 | $a^2 = b^2 + c^2 - 2b \cdot c \cdot \cos A$<br>$CD^2 = BC^2 + BD^2 - 2BC \cdot BD \cdot \cos \widehat{CBD}$<br>$(20)^2 = (28,56)^2 + (28,56)^2 - 2(28,56)(28,56)\cos \widehat{CBD}$<br>$0,75 \dots = \cos \widehat{CBD}$<br>$40,99 \dots^\circ = \widehat{CBD}$<br>$\therefore \widehat{CBD} = 41^\circ$  | ✓ F      A<br>✓ SF      CA<br>✓ S      CA<br><br>✓ Answer/Antw.      A<br>(4)          |
| 6.3 | $\text{Area } \triangle BCD = \frac{1}{2} \cdot a \cdot b \cdot \sin C$<br>$\text{Area } \triangle BCD = \frac{1}{2} \cdot BC \cdot BD \cdot \sin \widehat{CBD}$<br>$\text{Area } \triangle BCD = \frac{1}{2} (28,56)(28,56) \sin 41^\circ$<br>$\text{Area } \triangle BCD = 267,57 \text{ square units}$ | ✓ F      A<br><br>✓ SF      CA<br><br>✓ Answer/Antw.      A<br>(3)                     |
|     |                                                                                                                                                                                                                                                                                                           | [10]                                                                                   |



## QUESTION/VRAAG 7

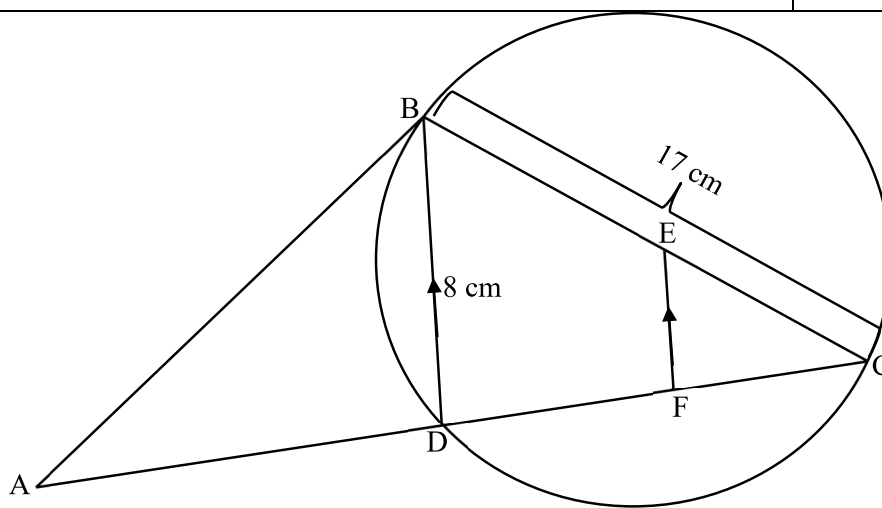
|       |                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                         |                   |
|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| 7.1   | Equal/gelyk                                                                                                                                                                                                                                  | ✓                                                                                                                                                                                                                                                       | (1)               |
| 7.2   |                                                                                                                                                            |                                                                                                                                                                                                                                                         |                   |
| 7.2.1 | $\hat{B}_3 = 80^\circ$ (ext. $\angle$ of cq / buite $\angle$ van kvh)<br>$\hat{C}_1 = 80^\circ$ ( $\angle$ 's opp = sides / $\angle$ 'e teenoor = sye)<br>$\hat{B}_1 = 80^\circ$ ( $\angle$ 's in same seg. / $\angle$ 'e in dieselfde seg.) | ✓ ST ✓ RE<br>✓ ST ✓ RE<br>✓ ST ✓ RE                                                                                                                                                                                                                     | (6)               |
| 7.2.2 | (a)                                                                                                                                                                                                                                          | $\hat{C}_3 = 70^\circ$ (ext. $\angle$ of cq / buite $\angle$ van kvh)                                                                                                                                                                                   | ✓ ST ✓ RE<br>(2)  |
|       | (b)                                                                                                                                                                                                                                          | $\hat{E} = 30^\circ$ (int. $\angle$ of $\Delta$ / binne $\angle$ van $\Delta$ )                                                                                                                                                                         | ✓ ST ✓ RE<br>(2)  |
|       | (c)                                                                                                                                                                                                                                          | $\hat{D}_1 = \hat{C}_2$ ( $\angle$ 's in same seg. / $\angle$ 'e in dieselfde seg.)<br>$\therefore \hat{C}_2 = 180^\circ - 70^\circ - 80^\circ$<br>( $\angle$ 's on a straight line / $\angle$ 'e op 'n reguitlyn)<br>$\therefore \hat{D}_1 = 30^\circ$ | ✓ ST ✓ RE<br>✓ ST |
|       |                                                                                                                                                                                                                                              | <b>OR/OF</b>                                                                                                                                                                                                                                            | <b>OR/OF</b>      |
|       |                                                                                                                                                                                                                                              | $\hat{D}_1 + \hat{A} + \hat{B}_1 = 180^\circ$ (int. $\angle$ of $\Delta$ / binne $\angle$ van $\Delta$ )<br>$\therefore \hat{D}_1 = 180^\circ - 70^\circ - 80^\circ = 30^\circ$                                                                         | ✓ ST ✓ RE<br>✓ ST |
| 7.2.3 | $\hat{D}_1 = \hat{E} = 30^\circ$<br>$\therefore AD$ is a tangent / $AD$ is 'n raaklyn<br>( $\angle$ between the line and a chord / $\angle$ tussen die lyn en 'n koord)                                                                      | ✓ ST<br>✓ RE                                                                                                                                                                                                                                            | (2)               |
|       |                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                         | [16]              |



**QUESTION/VRAAG 8**

|       |                                                                                                                                 |           |     |
|-------|---------------------------------------------------------------------------------------------------------------------------------|-----------|-----|
| 8.1   | twice / twee keer                                                                                                               | ✓         | (1) |
| 8.2   |                                                                                                                                 |           |     |
| 8.2.1 | $\hat{L}_1 = 76^\circ$ ( $\angle$ 's in same seg. / $\angle$ 'e in dieselfde seg.)                                              | ✓ ST ✓ RE | (2) |
| 8.2.2 | $\hat{O}_1 = 76^\circ$ (corresp. $\angle$ 's =; $ON \parallel LM$ / ooreenk. $\angle$ 'e =; $ON \parallel LM$ )                 | ✓ ST ✓ RE | (2) |
| 8.2.3 | $\hat{M}_4 = 38^\circ$<br>( $\angle$ at centre = $2 \times \angle$ at circumf. / $middelpts \angle = 2 \times omtreks \angle$ ) | ✓ ST ✓ RE | (2) |
| 8.2.4 | $\hat{N}_1 + \hat{N}_2 = 104^\circ$ (opp $\angle$ 's of cq / teenoorst. $\angle$ 'e van kvh)                                    | ✓ ST ✓ RE | (2) |
|       |                                                                                                                                 |           | [9] |

## QUESTION/VRAAG 9

|       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                    |     |
|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|-----|
| 9.1   | Divides / verdeel                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | ✓ A                                                                                                                | (1) |
| 9.2   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                    |     |
| 9.2.1 | In $\triangle BDC$ :<br>$\hat{D} = 90^\circ$ ( $\angle$ in semi-circle / $\angle$ in semi-sirkel)<br>$\therefore DC^2 = 17^2 - 8^2$ (Pyth)<br>$\therefore DC = 15$ cm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | ✓ ST ✓ RE<br>✓ SF<br>✓ Answer / Antw. CA<br>(4)                                                                    |     |
| 9.2.2 | (a) $\frac{CE}{BC} = \frac{CF}{CD}$ (line $\parallel$ one side of $\Delta$ / lyn $\parallel$ een sy van $\Delta$ )<br>$\frac{1}{4} = \frac{CF}{15}$<br>$\therefore CF = 3,75$ cm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | ✓ ST ✓ RE<br>✓ SF<br>✓ Answer / Antw. CA<br>(4)                                                                    |     |
|       | (b) In $\triangle BAC$ and/en $\triangle FEC$ :<br>1. $\hat{C}$ is a common angle/gemene hoek<br>2. $E\hat{B}A = 90^\circ$ (rad $\perp$ tan)<br>$E\hat{F}C = 90^\circ$<br>(corresp. $\angle$ 's =; $BD \parallel EF$ / ooreenk. $\angle$ 'e =; $BD \parallel EF$ )<br>$\therefore E\hat{B}A = E\hat{F}C$<br>3. $C\hat{E}F = B\hat{A}C$ (int. $\angle$ of $\Delta$ / binne $\angle$ van $\Delta$ )<br>$\therefore \triangle BAC \parallel \triangle FEC$<br><br><b>OR / OF</b><br><br>In $\triangle BAC$ and/en $\triangle FEC$ :<br>1. $\hat{C}$ is a common angle/gemene hoek<br>2. $E\hat{B}A = 90^\circ$ (rad $\perp$ tan)<br><br>$E\hat{F}C = 90^\circ$<br>(corresp. $\angle$ 's =; $BD \parallel EF$ / ooreenk. $\angle$ 'e =; $BD \parallel EF$ )<br>$\therefore E\hat{B}A = E\hat{F}C$<br><br>$\therefore \triangle BAC \parallel \triangle FEC$ ( $\angle\angle\angle$ ) | ✓ ST<br>✓ ST ✓ RE<br><br>✓ ST RE<br>✓ ST<br><br><b>OR / OF</b><br><br>✓ ST<br>✓ ST ✓ RE<br><br>✓ ST RE<br><br>✓ RE |     |



|  |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                 |
|--|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | (c) | <p>In <math>\triangle BAD</math> and/en <math>\triangle CBD</math>:</p> <ol style="list-style-type: none"> <li>1. <math>\widehat{BDA} = \widehat{BDC}</math> (<math>\angle</math>'s on str. line/<math>\angle</math>'e op reguit lyn)</li> <li>2. <math>\widehat{ABD} = \widehat{BCD}</math> (tanchord/raaklynkoord)</li> <li>3. <math>\widehat{BAD} = \widehat{BCD}</math> (int. <math>\angle</math> of <math>\Delta</math> / binne <math>\angle</math> van <math>\Delta</math>)</li> </ol> <p><math>\therefore \triangle BAD \parallel \triangle CBD</math> (<math>\angle\angle\angle</math>)</p> <p><math>\therefore \frac{BA}{CB} = \frac{AD}{BD} = \frac{BD}{CD}</math> (<math>\triangle BAD \parallel \triangle CBD</math>)</p> <p><math>\therefore \frac{AD}{8} = \frac{15}{15}</math></p> <p><math>\therefore AD = \frac{64}{15} \approx 4,27 \text{ cm}</math></p> <p style="text-align: center;"><b>OR/OF</b></p> <p><math>\frac{AC}{EC} = \frac{BC}{FC}</math> (<math>\triangle BAC \parallel \triangle FEC</math>)</p> <p>But, <i>maar</i> <math>EC = \frac{1}{4}BC = \frac{17}{4}</math> and/en</p> <p><math>FC = \frac{1}{4}DC = \frac{15}{4}</math> (Prop th/ewerig st. <math>BD \parallel EF</math>)</p> <p><math>\therefore \frac{AC}{\frac{17}{4}} = \frac{15}{\frac{15}{4}}</math></p> <p><math>\therefore AC \approx 19,27</math></p> <p><math>\therefore AD = 19,27 - 15 = 4,27</math></p> | <p>✓ ST RE</p> <p>✓ ST RE</p> <p>✓ ST</p> <p>✓ Answer / Antw. <b>CA</b></p> <p>✓ ST</p> <p>✓ ST</p> <p>✓ ST</p> <p>✓ ST</p> <p style="text-align: right;">(4)</p> <p style="text-align: right;"><b>[18]</b></p> |
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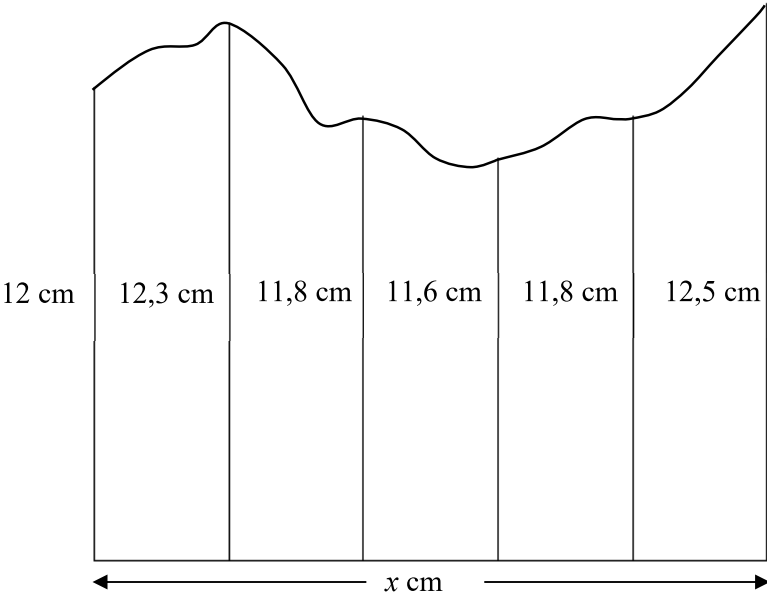


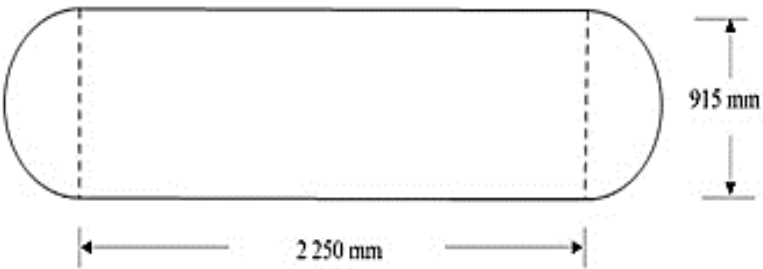
## QUESTION/VRAAG 10

|        |                                                                                                                                                     |                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                |                                                                                        |
|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|
| 10.1.1 | $n = \frac{No. \text{ of rev.}}{\text{time}} = \frac{1 \text{ rev}}{50 \text{ min}} = 0,02 \text{ rev/min}$                                         |                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                | ✓conv. /Herleid A<br>(1)                                                               |
| 10.1.2 | 14 6425 km = 14,6425 × 1 000 = 14 642,5 m                                                                                                           |                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                | ✓conv. /Herleid A<br>(1)                                                               |
| 10.1.3 | $V = \pi Dn$<br>$V = \pi(14\,642,5)(0,02)$<br>$V \approx 920,02 \text{ m/min}$                                                                      |                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                | ✓ F A<br>✓ SF CA<br>✓ Answer/Antw.CA<br>(3)                                            |
| 10.2   | $n = 15 \text{ rev / sec} = 900 \text{ rev / min}$<br><br>$\omega = 2\pi n$<br>$\omega = 2\pi(900)$<br>$\omega \approx 5\,654,87 \text{ rad / min}$ |                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                | ✓conv. /Herleid A<br><br>✓ F A<br>✓ SF CA<br>✓ Answer/Antw.CA<br>(4)                   |
| 10.3   | 10.3.1                                                                                                                                              | 80 mm = 8 cm<br>$4h^2 - 4dh + x^2 = 0$<br>$4h^2 - 4(10)h + (8)^2 = 0$<br>$4h^2 - 40h + 64 = 0$<br>$\div 4: h^2 - 10h + 16 = 0$<br>$(h - 8)(h - 2) = 0$<br>$\therefore h = 8 \text{ or } h = 2$<br>$\therefore h = 2 \text{ cm}$ | 80 mm = 8 cm<br>$4h^2 - 4dh + x^2 = 0$<br>$4h^2 - 4(10)h + (8)^2 = 0$<br>$4h^2 - 40h + 64 = 0$<br>$\div 4: h^2 - 10h + 16 = 0$<br>$h = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$<br>$h = \frac{-(-10) \pm \sqrt{(-10)^2 - 4(1)(16)}}{2(1)}$<br>$\therefore h = 8 \text{ or } h = 2$<br>$\therefore h = 2 \text{ cm}$ | ✓ F A<br>✓ SF CA<br><br>✓ Factors/faktore A<br>✓ Answer/Antw.CA<br>✓ h = 2 cm A<br>(5) |
|        | 10.3.2                                                                                                                                              | $r = 10 \div 2 = 5$<br>$s = r\theta$<br>$5,24 = 5\theta$<br>$1,048 \text{ rad} = \theta$<br>$\therefore \theta = 1,048 \times \frac{180^\circ}{\pi}$<br>$\therefore \theta = 60^\circ$                                          |                                                                                                                                                                                                                                                                                                                | ✓ F A<br>✓ SF CA<br><br>✓conv. /Herleid A<br>✓ Answer/Antw. CA<br>(4)                  |
|        | 10.3.3                                                                                                                                              | $Area = \frac{r^2\theta}{2}$<br>$Area = \frac{(5)^2(1,048)}{2}$<br>$Area = 13,1 \text{ cm}^2$                                                                                                                                   | $Area = \frac{rs}{2}$<br>$Area = \frac{(5)(5,25)}{2}$<br>$Area = 13,1 \text{ cm}^2$                                                                                                                                                                                                                            | ✓ F A<br>✓ SF CA<br>✓ Area CA<br>(3)                                                   |
|        |                                                                                                                                                     |                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                | [21]                                                                                   |



## QUESTION/VRAAG 11

|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                          |                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                          |
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| 11.1                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                          |                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                          |
|                                                                                                                                                                                                                                                                                                                                                                                                                             | <table border="1"> <tr> <td data-bbox="321 892 1128 1165"> <math display="block">Area = a \left( \frac{O_1 + O_n}{2} + O_2 + O_3 + \dots + O_{n-1} \right)</math> <math display="block">149,38 = \frac{x}{5} \left( \frac{12 + 12,5}{2} + 12,3 + 11,8 + 11,6 + 11,8 \right)</math> <math display="block">149,38 = \frac{x}{5} (59,75)</math> <math display="block">\frac{x}{5} = \frac{149,38}{59,75} \approx 2,50</math> <math display="block">x = 12,5 \text{ cm}</math> </td><td data-bbox="1128 892 1429 1165"> <div>✓ F A</div> <div>✓ <math>a = \frac{x}{5}</math> A</div> <div>✓ SF CA</div> <div>✓ value of / waarde van x CA</div> <div>(4)</div> </td></tr> <tr> <td data-bbox="321 1165 1128 1596"> <p style="text-align: center;"><b>OR/OF</b></p> <math display="block">Area = a(m_1 + m_2 + m_3 + \dots + m_{n-1})</math> <math display="block">149,38 = \frac{x}{5} \left( \frac{12 + 12,3}{2} + \frac{12,3 + 11,8}{2} + \frac{11,8 + 11,6}{2} + \frac{11,6 + 11,8}{2} + \frac{11,8 + 12,5}{2} \right)</math> <math display="block">149,38 = \frac{x}{5} (12,15 + 12,05 + 11,7 + 11,7 + 12,15)</math> <math display="block">149,38 = \frac{x}{5} (59,75)</math> <math display="block">\frac{x}{5} = \frac{149,38}{59,75} \approx 2,50</math> <math display="block">x = 12,5 \text{ cm}</math> </td><td data-bbox="1128 1165 1429 1596"> <p style="text-align: center;"><b>OR / OF</b></p> <div>✓ F A</div> <div>✓ <math>a = \frac{x}{5}</math> A</div> <div>✓ SF CA</div> <div>✓ value of / waarde van x CA</div> <div>(4)</div> </td></tr> </table> | $Area = a \left( \frac{O_1 + O_n}{2} + O_2 + O_3 + \dots + O_{n-1} \right)$ $149,38 = \frac{x}{5} \left( \frac{12 + 12,5}{2} + 12,3 + 11,8 + 11,6 + 11,8 \right)$ $149,38 = \frac{x}{5} (59,75)$ $\frac{x}{5} = \frac{149,38}{59,75} \approx 2,50$ $x = 12,5 \text{ cm}$ | <div>✓ F A</div> <div>✓ <math>a = \frac{x}{5}</math> A</div> <div>✓ SF CA</div> <div>✓ value of / waarde van x CA</div> <div>(4)</div> | <p style="text-align: center;"><b>OR/OF</b></p> $Area = a(m_1 + m_2 + m_3 + \dots + m_{n-1})$ $149,38 = \frac{x}{5} \left( \frac{12 + 12,3}{2} + \frac{12,3 + 11,8}{2} + \frac{11,8 + 11,6}{2} + \frac{11,6 + 11,8}{2} + \frac{11,8 + 12,5}{2} \right)$ $149,38 = \frac{x}{5} (12,15 + 12,05 + 11,7 + 11,7 + 12,15)$ $149,38 = \frac{x}{5} (59,75)$ $\frac{x}{5} = \frac{149,38}{59,75} \approx 2,50$ $x = 12,5 \text{ cm}$ | <p style="text-align: center;"><b>OR / OF</b></p> <div>✓ F A</div> <div>✓ <math>a = \frac{x}{5}</math> A</div> <div>✓ SF CA</div> <div>✓ value of / waarde van x CA</div> <div>(4)</div> |
| $Area = a \left( \frac{O_1 + O_n}{2} + O_2 + O_3 + \dots + O_{n-1} \right)$ $149,38 = \frac{x}{5} \left( \frac{12 + 12,5}{2} + 12,3 + 11,8 + 11,6 + 11,8 \right)$ $149,38 = \frac{x}{5} (59,75)$ $\frac{x}{5} = \frac{149,38}{59,75} \approx 2,50$ $x = 12,5 \text{ cm}$                                                                                                                                                    | <div>✓ F A</div> <div>✓ <math>a = \frac{x}{5}</math> A</div> <div>✓ SF CA</div> <div>✓ value of / waarde van x CA</div> <div>(4)</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                          |                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                          |
| <p style="text-align: center;"><b>OR/OF</b></p> $Area = a(m_1 + m_2 + m_3 + \dots + m_{n-1})$ $149,38 = \frac{x}{5} \left( \frac{12 + 12,3}{2} + \frac{12,3 + 11,8}{2} + \frac{11,8 + 11,6}{2} + \frac{11,6 + 11,8}{2} + \frac{11,8 + 12,5}{2} \right)$ $149,38 = \frac{x}{5} (12,15 + 12,05 + 11,7 + 11,7 + 12,15)$ $149,38 = \frac{x}{5} (59,75)$ $\frac{x}{5} = \frac{149,38}{59,75} \approx 2,50$ $x = 12,5 \text{ cm}$ | <p style="text-align: center;"><b>OR / OF</b></p> <div>✓ F A</div> <div>✓ <math>a = \frac{x}{5}</math> A</div> <div>✓ SF CA</div> <div>✓ value of / waarde van x CA</div> <div>(4)</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                          |                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                          |

|        |                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                |
|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 11.2   |                                                                                                                                                                                                                                                                                        |                                                                                                                                                                |
| 11.2.1 | 915 mm = 91,5 cm and/en 2 250 mm = 225 cm                                                                                                                                                                                                                                                                                                                                | ✓ conversion /herleiding A<br>(1)                                                                                                                              |
| 11.2.2 | <p>Volume of storage tank = Volume of sphere + volume of cylinder</p> <p><i>Volume van opgaartenk</i> = <math>\frac{4}{3}\pi r^3 + \pi r^2 h</math></p> <p><math>= \frac{4}{3}\pi \left(\frac{91,5}{2}\right)^3 + \pi \left(\frac{91,5}{2}\right)^2 \times 225</math></p> <p><math>= 598\,615,875\pi \text{ cm}^3</math></p> <p><math>= 598,62 \text{ litres}</math></p> | <p>✓ radius A</p> <p>✓ F A</p> <p>✓ SF A</p> <p>✓ ans in litres / antw in liters CA<br/>(4)</p>                                                                |
| 11.2.3 | <p>0,5 ton = 500 kg</p> <p>∴ Weight/Gewig of/van gas = <math>598,62 \text{ l} \times \frac{1 \text{ kg}}{1,96 \text{ l}} = 305,42 \text{ kg}</math></p> <p>∴ Tare weight /tarra gewig = <math>500 - 305,42 = 194,58 \text{ kg}</math></p> <p>∴ Tare weight % / tarra gewig % = <math>\frac{194,58}{500} \times 100\% \approx 38,92\%</math></p>                          | <p>✓ conversion / herleiding A</p> <p>✓ Weight of gas / gewig van gas CA</p> <p>✓ tare weight / tarra gewig CA</p> <p>✓ tare perct /tarra perst CA<br/>(4)</p> |
|        |                                                                                                                                                                                                                                                                                                                                                                          | [13]                                                                                                                                                           |
|        |                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                |
|        |                                                                                                                                                                                                                                                                                                                                                                          | <b>TOTAL/TOTAAL: 150</b>                                                                                                                                       |