



# basic education

Department:  
Basic Education  
**REPUBLIC OF SOUTH AFRICA**

**NATIONAL  
SENIOR CERTIFICATE  
*NATIONALE SENIOR  
SERTIFIKAAT***

**GRADE 12/*GRAAD 12***

**MATHEMATICS P2/*WISKUNDE V2***

**NOVEMBER 2017**

**MARKING GUIDELINES/*NASIENRIGLYNE***

**MARKS/*PUNTE*: 150**

**These marking guidelines consist of 29 pages.  
*Hierdie nasienriglyne bestaan uit 28 bladsye.***

**NOTE:**

- If a candidate answers a question TWICE, only mark the FIRST attempt.
- If a candidate has crossed out an attempt of a question and not redone the question, mark the crossed out version.
- Consistent accuracy applies in ALL aspects of the marking guidelines. Stop marking at the second calculation error.
- Assuming answers/values in order to solve a problem is NOT acceptable.

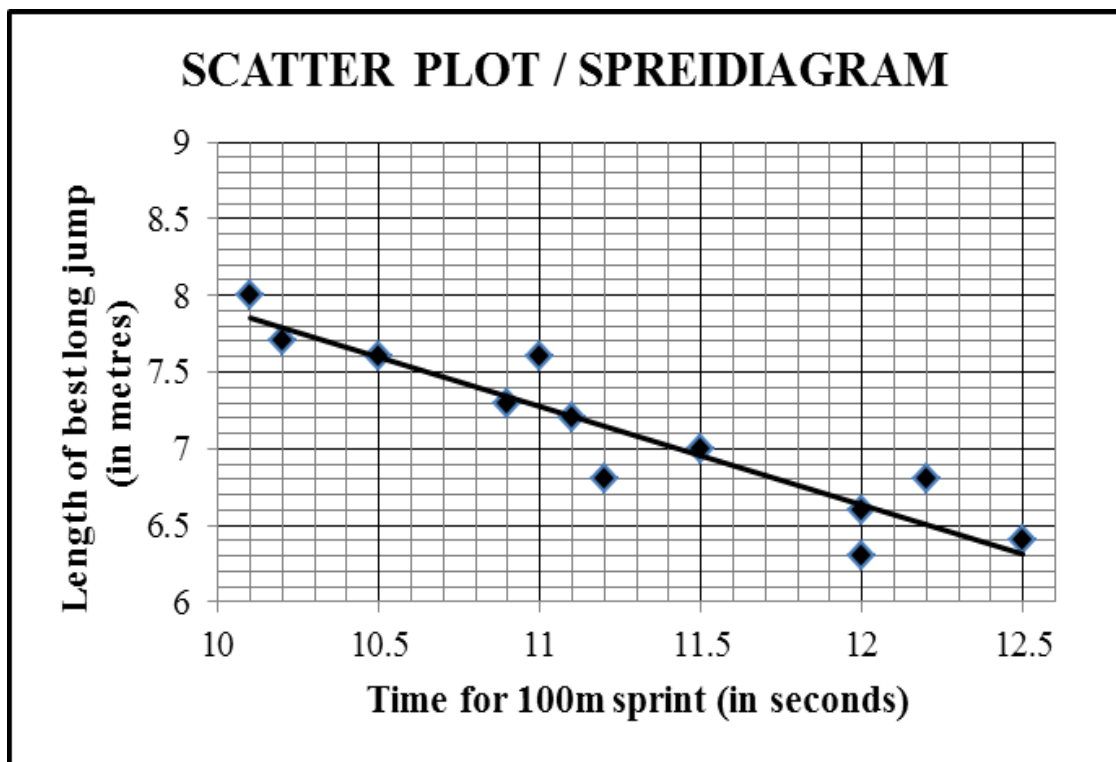
**NOTA:**

- *As 'n kandidaat 'n vraag TWEE KEER beantwoord, merk slegs die EERSTE poging.*
- *As 'n kandidaat 'n antwoord van 'n vraag doodtrek en nie oordoen nie, merk die doodgetrekte poging.*
- *Volgehoue akkuraatheid word in ALLE aspekte van die nasienriglyne toegepas. Hou op nasien by die tweede berekeningsfout.*
- *Aanvaar van antwoorde/waardes om 'n probleem op te los, word NIE toegelaat nie.*

<b>GEOMETRY</b>	
<b>S</b>	<b>A mark for a correct statement (A statement mark is independent of a reason.)</b>
	<b>'n Punt vir 'n korrekte bewering ( 'n Punt vir 'n bewering is onafhanklik van die rede.)</b>
<b>R</b>	<b>A mark for a correct reason (A reason mark may only be awarded if the statement is correct.)</b>
	<b>'n Punt vir 'n korrekte rede ( 'n Punt word slegs vir die rede toegeken as die bewering korrek is.)</b>
<b>S/R</b>	<b>Award a mark if the statement AND reason are both correct.</b>
	<b>Ken 'n punt toe as beide die bewering EN rede korrek is.</b>

**QUESTION/VRAAG 1**

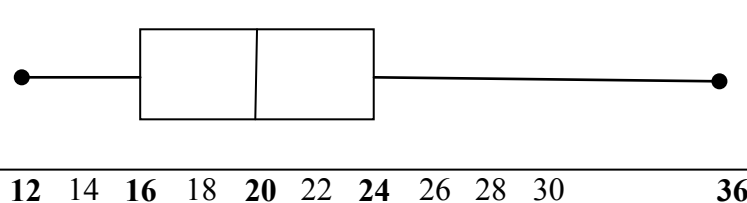
<b>Time for 100 m sprint (in seconds)</b> <i>Tyd vir 100 m-naelloop (in sekondes)</i>	10,1	10,2	10,5	10,9	11	11,1	11,2	11,5	12	12	12,2	12,5
<b>Distance of best long jump (in metres)</b> <i>Afstand van beste sprong in verspring (in meter)</i>	8	7,7	7,6	7,3	7,6	7,2	6,8	7	6,6	6,3	6,8	6,4



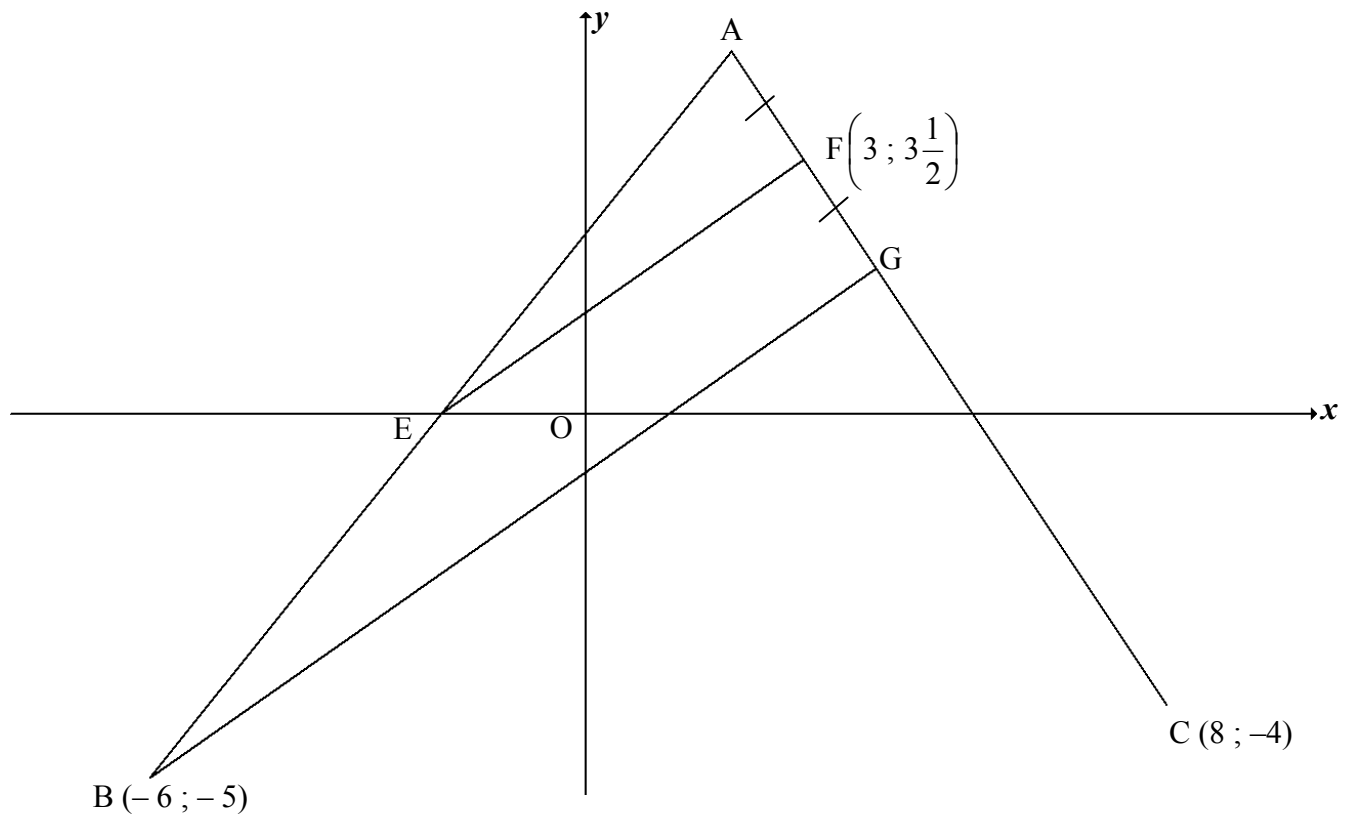
1.1	$a = 14,343\dots = 14,34$ $b = -0,642\dots = -0,64$	✓✓ value of $a$ ✓ value of $b$  (3)
1.2	$y = 14,34 - 0,64(11,7)$ $= 6,85$ <b>OR/OF</b> $y = 6,83$ (calculator / <i>sakrekenaar</i> )	✓ substitution correctly ✓ answer  ✓✓ answer  (2) (2)
1.3	The gradient increases / <i>Die gradient neem toe</i> The point (12,3 ; 7,6) lies some distance above the current data. <i>Die punt (12,3 ; 7,6) lê bokant die huidige data.</i>	✓ increases/ <i>neem toe</i> ✓ reasoning in words/ <i>redenasie in woorde</i>  (2) <b>[7]</b>

**QUESTION/VRAAG 2**

12	13	13	14	14	16	17	18	18	18	19	20
21	21	22	22	23	24	25	27	29	30	36	

2.1.1	$\bar{x} = \frac{472}{23}$ $\bar{x} = 20,52 \text{ seconds / sekonde}$	✓ $\frac{472}{23}$ ✓ answer (2)
2.1.2	$Q_1 = 16$ $Q_3 = 24$ $IQR/IKO = Q_3 - Q_1$ $= 24 - 16 = 8$	✓ $Q_1$ ✓ $Q_3$ ✓ answer (3)
2.2	$20,52 + 5,94 = 26,46$ $\therefore > 26,46$ $\therefore 4 \text{ girls/dogters}$	✓ 26,46 ✓ answer (2)
2.3		✓ whiskers ending at 12 & 36 ✓ $Q_1 = 16$ & $Q_3 = 24$ (box) ✓ $Q_2 = 20$ (3)
2.4.1	Girls / Meisies	✓ answer (1)
2.4.2	Five-number summary of boys: (15 ; 21 ; 23,5 ; 26 ; 38) <b>None</b> of the boys / <b>Nie een</b> van die seuns <b>nie</b> 5 girls completed in less than 15 seconds which was the minimum time taken by the boys. 5 meisies voltooi in minder as 15 sekondes, wat die minimumtyd is wat die seuns geneem het.	✓ answer ✓ reason/rede (2) <b>[13]</b>

**QUESTION/VRAAG 3**



<p>3.1.1</p>	$m_{FC} = \frac{y_2 - y_1}{x_2 - x_1}$ $= \frac{3\frac{1}{2} - (-4)}{3 - 8}$ $= -\frac{3}{2}$ <p><math>y = mx + c</math>                      <math>y - y_1 = m(x - x_1)</math></p> $y = -\frac{3}{2}x + c$ $-4 = -\frac{3}{2}(8) + c \quad \text{OR/OF} \quad (y - (-4)) = -\frac{3}{2}(x - 8)$ $c = 8$ $y = -\frac{3}{2}x + 8$ <p><b>OR/OF</b></p> $y + 4 = -\frac{3}{2}x + 12$ $y = -\frac{3}{2}x + 8$	<ul style="list-style-type: none"> <li>✓ substitution of (8 ; -4) &amp; <math>(3; 3\frac{1}{2})</math></li> <li>✓ gradient</li> <li>✓ substitution of <math>m</math> and (8 ; -4)</li> <li>✓ equation of AC</li> </ul> <p style="text-align: right;">(4)</p>
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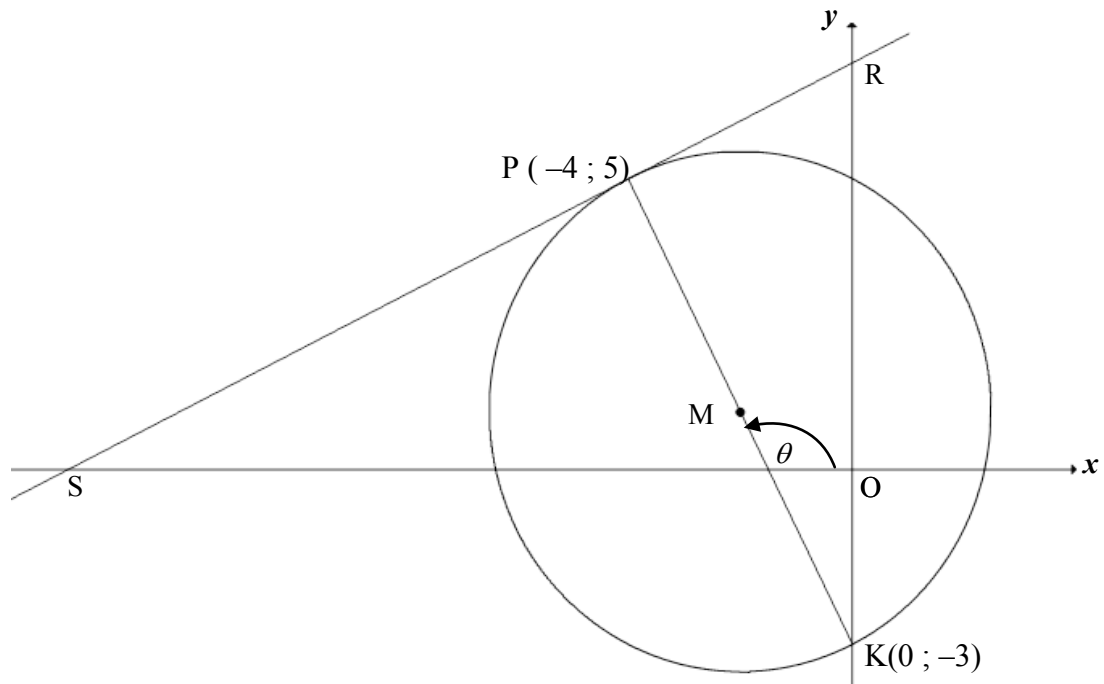
	$m_{FC} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{(-4) - \left(3\frac{1}{2}\right)}{8 - 3}$ $= -\frac{3}{2}$ $y = mx + c$ $3\frac{1}{2} = -\frac{3}{2}(3) + c$ $c = 8$ $y = -\frac{3}{2}x + 8$ $y - y_1 = m(x - x_1)$ $\left(y - 3\frac{1}{2}\right) = -\frac{3}{2}(x - 3)$ <p style="text-align: center;"><b>OR/OF</b></p> $\left(y - 3\frac{1}{2}\right) = -\frac{3}{2}x + \frac{9}{2}$ $y = -\frac{3}{2}x + 8$	<ul style="list-style-type: none"> <li>✓ substitution of <math>(8 ; -4)</math> &amp; <math>\left(3 ; 3\frac{1}{2}\right)</math></li> <li>✓ gradient</li> <li>✓ substitution of <math>m</math> and <math>\left(3 ; 3\frac{1}{2}\right)</math></li> <li>✓ equation of AC</li> </ul> <p style="text-align: right;">(4)</p>
<p>3.1.2</p>	<p>AC: <math>3x + 2y = 16</math> and BG: <math>7x - 10y = 8</math></p> $15x + 10y = 80$ $\underline{7x - 10y = 8}$ $22x = 88$ $x = 4$ $3(4) + 2y = 16$ $y = 2$ <p>∴ G(4 ; 2)</p> <p><b>OR/OF</b></p> <p>BG: <math>7x - 10y = 8</math> ∴ <math>y = \frac{7}{10}x - \frac{8}{10}</math></p> $\therefore \frac{7}{10}x - \frac{8}{10} = -\frac{3}{2}x + 8 \quad [\text{CA from 3.1.1}]$ $\frac{11}{5}x = \frac{44}{5}$ $x = 4$ $3(4) + 2y = 16$ $y = 2$ <p>∴ G(4 ; 2)</p>	<ul style="list-style-type: none"> <li>✓ method /metode: solving simultaneously / los gelyktydig op</li> <li>✓ <math>x</math> coordinate (<math>x &gt; 0</math>)</li> <li>✓ <math>y</math> coordinate</li> </ul> <p style="text-align: right;">(3)</p> <ul style="list-style-type: none"> <li>✓ method: equating</li> <li>metode: stel vgl's gelyk</li> <li>✓ <math>x</math> coordinate (<math>x &gt; 0</math>)</li> <li>✓ <math>y</math> coordinate</li> </ul> <p style="text-align: right;">(3)</p>
<p>3.2</p>	$\frac{x_A + 4}{2} = 3 \quad \text{and} \quad \frac{y_A + 2}{2} = 3\frac{1}{2}$ <p>∴ A(2 ; 5)</p> <p><b>OR/OF</b> by translation/deur translasie:</p> $x_A = 3 - (4 - 3) = 2$ $y_A = 3\frac{1}{2} + (3\frac{1}{2} - 2) = 5$ <p>∴ A(2 ; 5)</p>	<ul style="list-style-type: none"> <li>✓ equation ito <math>x</math></li> <li>✓ equation ito <math>y</math></li> </ul> <p style="text-align: right;">(2)</p> <ul style="list-style-type: none"> <li>✓ equation ito <math>x</math></li> <li>✓ equation ito <math>y</math></li> </ul> <p style="text-align: right;">(2)</p>

<p>3.3</p>	<p>The coordinates of the midpt of AB / <i>Die koordinaat van midpt van AB is:</i></p> $\left(\frac{2+(-6)}{2}; \frac{5+(-5)}{2}\right) = (-2 ; 0)$ <p><b>But the y-coordinate of E is 0</b>  <b>∴ E(-2 ; 0) is the midpoint of AB</b>          ∴ EF    BG [midpoint theorem/<i>middelpuntst</i> <b>OR/OF</b>          line divides 2 sides of Δ in prop/lyn  <i>verdeel 2 sye van Δ in dies verh</i>]</p> <p><b>OR/OF</b>          The coordinates of the midpt of AB / <i>Die koordinaat van midpt van AB is:</i></p> $\left(\frac{2+(-6)}{2}; \frac{5+(-5)}{2}\right) = (-2 ; 0)$ $AE = \sqrt{(-2-2)^2 + (0-5)^2} = \sqrt{41}$ $EB = \sqrt{(-2-(-6))^2 + (0-(-5))^2} = \sqrt{41}$ <p>∴ In ΔABG: <b>AE = EB</b> and AF = FG          ∴ EF    BG [midpoint theorem/<i>middelpuntst</i>]</p> <p><b>OR/OF</b>          Equation of AB:</p> $y - (-5) = \left(\frac{5-(-5)}{2-(-6)}\right)(x - (-6))$ $y + 5 = \frac{10}{8}x + \frac{15}{2} \quad \therefore y = \frac{5}{4}x + \frac{5}{2}$ <p>x-intercept of AB:</p> $0 = \frac{5}{4}x + \frac{5}{2} \quad \therefore x = -2$ <p>∴ E(-2 ; 0)</p> $m_{EF} = \frac{3\frac{1}{2} - 0}{3 - (-2)} = \frac{7}{10}$ $m_{EF} = m_{BG} = \frac{7}{10}$ <p>∴ EF    BG</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p>BG: <math>7x - 10y = 8</math>  <math>\therefore y = \frac{7}{10}x - \frac{8}{10}</math>  <math>\therefore m_{BG} = \frac{7}{10}</math></p> </div>	<ul style="list-style-type: none"> <li>✓ subst A &amp; B into midpt formula</li> <li>✓ y coordinate = 0</li> <li>✓ E = midpt</li> <li>✓ Reason (4)</li> </ul> <ul style="list-style-type: none"> <li>✓ subst A &amp; B into midpt formula</li> <li>✓ lengths of AE &amp; EB</li> <li>✓ AE = EB or E = midpt</li> <li>✓ Reason (4)</li> </ul> <ul style="list-style-type: none"> <li>✓ equation of AB</li> <li>✓ coordinates of E</li> <li>✓ gradient of EF</li> <li>✓ gradient EF = gradient BG (4)</li> </ul>
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<p>3.4</p>	<p>Midpoint of AC = <math>\left(5; \frac{1}{2}\right)</math></p> <p><math>\frac{x_D + (-6)}{2} = 5</math> and <math>\frac{y_D + (-5)}{2} = \frac{1}{2}</math></p> <p><math>\therefore D(16; 6)</math></p> <p><b>OR/OF</b> by translation/<i>dmv translasië</i>: D(16; 6)</p> <p><b>OR/OF</b></p> <p><math>m_{BC} = \frac{-5 - (-4)}{-6 - 8} = \frac{1}{14}</math> and <math>m_{AB} = \frac{5 - (-5)}{2 - (-6)} = \frac{5}{4}</math></p> <p>AD: <math>y - 5 = \frac{1}{14}(x - 2) \Rightarrow y = \frac{1}{14}x + \frac{34}{7}</math></p> <p>CD: <math>y + 4 = \frac{5}{4}(x - 8) \Rightarrow y = \frac{5}{4}x - 14</math></p> <p><math>\frac{5}{4}x - 14 = \frac{1}{14}x + \frac{34}{7}</math></p> <p><math>\therefore x = 16</math> <math>y = 6</math></p>	<p><math>\checkmark\checkmark \left(5; \frac{1}{2}\right)</math></p> <p><math>\checkmark</math> x value <math>\checkmark</math> y value (4)</p> <p><math>\checkmark</math> method finding x <math>\checkmark</math> method finding y <math>\checkmark</math> x value <math>\checkmark</math> y value (4)</p> <p><math>\checkmark\checkmark</math> equating <math>\checkmark</math> x value <math>\checkmark</math> y value (4)</p> <p>[17]</p>
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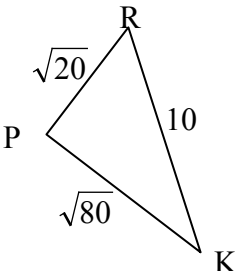


**QUESTION/VRAAG 4**



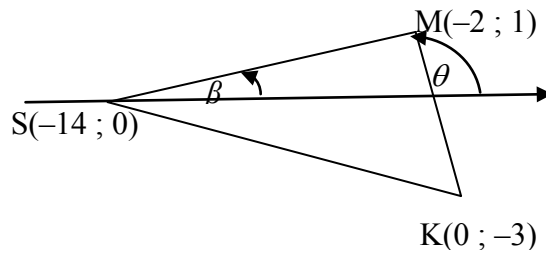
<p>4.1.1</p>	$m_{PK} = \frac{5 - (-3)}{-4 - 0}$ $= -2$ <p>PK <math>\perp</math> SR [radius <math>\perp</math> tangent/raaklyn]</p> $\therefore m_{PK} \times m_{RS} = -1$ $\therefore m_{RS} = \frac{1}{2}$	<ul style="list-style-type: none"> <li>✓ substitution P &amp; K into gradient formula</li> <li>✓ gradient of PK</li> <li>✓ PK <math>\perp</math> SR <b>OR</b> r <math>\perp</math> tangent</li> <li>✓ answer</li> </ul> <p style="text-align: right;">(4)</p>
<p>4.1.2</p>	$y = \frac{1}{2}x + c$ $5 = \frac{1}{2}(-4) + c \quad \mathbf{OR/OR} \quad (y - 5) = \frac{1}{2}(x - (-4))$ $c = 7 \quad \quad \quad (y - 5) = \frac{1}{2}x + 2$ $y = \frac{1}{2}x + 7 \quad \quad \quad y = \frac{1}{2}x + 7$	<ul style="list-style-type: none"> <li>✓ substitution of m and P</li> <li>✓ equation</li> </ul> <p style="text-align: right;">(2)</p>

<p>4.1.3</p>	$M\left(\frac{-4+0}{2}; \frac{5+(-3)}{2}\right)$ $\therefore M(-2; 1)$ $r^2 = (x_2 - x_1)^2 + (y_2 - y_1)^2$ $r^2 = (-2 + 4)^2 + (1 - 5)^2$ $\therefore r^2 = 20$ $\therefore (x + 2)^2 + (y - 1)^2 = 20 \text{ or } (\sqrt{20})^2$ <p><b>OR/OF</b></p> $M\left(\frac{-4+0}{2}; \frac{5+(-3)}{2}\right) \therefore M(-2; 1)$ $(x + 2)^2 + (y - 1)^2 = r^2$ $(-4 + 2)^2 + (5 - 1)^2 = r^2$ $\therefore r^2 = 20$ $\therefore (x + 2)^2 + (y - 1)^2 = 20 \text{ or } (\sqrt{20})^2$ <p><b>OR/OF</b></p> $M\left(\frac{-4+0}{2}; \frac{5+(-3)}{2}\right) \therefore M(-2; 1)$ $PK = \sqrt{(-4 - 0)^2 + (5 - (-3))^2} = \sqrt{80}$ $r = \frac{\sqrt{80}}{2} = \sqrt{20}$ $\therefore (x + 2)^2 + (y - 1)^2 = 20 \text{ or } (\sqrt{20})^2$	<p>✓ x value of M                  ✓ y value of M</p> <p>✓ <math>r^2 = 20</math></p> <p>✓ equation (4)</p> <p>✓✓ M (- 2 ; 1)</p> <p><math>r^2 = 20</math></p> <p>✓ equation (4)</p> <p>✓✓ M (- 2 ; 1)</p> <p><math>r^2 = 20</math></p> <p>✓ equation (4)</p>
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<p>4.1.4</p>	<p> <math>\tan \theta = m_{PK} = -2</math>  <math>\therefore \theta = 180^\circ - 63,43^\circ</math>  <math>= 116,57^\circ</math>  <math>\hat{P}KR = 116,57^\circ - 90^\circ</math> [ext <math>\angle</math> of <math>\Delta MOK</math>]  <math>= 26,57^\circ</math>  <b>OR/OF</b> </p>  <p> <u>In <math>\Delta RPK</math>:</u>  <math>PK = \sqrt{(0 - (-4))^2 + (-3 - 5)^2} = \sqrt{80}</math>  <math>PR = \sqrt{(-4 - 0)^2 + (5 - 7)^2} = \sqrt{20}</math>  <math>RK = 10</math>  <math>\cos \hat{P}KR = \frac{PK^2 + KR^2 - PR^2}{2 \cdot PK \cdot KR} = \frac{(\sqrt{80})^2 + (10)^2 - (\sqrt{20})^2}{2(\sqrt{80})(10)}</math>  <math>= \frac{2\sqrt{5}}{5}</math>  <math>\hat{P}KR = 26,57^\circ</math>  <b>OR/OF</b> </p> <p> <math>\sin \hat{P}KR = \frac{\sqrt{20}}{10}</math>    <b>OR/OF</b>    <math>\cos \hat{P}KR = \frac{\sqrt{80}}{10}</math>  <math>\hat{P}KR = 26,57^\circ</math>                      <math>\hat{P}KR = 26,57^\circ</math> </p> <p> <b>OR/OF</b>  <math>\tan \hat{P}KR = \frac{\sqrt{20}}{\sqrt{80}}</math>  <math>\hat{P}KR = 26,57^\circ</math> </p>	<p> <math>\checkmark \tan \theta = -2</math>  <math>\checkmark</math> size of <math>\theta</math>  <math>\checkmark</math> answer (3)                 </p> <p> <math>\checkmark</math> lengths of PK, PR &amp; RK  <math>\checkmark</math> correct values into cos rule  <math>\checkmark</math> answer (3)                 </p> <p> <math>\checkmark</math> lengths of sides  <math>\checkmark</math> ratio  <math>\checkmark</math> answer (3)                 </p> <p> <math>\checkmark</math> lengths of sides  <math>\checkmark</math> ratio  <math>\checkmark</math> answer (3)                 </p>
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4.1.5	<p>RS    tangent at K(0 ; - 3 )</p> $\therefore m_{PS} = m_{\text{tang}} = \frac{1}{2}$ $\therefore y = \frac{1}{2}x - 3$ <p><b>OR/OF</b></p> $m_{PK} = \frac{1-5}{-2+4} = -2$ $m_{PK} \times m_{\text{tang}} = -1 \quad [\text{radius } \perp \text{ tangent/raaklyn}]$ $\therefore m_{\text{tang}} = \frac{1}{2}$ $\therefore y = \frac{1}{2}x - 3$	<p>✓ gradient</p> <p>✓ equation (2)</p> <p>✓ gradient</p> <p>✓ equation (2)</p>
4.2	<p><math>t \in (-3 ; 7)</math></p> <p><b>OR/OF</b></p> $-3 < t < 7$	<p>✓ - 3 (A)</p> <p>✓ 7 (CA from 4.1.2)</p> <p>✓ correct inequality (3)</p> <p>✓ - 3 (A)</p> <p>✓ 7 (CA from 4.1.2)</p> <p>✓ correct inequality (3)</p>
4.3	<p>RS: <math>y = \frac{1}{2}x + 7 \quad \therefore S(-14 ; 0)</math></p> $SP = \sqrt{(-14 - (-4))^2 + (0 - 5)^2} = \sqrt{100 + 25} = \sqrt{125}$ $\text{Area } \triangle SMK = \frac{1}{2} \cdot MK \cdot SP$ $= \frac{1}{2} (\sqrt{20})(\sqrt{125})$ $= 25 \text{ square units}$	<p>✓ coordinates of S</p> <p>✓ length of SP</p> <p>✓ correct base &amp; height into Area rule</p> <p>✓ correct substitution</p> <p>✓ answer (5)</p>

**OR/OF**



Let  $\beta$  = inclination of SM/ *inklinasie van SM*

RS:  $y = \frac{1}{2}x + 7 \quad \therefore S(-14; 0)$

$$SM = \sqrt{(-14 - (-2))^2 + (0 - 1)^2} = \sqrt{145}$$

$$\tan \beta = \frac{1 - 0}{-2 - (-14)} = \frac{1}{12} \quad \therefore \beta = 4,76^\circ$$

$$\therefore \hat{SMK} = 116,57^\circ - 4,76^\circ \quad [\text{ext } \angle \text{ of } \Delta]$$

$$= 111,81^\circ$$

$$\text{Area } \Delta SMK = \frac{1}{2}(SM)(MK) \cdot \sin \hat{SMK}$$

$$= \frac{1}{2}(\sqrt{145})(\sqrt{20}) \cdot \sin 111,81^\circ$$

$$= 24,9985 = 25 \text{ square units}$$

✓ coordinates of S

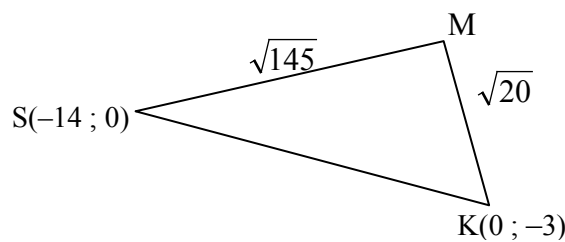
✓ length of SM

✓ size of/grootte v  $\hat{SMK}$

✓ correct substitution into area rule  
✓ answer

(5)

**OR/OF**



RS:  $y = \frac{1}{2}x + 7 \quad \therefore S(-14; 0)$

$$SK = \sqrt{(-14 - 0)^2 + (0 + 3)^2} = \sqrt{205}$$

$$\cos \hat{SMK} = \frac{(\sqrt{145})^2 + (\sqrt{20})^2 - (\sqrt{205})^2}{2(\sqrt{145})(\sqrt{20})} = -\frac{2\sqrt{29}}{29}$$

$$\hat{SMK} = 111,80^\circ$$

$$\text{Area } \Delta SMK = \frac{1}{2}(SM)(MK) \cdot \sin \hat{SMK}$$

$$= \frac{1}{2}(\sqrt{145})(\sqrt{20}) \cdot \sin 111,81^\circ$$

$$= 24,9985 = 25 \text{ square units}$$

✓ coordinates of S

✓ length of SK

✓ size of/grootte v  $\hat{SMK}$

✓ correct substitution into area rule  
✓ answer

(5)

	<p><b>OR/OF</b></p> <p>Produce KS to T</p> <p>RS: <math>y = \frac{1}{2}x + 7 \quad \therefore S(-14; 0)</math></p> <p><math>SK = \sqrt{(-14 - 0)^2 + (0 + 3)^2} = \sqrt{205}</math></p> <p><math>SM = \sqrt{(-14 - (-2))^2 + (0 - 1)^2} = \sqrt{145}</math></p> <p><math>m_{SK} = -\frac{3}{14} \Rightarrow T\hat{S}O = 167,91^\circ</math></p> <p><math>m_{SM} = \frac{1}{12} \Rightarrow M\hat{S}O = 4,76^\circ</math></p> <p><math>M\hat{S}K = 180^\circ - 167,91^\circ + 4,76^\circ = 16,85^\circ</math></p> <p>Area <math>\Delta SMK = \frac{1}{2}(SM)(SK) \cdot \sin M\hat{S}K</math></p> <p><math>= \frac{1}{2}(\sqrt{145})(\sqrt{205}) \cdot \sin 16,85^\circ</math></p> <p><math>= 24,9985 = 25 \text{ square units}</math></p>	<p>✓ coordinates of S</p> <p>✓ length of SK &amp; SM</p> <p>✓ size of /grootte v <math>M\hat{S}K</math></p> <p>✓ correct substitution into area rule</p> <p>✓ answer</p> <p>(5)</p>
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**QUESTION/VRAAG 5**

5.1	$\frac{\sin(A - 360^\circ) \cdot \cos(90^\circ + A)}{\cos(90^\circ - A) \cdot \tan(-A)}$ $= \frac{\sin A (-\sin A)}{\sin A (-\tan A)}$ $= \frac{\sin A}{\left(\frac{\sin A}{\cos A}\right)}$ $= \cos A$	<ul style="list-style-type: none"> <li>✓ sin A</li> <li>✓ -sin A</li> <li>✓ sin A</li> <li>✓ -tan A</li> <li>✓ <math>\tan A = \frac{\sin A}{\cos A}</math></li> <li>✓ answer</li> </ul>	(6)
5.2.1	$t^2 = (\sqrt{34})^2 - (3)^2$ $\therefore t = -5$	<ul style="list-style-type: none"> <li>✓ substitution</li> <li>✓ answer</li> </ul>	(2)
5.2.2	$\tan \beta = \frac{-5}{3}$	<ul style="list-style-type: none"> <li>✓ correct ratio</li> </ul>	(1)
5.2.3	$\cos 2\beta = 2 \cos^2 \beta - 1$ $= 2 \left( \frac{3}{\sqrt{34}} \right)^2 - 1$ $= 2 \left( \frac{9}{34} \right) - 1$ $= -\frac{16}{34} \text{ OR } -\frac{8}{17}$ <p><b>OR/OF</b></p> $\cos 2\beta = 1 - 2 \sin^2 \beta$ $= 1 - 2 \left( -\frac{5}{\sqrt{34}} \right)^2$ $= 1 - 2 \left( \frac{25}{34} \right)$ $= -\frac{16}{34} \text{ OR } -\frac{8}{17}$ <p><b>OR/OF</b></p> $\cos 2\beta = \cos^2 \beta - \sin^2 \beta$ $= \left( \frac{3}{\sqrt{34}} \right)^2 - \left( -\frac{5}{\sqrt{34}} \right)^2$ $= \frac{9}{34} - \frac{25}{34}$ $= -\frac{16}{34} \text{ OR } -\frac{8}{17}$	<ul style="list-style-type: none"> <li>✓ compound formula</li> <li>✓ substitution</li> <li>✓ simplification</li> <li>✓ answer</li> </ul>	(4)
		<ul style="list-style-type: none"> <li>✓ compound formula</li> <li>✓ substitution</li> <li>✓ simplification</li> <li>✓ answer</li> </ul>	(4)
		<ul style="list-style-type: none"> <li>✓ compound formula</li> <li>✓ substitution</li> <li>✓ simplification</li> <li>✓ answer</li> </ul>	(4)

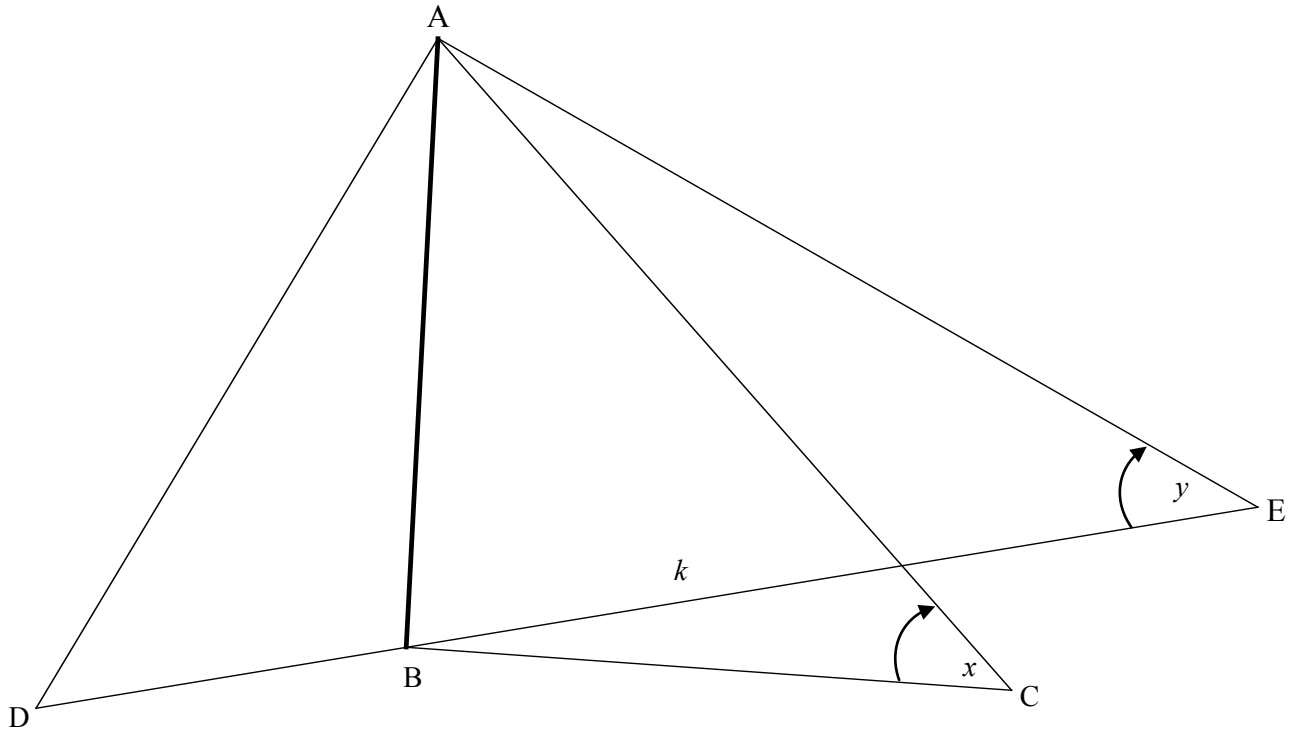
5.3.1	$\begin{aligned} \text{LHS} &= \sin(A + B) - \sin(A - B) \\ &= \sin A \cdot \cos B + \cos A \cdot \sin B - (\sin A \cdot \cos B - \cos A \cdot \sin B) \\ &= \sin A \cdot \cos B + \cos A \cdot \sin B - \sin A \cdot \cos B + \cos A \cdot \sin B \\ &= 2\cos A \cdot \sin B \\ &= \text{RHS} \end{aligned}$	✓ compound formula ✓ compound formula (2)
5.3.2	$\begin{aligned} \sin 77^\circ - \sin 43^\circ &= \sin(60^\circ + 17^\circ) - \sin(60^\circ - 17^\circ) \\ &= 2\cos 60^\circ \cdot \sin 17^\circ \\ &= 2 \times \frac{1}{2} \times \sin 17^\circ \\ &= \sin 17^\circ \end{aligned}$ <p><b>OR/OF</b></p> $\begin{aligned} \sin 77^\circ - \sin 43^\circ &= \sin(60^\circ + 17^\circ) - \sin(60^\circ - 17^\circ) \\ &= (\sin 60^\circ \cos 17^\circ + \cos 60^\circ \sin 17^\circ) - \\ &\quad (\sin 60^\circ \cos 17^\circ - \cos 60^\circ \sin 17^\circ) \\ &= \frac{\sqrt{3}}{2} \cos 17^\circ + \frac{1}{2} \sin 17^\circ - \frac{\sqrt{3}}{2} \cos 17^\circ + \frac{1}{2} \sin 17^\circ \\ &= \sin 17^\circ \end{aligned}$	✓ $60^\circ + 17^\circ$ ✓ $60^\circ - 17^\circ$ ✓ simplify ✓ $\frac{1}{2}$ (4) ✓ $60^\circ + 17^\circ$ ✓ $60^\circ - 17^\circ$ ✓ expansion ✓ $\frac{1}{2}$ (4) <b>[19]</b>



**QUESTION/VRAAG 6**

<p>6.1</p>		<ul style="list-style-type: none"> <li>✓ <math>(-90^\circ ; -3)</math></li> <li>✓ <math>(0 ; -1)</math></li> <li>✓ <math>x</math> – intercepts: -210° &amp; 30°</li> <li>✓ shape</li> </ul> <p style="text-align: right;">(4)</p>
<p>6.2</p>	$\cos 2x = 2 \sin x - 1$ $1 - 2 \sin^2 x = 2 \sin x - 1$ $2 \sin^2 x + 2 \sin x - 2 = 0$ $\sin^2 x + \sin x - 1 = 0$ $\sin x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{-1 \pm \sqrt{1^2 - 4(1)(-1)}}{2(1)}$ $\sin x = \frac{-1 + \sqrt{5}}{2}, \text{ since } \sin x = \frac{-1 - \sqrt{5}}{2} < -1 \text{ has no solution}$	<ul style="list-style-type: none"> <li>✓ <math>\cos 2x = 1 - 2 \sin^2 x</math></li> <li>✓ standard form</li> <li>✓ using quadratic formula</li> <li>✓ substitution into quadratic formula</li> </ul> <p style="text-align: right;">(4)</p>
<p>6.3</p>	$\sin x = \frac{-1 + \sqrt{5}}{2} = 0,618\dots$ <p>Reference <math>\angle = 38,17^\circ</math></p> $\therefore x = 38,17^\circ + k \cdot 360^\circ \text{ or } x = 141,83^\circ + k \cdot 360^\circ ; k \in \mathbb{Z}$ $\therefore x = 38,17^\circ \text{ or } -218,17^\circ$ $y = 0,24$ <p><math>\therefore</math> Points of intersection/snyypunte: <math>(38,17^\circ ; 0,24)</math> and <math>(-218,17^\circ ; 0,24)</math></p>	<ul style="list-style-type: none"> <li>✓ <math>38,17^\circ</math></li> <li>✓ <math>141,83^\circ</math></li> <li>✓ <math>-218,17^\circ</math></li> <li>✓ <math>0,24</math></li> </ul> <p style="text-align: right;">(4) <b>[12]</b></p>

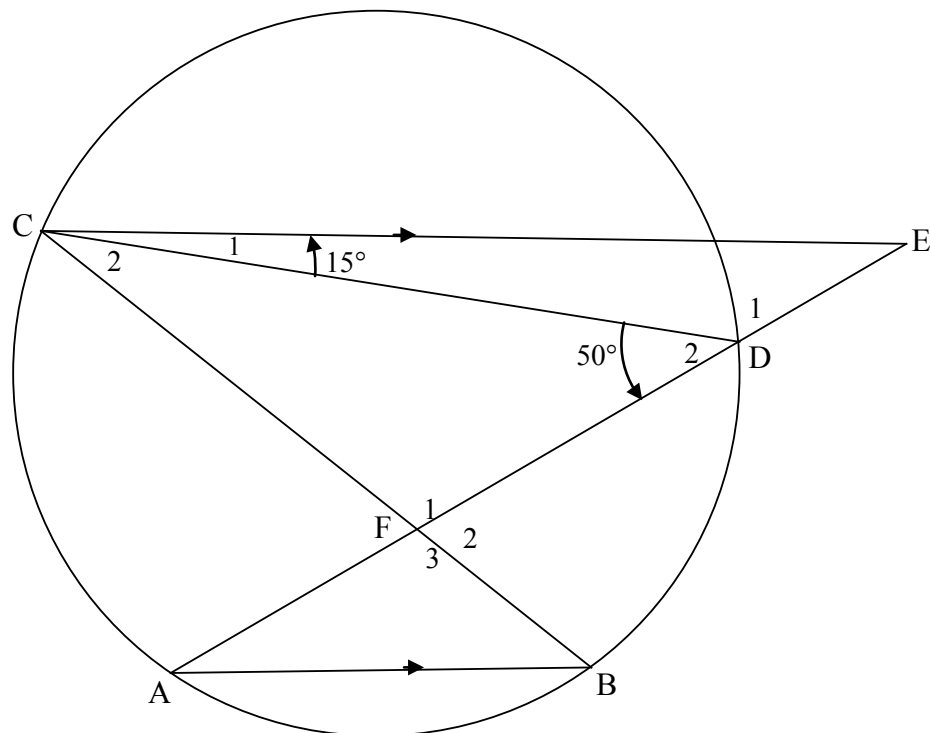
**QUESTION/VRAAG 7**



7.1	$\hat{A}BC = 90^\circ$	✓ answer (1)
7.2	<p>In <math>\triangle ABE</math>:</p> $\frac{AB}{BE} = \tan y$ $AB = k \tan y$ <p>In <math>\triangle ABC</math>:</p> $\frac{AB}{AC} = \sin x$ $AC = \frac{AB}{\sin x}$ $= \frac{k \tan y}{\sin x}$	<p>✓ correct ratio ✓ value AB</p> <p>✓ correct ratio ✓ AC as subject and substitution</p> <p>(4)</p>

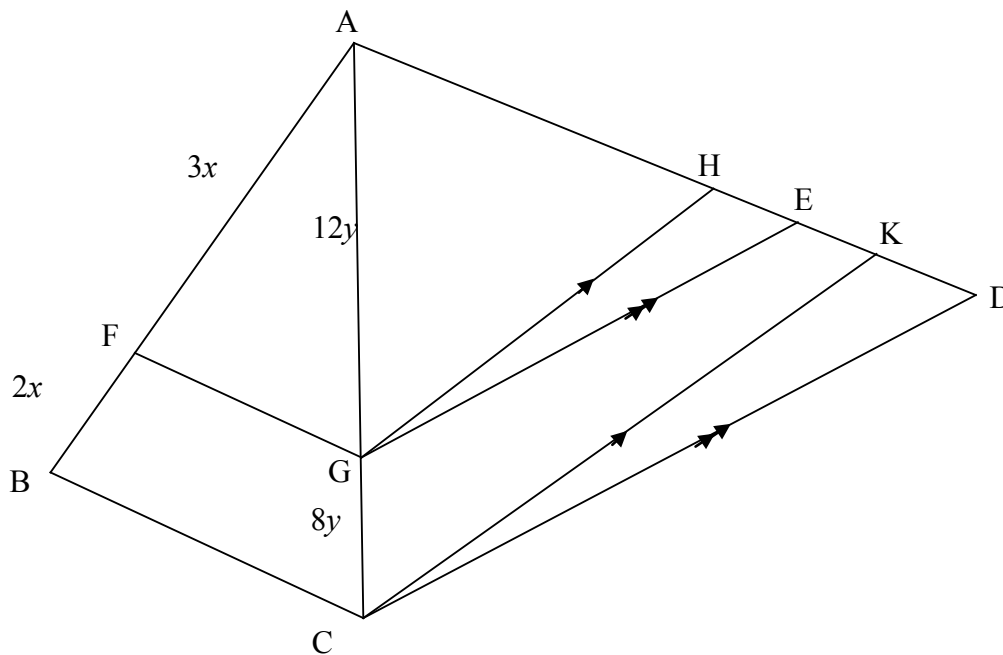
<p>7.3</p>	$\hat{A}DC = \hat{A}CD = \frac{180^\circ - 2x}{2} = 90^\circ - x$ $\frac{DC}{\sin 2x} = \frac{AC}{\sin(90^\circ - x)}$ $\frac{DC}{2 \sin x \cos x} = \frac{AC}{\cos x}$ $DC = \frac{AC(2 \sin x \cos x)}{\cos x}$ $= \frac{k \tan y}{\sin x} \cdot \frac{2 \sin x \cos x}{\cos x}$ $= 2k \tan y$ <p><b>OR/OF</b></p> $DC^2 = AD^2 + AC^2 - 2AD \cdot AC \cos 2x$ $= AC^2 + AC^2 - 2AC^2 \cos 2x$ $= 2AC^2(1 - \cos 2x)$ $= 2AC^2(1 - 1 + \sin^2 x)$ $= 4AC^2 \sin^2 x$ $DC = 2AC \cdot \sin x$ $= 2 \left( \frac{k \cdot \tan y}{\sin x} \right) \cdot \sin x$ $= 2k \cdot \tan y$ <p><b>OR/OF</b></p> $DC^2 = AD^2 + AC^2 - 2AD \cdot AC \cos 2x$ $= 2 \left( \frac{k \tan y}{\sin x} \right)^2 - 2 \left( \frac{k \tan y}{\sin x} \right)^2 \cos 2x$ $= \frac{2k^2 \tan^2 y}{\sin^2 x} - \frac{2k^2 \tan^2 y}{\sin^2 x} (1 - 2 \sin^2 x)$ $= \frac{2k^2 \tan^2 y}{\sin^2 x} - \frac{2k^2 \tan^2 y}{\sin^2 x} + 4k^2 \tan^2 y$ $DC = \sqrt{4k^2 \tan^2 y}$ $= 2k \tan y$	<ul style="list-style-type: none"> <li>✓ <math>90^\circ - x</math></li> <li>✓ subst into sine rule</li> <li>✓ <math>2 \sin x \cos x</math></li> <li>✓ <math>\cos x</math></li> <li>✓ substitution (5)</li> <li>✓ substitution into cos rule</li> <li>✓ factorisation</li> <li>✓ <math>1 - 2 \sin^2 x</math></li> <li>✓ DC ito AC and <math>\sin x</math></li> <li>✓ substitution (5)</li> <li>✓ correct cos rule</li> <li>✓ substitution</li> <li>✓ <math>1 - 2 \sin^2 x</math></li> <li>✓ squaring and multiplication</li> <li>✓ <math>\sqrt{4k^2 \tan^2 y}</math> (5)</li> </ul> <p style="text-align: right;"><b>[10]</b></p>
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**QUESTION/VRAAG 8**



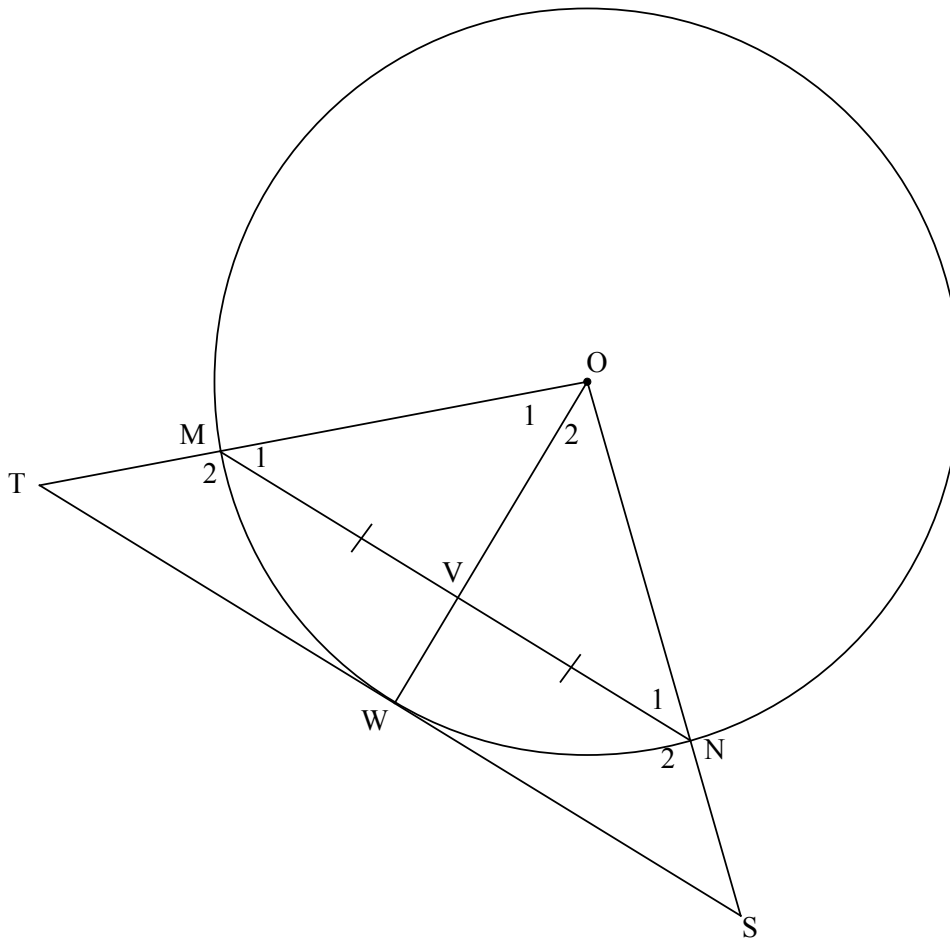
<p>8.1.1</p>	<p><math>\hat{E} = 50^\circ - 15^\circ = 35^\circ</math> [ext <math>\angle</math> of <math>\Delta</math>/buite <math>\angle</math> van <math>\Delta</math>]  <math>\hat{A} = 35^\circ</math> [alt <math>\angle</math>s / verwiss <math>\angle</math>e; CE    AB]</p> <p><b>OR/OF</b>  <math>\hat{E} = 180^\circ - (130^\circ + 15^\circ) = 35^\circ</math> [str line; <math>\angle</math>s of <math>\Delta</math>/rt lyn; <math>\angle</math>e van <math>\Delta</math>]  <math>\hat{A} = 35^\circ</math> [alt <math>\angle</math>s / verwiss <math>\angle</math>e; CE    AB]</p> <p><b>OR/OF</b>  <math>\hat{B} = 50^\circ</math> [<math>\angle</math>s in same segment/<math>\angle</math>e in dieselfde segment]  <math>\hat{C}_2 + 15^\circ = 50^\circ</math> [alt <math>\angle</math>s / verwiss <math>\angle</math>e; CE    AB]  <math>\therefore \hat{C}_2 = 35^\circ</math>  <math>\hat{A} = 35^\circ</math> [<math>\angle</math>s in same segment/<math>\angle</math>e in dieselfde segment]</p>	<p>✓ S                  ✓ S ✓ R                  (3)</p> <p>✓ S                  ✓ S ✓ R                  (3)</p> <p>✓ S                  ✓ S ✓ R                  (3)</p>
<p>8.1.2</p>	<p><math>\hat{C}_2 = 35^\circ</math> [<math>\angle</math>s in same segment/<math>\angle</math>e in dieselfde segment]</p>	<p>✓ S ✓ R                  (2)</p>
<p>8.2</p>	<p><math>\hat{C}_2 = \hat{E}</math> [from 8.1.1 and 8.1.2]  <math>\therefore</math> CF is a tangent to the circle [converse tan chord theorem]  <math>\therefore</math> CF is 'n raaklyn aan die sirkel [omgekeerde raakl koordst]</p>	<p>✓ S                  ✓ R                  (2)                  [7]</p>

**QUESTION/VRAAG 9**



<p>9.1.1</p>	$\frac{AF}{BF} = \frac{3x}{2x} = \frac{3}{2} \quad \& \quad \frac{AG}{CG} = \frac{12y}{8y} = \frac{3}{2}$ $\therefore \frac{AF}{BF} = \frac{AG}{CG}$ <p><math>\therefore FG \parallel BC</math> [conv prop th/omg eweredigh st. <b>OR</b> line divides 2 sides of <math>\Delta</math> in prop/lyn verdeel 2 sye v <math>\Delta</math> in dies verh]</p>	<p><math>\checkmark \frac{AF}{BF} = \frac{AG}{CG}</math></p> <p><math>\checkmark R</math></p> <p style="text-align: right;">(2)</p>
<p>9.1.2</p>	$\frac{AG}{GC} = \frac{AH}{HK} \quad \text{[prop theorem/eweredigh st; } \underline{GH \parallel CK} \text{ OR line } \parallel \text{ to 1 side of } \Delta \text{/lyn } \parallel \text{ 1 sy van } \Delta]$ $\frac{AG}{GC} = \frac{AE}{ED} \quad \text{[prop theorem/eweredigh st; } \underline{GE \parallel CD}]$ $\therefore \frac{AH}{HK} = \frac{AE}{ED}$	<p><math>\checkmark S \checkmark R</math></p> <p><math>\checkmark S</math></p> <p style="text-align: right;">(3)</p>
<p>9.2</p>	$\frac{AE}{ED} = \frac{3}{2} \quad \text{and} \quad \frac{AH}{HK} = \frac{3}{2}$ $\frac{AE}{12} = \frac{3}{2} \quad \text{and} \quad \frac{15}{HK} = \frac{3}{2}$ <p><math>\therefore AE = 18</math> and <math>HK = 10</math></p> <p><math>\therefore HE = AE - AH</math>  <math>= 18 - 15</math>  <math>= 3</math></p> <p><math>\therefore EK = HK - HE</math>  <math>= 10 - 3</math>  <math>= 7</math></p> <p style="text-align: center;"><b>OR/OF</b></p> $AD = 30$ $KD = AD - AH - HK$ $= 30 - 15 - 10$ $= 5$ $EK = ED - KD$ $= 12 - 5$ $= 7$	<p><math>\checkmark</math> use of ratios</p> <p><math>\checkmark AE = 18</math></p> <p><math>\checkmark HK = 10</math></p> <p><math>\checkmark HE = 3</math> <b>or</b> <math>KD = 5</math></p> <p><math>\checkmark EK = 7</math></p> <p style="text-align: right;">(5) <b>[10]</b></p>

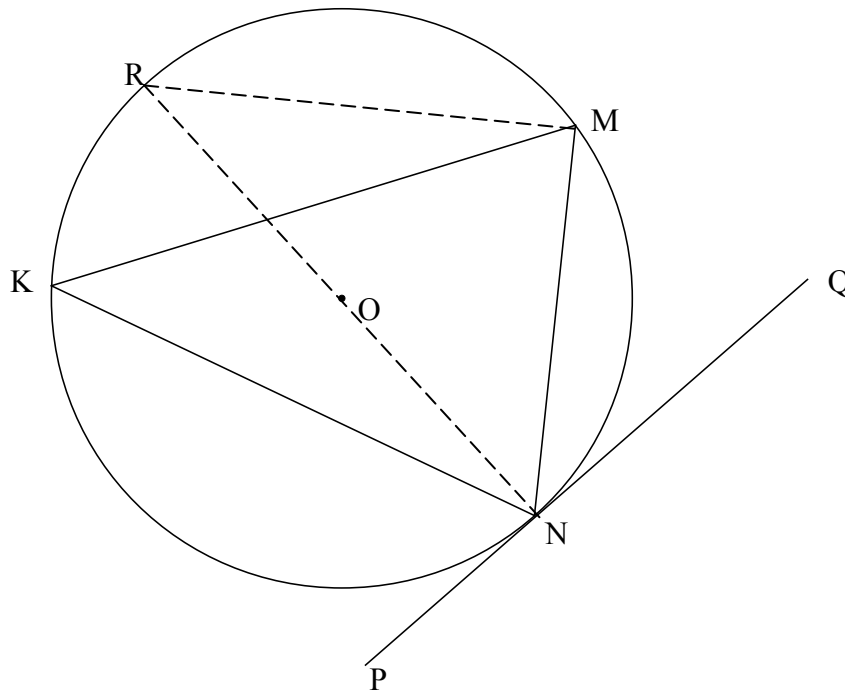
**QUESTION/VRAAG 10**



10.1	Line from centre to midpoint of chord/ <i>lyn vanaf midpt na midpt van koord</i>	✓ R (1)
10.2.1	$O\hat{W}T = O\hat{W}S = 90^\circ$ [radius $\perp$ tangent/raaklyn] $\therefore MN \parallel TS$ [corresp $\angle$ s =/ooreenkomstige $\angle$ e = <b>OR</b> co-int $\angle$ s $180^\circ$ /ko-binne $\angle$ e $180^\circ$ <b>OR</b> alternate $\angle$ s/verwiss $\angle$ e]	✓ R ✓ R (2)
10.2.2	$\hat{M}_1 = \hat{N}_1$ [ $\angle$ s opp = sides/ $\angle$ e teenoor = sye] $\hat{M}_1 = \hat{T}$ [corresp $\angle$ s/ooreenk $\angle$ e; $MN \parallel TS$ ] $\therefore \hat{N}_1 = \hat{T}$ $\therefore$ TMNS is a cyclic quadrilateral [conv: ext $\angle$ cyclic quad] TMNS is 'n koordevierhoek [omgek: buite $\angle$ kdvh] <b>OR/OF</b> $\hat{M}_1 = \hat{N}_1$ [ $\angle$ s opp = sides/ $\angle$ e teenoor = sye] $\hat{N}_1 = \hat{S}$ [corresp $\angle$ s/ooreenk $\angle$ e; $MN \parallel TS$ ] $\therefore \hat{S} = \hat{M}_1$ $\therefore$ TMNS is a cyclic quadrilateral [conv: ext $\angle$ cyclic quad] TMNS is 'n koordevierhoek [omgek: buite $\angle$ kdvh]	✓ S ✓ S ✓ S ✓ R (4) ✓ S ✓ S ✓ S ✓ R (4)

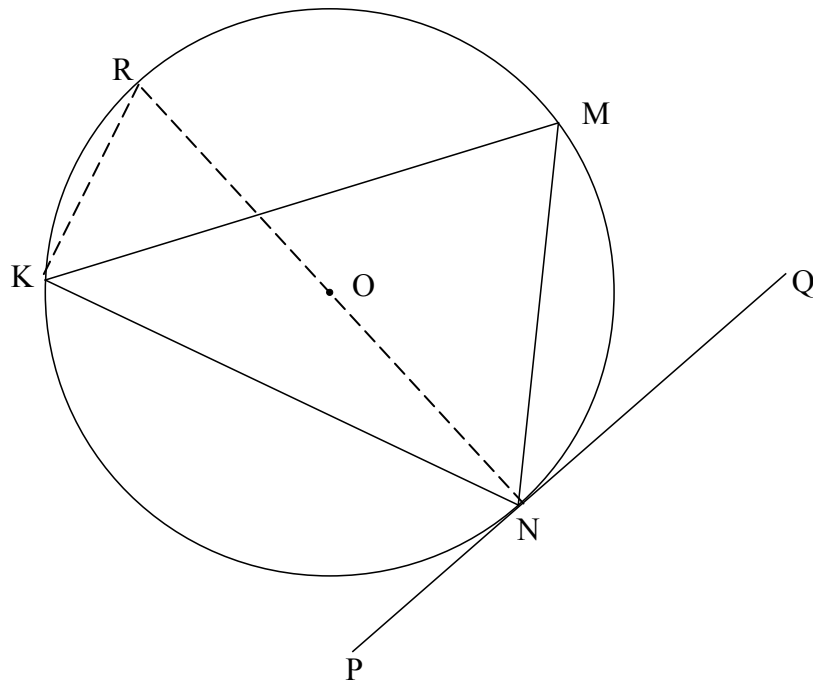
<p>10.2.3</p> <p>In <math>\triangle OVN</math> and <math>\triangle OWS</math></p> <p><math>\hat{O}_2 = \hat{O}_2</math> [common/<i>gemeenskaplik</i>]</p> <p><math>O\hat{V}N = O\hat{W}S = 90^\circ</math> [from 10.1]</p> <p><math>O\hat{N}V = O\hat{S}W</math> [sum <math>\angle s \triangle / som \angle e \triangle</math>]</p> <p><math>\therefore \triangle OVN \parallel \triangle OWS</math> [<math>\angle, \angle, \angle</math>]</p> <p><math>\therefore \frac{VN}{WS} = \frac{ON}{OS}</math></p> <p>But <math>VN = \frac{1}{2} MN</math> [given]</p> <p><math>\therefore \frac{\frac{1}{2} MN}{WS} = \frac{ON}{OS}</math></p> <p><math>\therefore OS \cdot MN = 2ON \cdot WS</math></p> <p><b>OR/OF</b></p> <p>In <math>\triangle OVM</math> and <math>\triangle OWS</math></p> <p><math>O\hat{V}M = O\hat{W}S = 90^\circ</math> [from 10.1]</p> <p><math>O\hat{M}V = O\hat{S}W</math> [sum <math>\angle s \triangle / som \angle e \triangle</math>]</p> <p><math>\therefore \triangle OVM \parallel \triangle OWS</math> [<math>\angle, \angle, \angle</math>]</p> <p><math>\therefore \frac{OM}{OS} = \frac{VM}{WS}</math></p> <p>But <math>VN = \frac{1}{2} MN</math> [given]</p> <p><math>\therefore \frac{\frac{1}{2} MN}{WS} = \frac{OM}{OS}</math></p> <p><math>\therefore OS \cdot MN = 2ON \cdot WS</math> [VM = VN]</p> <p><b>OR/OF</b></p> <p>If any other 2 <math>\triangle s</math> are used, first need to prove that <math>TW = WS</math> by proving <math>\triangle OWT \equiv \triangle OWS</math></p> <p>In <math>\triangle OVM</math> and <math>\triangle OWT</math></p> <p><math>\hat{O}_1 = \hat{O}_1</math> [common/<i>gemeenskaplik</i>]</p> <p><math>O\hat{V}M = O\hat{W}T = 90^\circ</math> [from 10.1]</p> <p><math>O\hat{M}V = O\hat{T}W</math> [sum <math>\angle s \triangle / som \angle e \triangle</math>]</p> <p><math>\therefore \triangle OVM \parallel \triangle OWT</math> [<math>\angle, \angle, \angle</math>]</p> <p><math>\therefore \frac{VM}{WT} = \frac{OM}{OT}</math></p> <p>But <math>VN = VM = \frac{1}{2} MN</math> [given]</p> <p>and <math>WT = WS</math> and <math>OT = OS</math> [<math>\triangle OWT \equiv \triangle OWS</math>]</p> <p><math>\therefore \frac{\frac{1}{2} MN}{WS} = \frac{ON}{OS}</math></p> <p><math>\therefore OS \cdot MN = 2ON \cdot WS</math></p>	<p><math>\checkmark</math> S; S; S <b>OR</b> S; S; R</p> <p><math>\checkmark \triangle OVN \parallel \triangle OWS</math> <math>\checkmark \frac{VN}{WS} = \frac{ON}{OS}</math> <math>\checkmark VN = \frac{1}{2} MN</math></p> <p><math>\checkmark</math> substitution</p> <p>(5)</p> <p><math>\checkmark</math> S; S; S <b>OR</b> S; S; R</p> <p><math>\checkmark \triangle OVM \parallel \triangle OWS</math> <math>\checkmark \frac{OM}{OS} = \frac{VM}{WS}</math> <math>\checkmark VN = \frac{1}{2} MN</math></p> <p><math>\checkmark</math> substitution</p> <p>(5)</p> <p><math>\checkmark \checkmark</math> similarity <math>\checkmark \checkmark</math> congruency</p> <p><math>\checkmark VN = VM = \frac{1}{2} MN</math></p> <p>(5)</p> <p><b>[12]</b></p>
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**QUESTION/VRAAG 11**

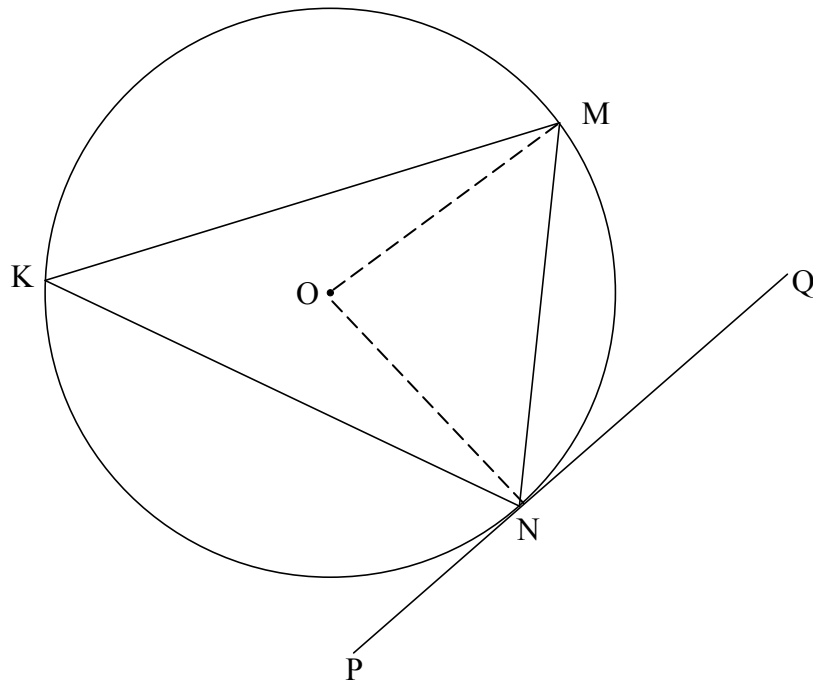


<p>11.1</p>	<p>Construction: Draw diameter NR and draw RM  <i>Konstruksie: Trek middellyn NR en verbind RM</i>  <math>\hat{O}N\hat{M} + \hat{M}\hat{N}Q = 90^\circ</math> [ radius <math>\perp</math> tangent/raaklyn]  <math>\hat{N}\hat{M}R = 90^\circ</math> [<math>\angle</math> in semi circle/semi-sirkel]  <math>\therefore \hat{M}\hat{R}N = 180^\circ - (90^\circ + 90^\circ - \hat{M}\hat{N}Q)</math> [sum <math>\angle</math>s <math>\Delta</math>]  <math>= \hat{M}\hat{N}Q</math>                      but <math>\hat{M}\hat{R}N = \hat{M}\hat{K}N</math> [<math>\angle</math>s same segment/<math>\angle</math>e dieselfde segment]  <math>\therefore \hat{M}\hat{N}Q = \hat{K}</math>  <b>OR/OF</b></p>	<p>✓ construction                       ✓ S / R                      ✓ S / R                       ✓ S                       ✓ S / R                       (5)</p>
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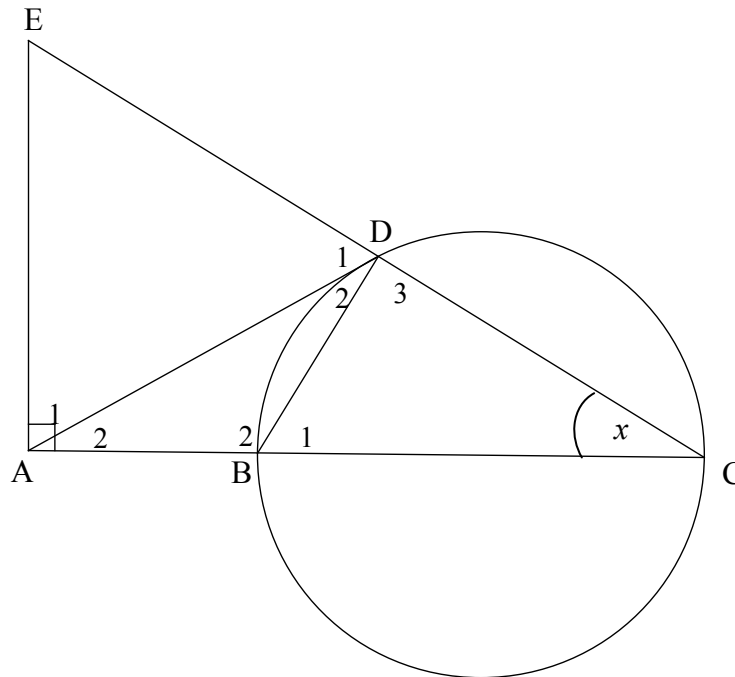


<p>11.1</p>	<p>Construction: Draw diameter NR and draw RK  <i>Konstruksie: Trek middellyn NR en verbind RK</i>  <math>M\hat{N}Q + R\hat{N}M = 90^\circ</math> [radius <math>\perp</math> tangent/raaklyn]  <math>N\hat{K}R = 90^\circ</math> [<math>\angle</math> in semicircle/semi-sirkel]  <math>\therefore M\hat{K}N = 90^\circ - R\hat{K}M</math>  <math>= 90^\circ - R\hat{N}M</math> [<math>\angle</math>s same segment/<math>\angle</math>e dieselfde segment]   <math>\therefore M\hat{N}Q = \hat{K}</math></p>	<p>✓ construction                   ✓ S / R                  ✓ S / R                   ✓ S                  ✓ S / R                   (5)</p>
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<p>11.1</p>	<p>Construction: Draw radii ON and OM  <i>Konstruksie: Trek radiusse ON en OM</i>  <math>\widehat{M\hat{O}N} = 2\hat{K}</math> [<math>\angle</math> at centre = <math>2\angle</math> at circumf/midpts <math>\angle = 2</math> omtreks <math>\angle</math>]  <math>\widehat{O\hat{N}M} + \widehat{O\hat{M}N} = 180^\circ - 2\hat{K}</math> [<math>\angle</math>s of <math>\Delta</math>/<math>\angle</math>e van <math>\Delta</math>]  <math>\widehat{O\hat{N}M} = \widehat{O\hat{M}N} = \frac{180^\circ - 2\hat{K}}{2} = 90^\circ - \hat{K}</math> [<math>\angle</math>s opp = sides/<math>\angle</math>e teenoor = sye]  <math>\widehat{O\hat{N}Q} = 90^\circ</math> [radius <math>\perp</math> tangent/radius <math>\perp</math> raaklyn]  <math>\therefore \widehat{M\hat{N}Q} = \hat{K}</math></p>	<p>✓ construction                  ✓ S / R                  ✓ S                  ✓ S / R                  ✓ S / R                  (5)</p>
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11.2



11.2.1(a)	Angle in a semi circle/ <i>Hoek in halfsirkel</i>	✓ R (1)
11.2.1(b)	Exterior $\angle$ of quad = opp interior $\angle$ / <i>Buite <math>\angle</math> van vierh = teenoorst binne <math>\angle</math></i> <b>OR/OF</b> Opp $\angle$ s of quad supplementary/ <i>Teenoorst <math>\angle</math>e van vierh is supplementêr</i>	✓ R (1)
11.2.1(c)	tangent chord theorem/ <i>raaklyn koord stelling</i>	✓ R (1)
11.2.2(a)	In $\triangle AEC$ $\hat{E} = 180^\circ - (90^\circ + x)$ [sum $\angle$ s $\triangle$ ] $= 90^\circ - x$ $\hat{D}_1 = 180^\circ - (90^\circ + x)$ [ $\angle$ s on a straight line] $= \hat{E} = 90^\circ - x$ $\therefore AD = AE$ [sides opp = $\angle$ s/ <i>syte teenoor = <math>\angle</math>e</i> ]	✓ S  ✓ S ✓ R (3)
11.2.2(b)	In $\triangle ADB$ and $\triangle ACD$ $\hat{A}_2 = \hat{A}_2$ [common] $\hat{D}_2 = \hat{C}$ [proven] $\hat{B}_2 = \hat{D}_2 + \hat{D}_3$ [sum $\angle$ $\triangle$ ] $\therefore \triangle ADB \parallel \triangle ACD$ <b>OR/OF</b> In $\triangle ADB$ and $\triangle ACD$ $\hat{A}_2 = \hat{A}_2$ [common] $\hat{D}_2 = \hat{C}$ [proven] $\therefore \triangle ADB \parallel \triangle ACD$ [ $\angle$ , $\angle$ , $\angle$ ]	✓ S ✓ S ✓ S (3)  ✓ S ✓ S ✓ R (3)

<p>11.2.3(a)</p>	$\frac{AD}{AC} = \frac{AB}{AD} \quad [    \Delta s]$ $AD^2 = AC \cdot AB$ $= 3r \times r$ $= 3r^2$	<p>✓ ratio</p> <p>✓ substitution</p> <p>(2)</p>
<p>11.2.3(b)</p>	$AD = AE = \sqrt{3}r \quad [\text{from 11.2.2(a) \& 11.2.3(a)}]$ $AB = r \text{ and } BC = 2r \therefore AC = 3r$ <p><u>In <math>\Delta ACE</math>:</u></p> $\tan \hat{E} = \frac{AC}{AE}$ $= \frac{3r}{\sqrt{3}r} = \sqrt{3}$ $\therefore \hat{E} = 60^\circ$ $\therefore \hat{D}_1 = 60^\circ \quad [\text{from 11.2.2(a)}]$ $\therefore \hat{A}_1 = 60^\circ \quad [\angle s \text{ of } \Delta = 180^\circ]$ $\therefore \Delta ADE \text{ is equilateral/is gelyksydig}$ <p><b>OR/OF</b></p> $\frac{AD}{AC} = \frac{DB}{CD} \quad [    \Delta s]$ $\frac{\sqrt{3}r}{3r} = \frac{DB}{CD}$ $\tan x = \frac{1}{\sqrt{3}}$ $\therefore \text{In } \Delta BDC: x = 30^\circ$ $\therefore \hat{E} = 60^\circ$ $\therefore \hat{D}_1 = 60^\circ \quad [\text{from 11.2.2(a)}]$ $\therefore \hat{A}_1 = 60^\circ \quad [\angle s \text{ of } \Delta = 180^\circ]$ $\therefore \Delta ADE \text{ is equilateral/is gelyksydig}$ <p><b>OR/OF</b></p> $\frac{AD}{AC} = \frac{DB}{CD} \quad [    \Delta s]$ $\frac{\sqrt{3}r}{3r} = \frac{DB}{CD} \quad \therefore BD = \frac{CD}{\sqrt{3}}$ $DC^2 = BC^2 - DB^2$ $= 4r^2 - \frac{CD^2}{3}$ $3DC^2 = 12r^2 - CD^2$ $4CD^2 = 12r^2$ $DC = \sqrt{3}r$	<p>✓ AC ito <math>r</math></p> <p>✓ trig ratio</p> <p>✓ simplification</p> <p>✓ all 3 <math>\angle s = 60^\circ</math></p> <p>(4)</p> <p>✓ <math>\frac{\sqrt{3}r}{3r} = \frac{DB}{CD}</math></p> <p>✓ <math>\frac{1}{\sqrt{3}} = \tan x</math></p> <p>✓ <math>x = 30^\circ</math></p> <p>✓ all 3 <math>\angle s = 60^\circ</math></p> <p>(4)</p> <p>✓ <math>BD = \frac{CD}{\sqrt{3}}</math></p> <p>✓ <math>DC = \sqrt{3}r</math></p>

	$EC^2 = EA^2 + AC^2$ $= 3r^2 + 9r^2$ $EC = 2\sqrt{3}r$ $\therefore ED = EC - DC$ $= \sqrt{3}r$ $\therefore ED = EA = AD$ $\therefore \triangle ADE \text{ is equilateral/is gelyksydig}$	$\checkmark EC = 2\sqrt{3}r$ $\checkmark ED = EA = AD$ <p style="text-align: right;">(4) [20]</p>
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**TOTAL/TOTAAL: 150**