



# basic education

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

**NATIONAL  
SENIOR CERTIFICATE/  
NASIONALE SENIOR  
SERTIFIKAAT**

**GRADE/GRAAD 12**

**MATHEMATICS P2/WISKUNDE V2  
FEBRUARY/MARCH/FEBRUARIE/MAART 2018  
MARKING GUIDELINES/NASIENRIGLYNE**

**MARKS/PUNTE: 150**

**These marking guidelines consist of 22 pages./  
Hierdie nasienriglyne bestaan uit 20 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>

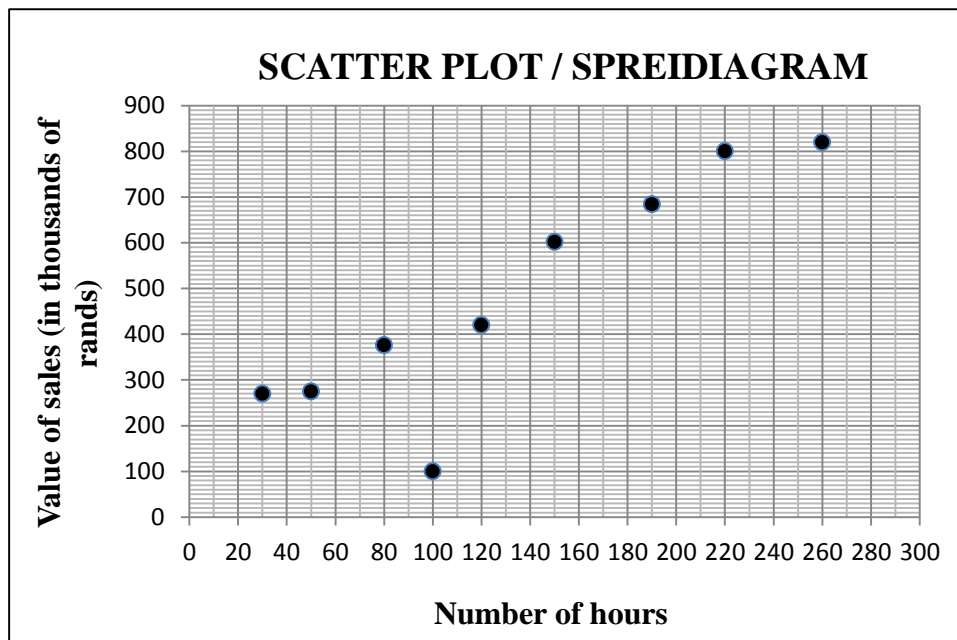
**QUESTION/VRAAG 1**

<b>Days/Dae</b>	1	2	3	4	5	6	7	8	9	10
<b>Units of blood/ Eenhede bloed</b>	45	59	65	73	79	82	91	99	101	106

1.1.1	$\bar{x} = \frac{800}{10}$ $= 80$	Answer only: full marks	✓ 800 (addition of units) ✓ answer (CA if $\div 10$ ) (2)
1.1.2	$\sigma = 18,83$	No penalty for rounding	✓✓ answer (A) (2)
1.1.3	(61,17; 98,83) Days 1, 2, 8, 9 and 10 lie outside 1 standard deviation from the mean $\therefore$ 5 days	Correct answer only: full marks provided that 1.1.1. & 1.1.2 both correct	✓ mean – 1 SD ✓ mean + 1 SD ✓ answer (3)
1.2.1	Skewed to the left or negatively skewed/ <i>Skeef na links of negatief skeef</i>		✓ answer (1)
1.2.2	A = 65 B = 99	Answers without labelling: 1/2	✓ answer ✓ answer (2)
1.3	New total = $95 \times 10 = 950$ $\therefore$ Units not counted = $950 - 800 = 150$		✓ answer (CA from 1.1.1) (1) <b>[11]</b>

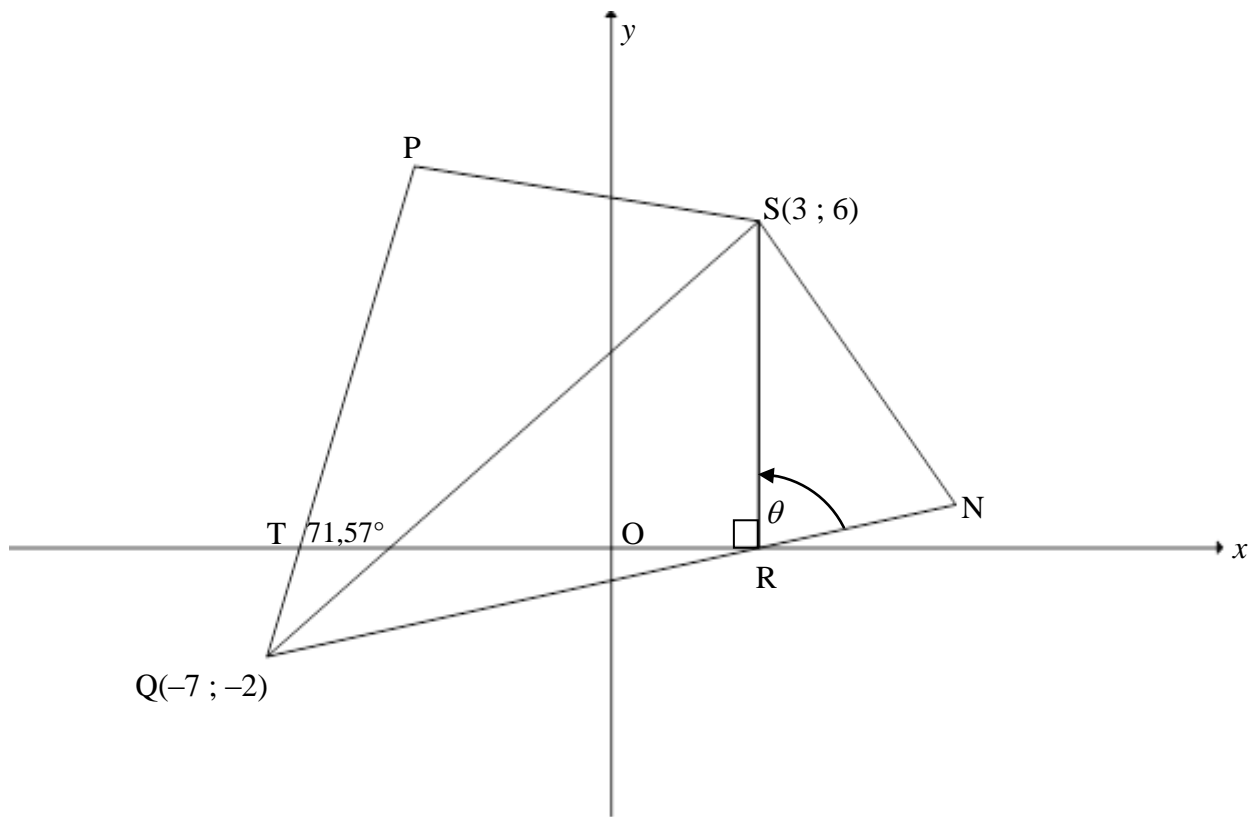
**QUESTION/VRAAG 2**

<b>Number of hours</b> <b>Aantal uur</b>	30	50	80	100	120	150	190	220	260
<b>Value of sales (in thousands of rands)</b> <b>Waarde van verkope (in duisend rand)</b>	270	275	376	100	420	602	684	800	820

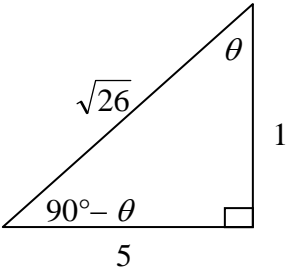
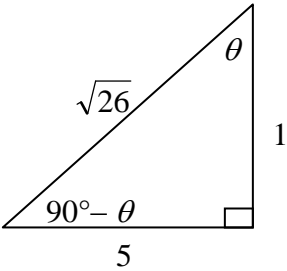


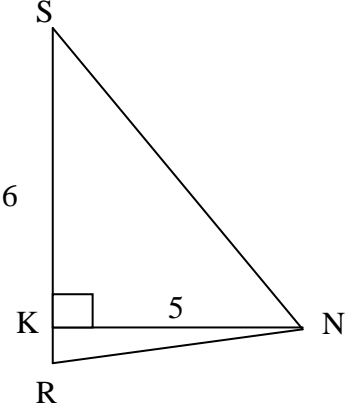
2.1	Outlier/Uitskieter: (100 ; 100)	accept: 100 as answer	✓ answer (1)
2.2	$a = 94,50273\dots$ $b = 2,913729\dots$ $\hat{y} = 94,50 + 2,91x$	Integral values: max 2/3 Swopped $a$ and $b$ : 2/3	✓ value of $a$ ✓ value of $b$ ✓ equation (3)
2.3	$\hat{y} = 2,91(240) + 94,50$ (CA from 2.1) $= 792,90$ Value = R793 000  <b>OR/OF</b>  $\hat{y} = 793,7978142$ (calculator) Value = R794 000	Penalise 1 mark if answer not in thousands of Rands	✓ substitution  ✓ answer in thousands of Rands (2)  ✓✓ answer in thousands of Rands (2)
2.4	$b = 2,913729\dots$ $\therefore$ R2 914 <b>OR/OF</b> R2 910 (calculator)	Answer only: full marks	✓ value of $b$ ✓ answer (2) <b>[8]</b>

**QUESTION/VRAAG 3**

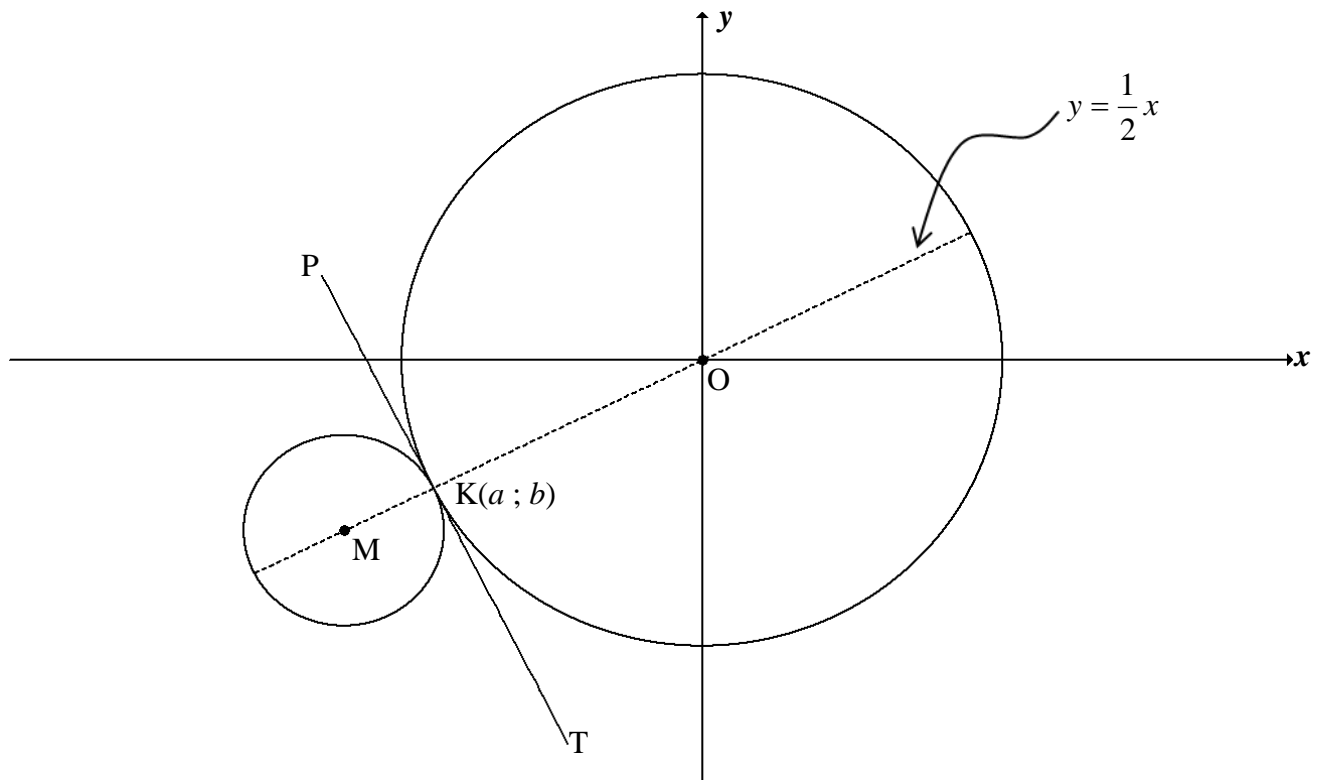


3.1	$x = 3$	✓ answer (1)
3.2	$m_{QP} = \tan 71,57^\circ$ $= 3$ <div style="border: 1px solid black; padding: 2px; display: inline-block; margin-left: 20px;">Answer only: full marks</div>	✓ $m_{QP} = \tan 71,57^\circ$ ✓ answer (2)
3.3	$y = mx + c$ $y - y_1 = m(x - x_1)$ $-2 = 3(-7) + c$ or $y + 2 = 3(x + 7)$ $y = 3x + 19$	(m CA from 3.2 if $> 0$ ) ✓ substitution of $m$ & Q ✓ equation (2)
3.4	$R(3 ; 0)$ $QR = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ $= \sqrt{(-7 - 3)^2 + (-2 - 0)^2}$ $= \sqrt{104}$ or $2\sqrt{26}$	(wrong R: CA if $x > 0$ )  ✓ substitution ✓ answer (in surd form) (2)

<p>3.5</p>	$\tan(90^\circ - \theta) = m_{QR}$ $= \frac{0 - (-2)}{3 - (-7)}$ $= \frac{1}{5}$ <div style="border: 1px solid black; padding: 5px; display: inline-block; margin: 5px;">                 Answer only: full             </div> <div style="border: 1px solid black; padding: 5px; display: inline-block; margin: 5px;"> <math>\tan \theta = \frac{1}{5} : 1/3</math> </div>	<p>(wrong R: CA if <math>x &gt; 0</math>)</p> <ul style="list-style-type: none"> <li>✓ gradient of QR/RN/QN</li> <li>✓ substitution of Q &amp; R</li> <li>✓ answer</li> </ul> <p style="text-align: right;">(3)</p>
<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;">                 using calculator: max 4 marks             </div>	<p>3.6</p> $RN = \frac{1}{2} \cdot 2\sqrt{26} = \sqrt{26}$ $SR = 6$  $\text{Area } \Delta RSN = \frac{1}{2} SR \cdot RN \cdot \sin \theta$ $= \frac{1}{2} \times 6 \times \sqrt{26} \times \frac{5}{\sqrt{26}}$ $= 15 \text{ square units}$ <p><b>OR/OF</b></p> $RN = \frac{1}{2} \cdot 2\sqrt{26} = \sqrt{26}$ $SR = 6$  $\text{Area } \Delta RSN = \frac{1}{2} SR \cdot RN \cdot \sin \theta$ $= \frac{1}{2} (6) \left( \frac{1}{2} QP \right) \cdot \sin \theta$ $= \frac{3}{2} (\sqrt{104}) \cdot \sin \theta$ $= \frac{3}{2} (\sqrt{104}) \left( \frac{5}{\sqrt{26}} \right)$ $= 15 \text{ square units}$	<ul style="list-style-type: none"> <li>✓ RN</li> <li>✓ SR</li> <li>✓ diagram (5 &amp; <math>\sqrt{26}</math>)</li> <li>✓ use of correct area rule</li> <li>✓ substitution of <math>\sin \theta</math></li> <li>✓ answer</li> </ul> <p style="text-align: right;">(6)</p> <ul style="list-style-type: none"> <li>✓ RN</li> <li>✓ SR</li> <li>✓ diagram</li> <li>✓ use of correct area rule</li> <li>✓ substitution of <math>\sin \theta</math></li> <li>✓ answer</li> </ul> <p style="text-align: right;">(6)</p>

	<p><b>OR/OF</b></p> <p>SR = 6  <math>\perp</math> height = 5</p>  <p><math>A = \frac{1}{2} SR \times \perp h</math>  <math>= \frac{1}{2} (6)(5)</math>  <math>= 30</math> square units</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p><b>Using <math>A = \frac{1}{2} b \times \perp h</math> incorrectly: max 1/6</b></p> </div>	<p>✓ SR          ✓✓ <math>\perp</math> height</p> <p>✓ use of correct area formula          ✓ substitution of <math>\sin \theta</math>          ✓ answer</p> <p style="text-align: right;">(6)</p> <p style="text-align: right;"><b>[16]</b></p>
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**QUESTION/VRAAG 4**



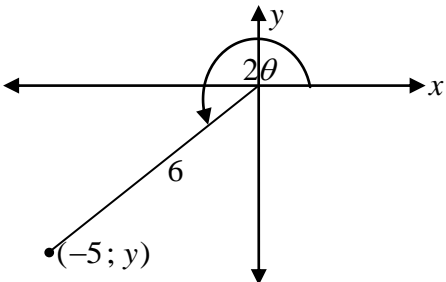
4.1	$OK = \sqrt{180}$ or $6\sqrt{5}$	✓ answer (1)
4.2	$a^2 + b^2 = 180$ $b = \frac{1}{2}a$ $a^2 + \left(\frac{1}{2}a\right)^2 = 180$ <span style="border: 1px solid black; padding: 2px;">No penalty if <math>x</math> and <math>y</math> are not converted to <math>a</math> and <math>b</math></span> $a^2 + \frac{1}{4}a^2 = 180$ $a^2 = 144 \quad \therefore a = -12$ $b = \frac{1}{2}(-12)$ <span style="border: 1px solid black; padding: 2px;">Error in simplification: max 2/4</span> $K(-12; -6)$ (given)  <b>OR/OF</b> $a^2 + b^2 = 180$ $a = 2b$ $(2b)^2 + b^2 = 180$ $5b^2 = 180$ $b^2 = 36 \quad \therefore b = -6$ $a = 2(-6)$ $K(-12; -6)$ (given)	✓ $b$ in terms of $a$ ✓ substitution ✓ $a^2 = 144$ ✓ substitution ✓ $a$ in terms of $b$ ✓ substitution ✓ $b^2 = 36$ ✓ substitution (4)



<p>4.3.1</p>	$m_{OK} = \frac{1}{2} \quad [y = \frac{1}{2}x]$ $m_{PT} = -2 \quad [\text{radius} \perp \text{tangent/raaklyn}]$ $y = mx + c \quad \text{OR/OF} \quad y - y_1 = m(x - x_1)$ $-6 = -2(-12) + c \quad y - (-6) = -2(x - (-12))$ $c = -30 \quad c = -30$ $y = -2x - 30$ <div style="border: 1px solid black; padding: 5px; margin: 10px auto; width: fit-content;"> <p>Using <math>m = \frac{1}{2} : 0/3</math></p> <p>Using <math>m = -\frac{1}{2} \text{ or } 2 : 2/3</math></p> </div>	<p>✓ <math>m_{PT} = -2</math></p> <p>✓ substitution of <math>m</math> &amp; <math>K(-12; -6)</math></p> <p>✓ equation</p> <p style="text-align: right;">(3)</p>
<p>4.3.2</p>	<p>3MK = OK</p> $\Rightarrow OM = \frac{4}{3} OK$ <p><math>M = \frac{4}{3}(-12; -6)</math></p> <p><math>\therefore M(-16; -8)</math></p> <p><b>OR/OF</b></p> <p>3MK = OK</p> $9MK^2 = OK^2 = 180$ $\therefore MK^2 = 20$ <p>Let <math>M(x; y)</math>, then :</p> $(x+12)^2 + (y+6)^2 = 20$ $(x+12)^2 + \left(\frac{1}{2}x+6\right)^2 = 20$ $x^2 + 24x + 144 + \frac{1}{4}x^2 + 6x + 36 = 20$ $\frac{5}{4}x^2 + 30x + 160 = 0$ $x^2 + 24x + 128 = 0$ $(x+16)(x+8) = 0$ <p><math>x = -16 \quad x \neq -8</math> [since M is outside the large circle]</p> <p><math>y = -8</math></p> <p><math>M(-16; -8)</math></p> <p><b>OR/OF</b></p> <div style="text-align: center;"> </div> <p><math>\therefore M(-16; -8)</math></p> <p><b>OR/OF</b></p>	<p>✓ 3MK = OK</p> <p>✓ <math>OM = \frac{4}{3} OK</math></p> <p>✓✓ <math>M = \frac{4}{3}(-12; -6)</math></p> <p>✓ x-coordinate</p> <p>✓ y-coordinate</p> <p style="text-align: right;">(6)</p> <p>✓ 3MK = OK</p> <p>✓ <math>MK^2 = 20</math></p> <p>✓ equation</p> <p>✓ substitution</p> <p>✓ x-coordinate</p> <p>✓ y-coordinate</p> <p style="text-align: right;">(6)</p> <p>✓ 3MK = OK</p> <p>✓ ✓ ✓ diagram with values <b>OR</b> valid explanation</p> <p>✓ x-coordinate</p> <p>✓ y-coordinate</p> <p style="text-align: right;">(6)</p>

	<p>3MK = OK  <math>9MK^2 = OK^2 = 180</math>  <math>\therefore MK^2 = 20</math></p> <p>Let M(x ; y), then <math>y = \frac{1}{2}x</math> :</p> $(x+12)^2 + (y+6)^2 = 20$ $(x+12)^2 + \left(\frac{1}{2}x+6\right)^2 = 20$ $4(x+12)^2 + (x+12)^2 = 80$ $(x+12)^2 = 16$ $x+12 = \pm 4$ $x = -16 \quad x \neq -8 \text{ [since M is outside the large circle]}$ $y = -8$ <p>M(-16; -8)</p>	<p>✓ 3MK = OK                  ✓ <math>MK^2 = 20</math>                  ✓ equation                  ✓ substitution                  ✓ x-coordinate                  ✓ y-coordinate</p> <p>(6)</p>
<p>4.3.3</p>	$(x - (-16))^2 + (y - (-8))^2 = \left(\frac{1}{3}\sqrt{180}\right)^2$ $(x+16)^2 + (y+8)^2 = 20$	<p>✓ LHS (CA from 4.3.2)                  ✓ RHS (CA from 4.1)</p> <p>(2)</p>
<p>4.4</p>	<p><math>OK &lt; r &lt; OK + 2KM</math></p> $\sqrt{180} < r < \sqrt{180} + \frac{2}{3}\sqrt{180}$ <div style="border: 1px solid black; padding: 5px; display: inline-block; margin-left: 100px;">                 Answer only: full marks                  (No need to simplify)             </div> $6\sqrt{5} < r < 10\sqrt{5}$	<p>✓✓ values                  ✓ inequality</p> <p>(3)</p>
<p>4.5</p>	$x^2 + 32x + (16)^2 + y^2 + 16y + (8)^2 = 256 + 64 - 240$ $(x+16)^2 + (y+8)^2 = 80$ <p>New circle/nuwe sirkel:                  Centre/middelpt (-16; -8) &amp;  <math>r = 4\sqrt{5}</math></p> <p>Original circle/oorspronklike sirkel:                  M(-16; -8) &amp; <math>r = 2\sqrt{5}</math></p> <p>This circle will never cut the circle with centre M as they have the <b>same centre (concentric circles) but unequal radii</b>/Hierdie sirkel sal nooit die sirkel met middelpnt M sny nie, want hulle is <b>konsentries, want het dieselfde middelpunt met verskillende radii</b>.</p>	<p>✓ equation in centre, radius form                  ✓ Centre: (-16; -8)                  ✓ <math>r = 4\sqrt{5}</math> (new)                  ✓ <math>r = 2\sqrt{5}</math> (original)                  ✓ conclusion (“concentric” must be stated)</p> <p>(5)                  [24]</p>

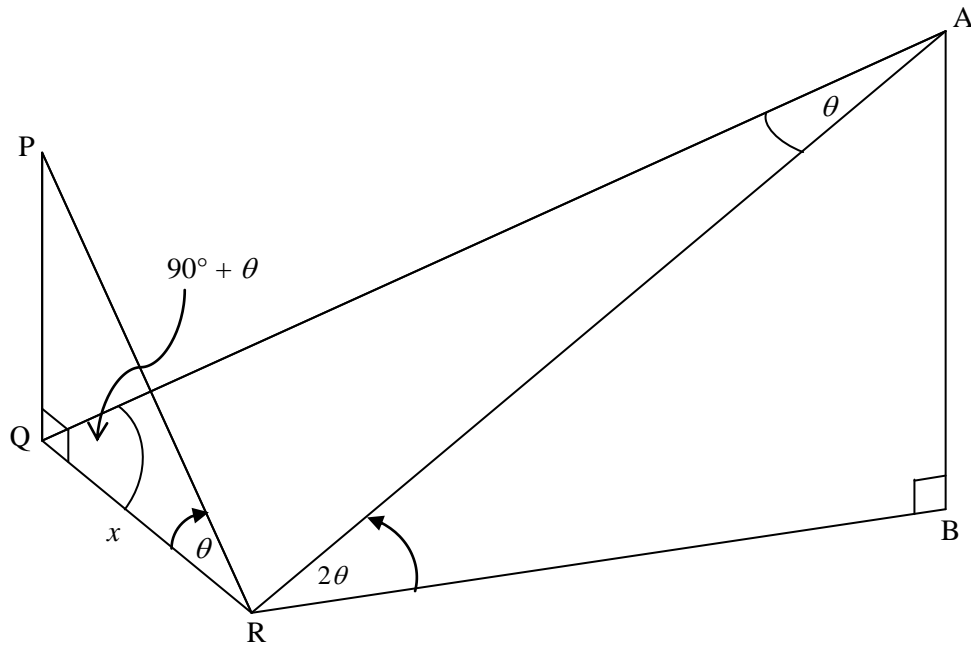
**QUESTION/VRAAG 5**

<p>5.1.1</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;">no calculator in 5.1</div>	<p><math>\cos 2\theta = -\frac{5}{6}</math>, where <math>2\theta \in [180^\circ; 270^\circ]</math></p>  <p><math>y^2 = 6^2 - (-5)^2</math> [Pythagoras]  <math>y = \pm\sqrt{11}</math>  <math>(-5; y)</math> is in 3rd quadrant:  <math>\therefore y = -\sqrt{11}</math>  <math>\sin 2\theta = -\frac{\sqrt{11}}{6}</math></p> <p><b>OR/OF</b></p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;">Getting to <math>\sin 2\theta = \frac{\sqrt{11}}{6} : 3/4</math></div> <p><math>\sin^2 2\theta = 1 - \cos^2 2\theta</math>  <math>= 1 - \left(-\frac{5}{6}\right)^2</math>  <math>= 1 - \frac{25}{36}</math>  <math>= \frac{11}{36}</math>  <math>\sin 2\theta = -\frac{\sqrt{11}}{6}</math></p>	<p>✓ diagram (3<sup>rd</sup> quadrant only)</p> <p>✓ using Pythagoras</p> <p>✓ y – value</p> <p>✓ answer (4)</p> <p>✓ <math>\sin^2 2\theta = 1 - \cos^2 2\theta</math></p> <p>✓ substitution</p> <p>✓ value of <math>\sin^2 2\theta</math></p> <p>✓ answer (4)</p>
<p>5.1.2</p>	<p><math>\cos 2\theta = 1 - 2\sin^2 \theta</math>  <math>2\sin^2 \theta = 1 - \cos 2\theta</math>  <math>\sin^2 \theta = \frac{1 - \left(-\frac{5}{6}\right)}{2}</math>  <math>= \frac{11}{6} \times \frac{1}{2}</math>  <math>= \frac{11}{12}</math></p>	<p>✓ <math>\cos 2\theta = 1 - 2\sin^2 \theta</math></p> <p>✓ substitution</p> <p>✓ answer (3)</p>

<p>5.2</p>	$\sin(180^\circ - x) \cdot \cos(-x) + \cos(90^\circ + x) \cdot \cos(x - 180^\circ)$ $= \sin x \cdot \cos x - \sin x(-\cos x)$ $= 2 \sin x \cdot \cos x$ $= \sin 2x$ <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;">                 Second line written as  <math>\sin x \cos x + \sin x \cos x</math>:                  max 5/6             </div>	<ul style="list-style-type: none"> <li>✓ <math>\sin x</math> ✓ <math>\cos x</math></li> <li>✓ <math>-\sin x</math> ✓ <math>-\cos x</math></li> <li>✓ simplification</li> <li>✓ answer</li> </ul> <p style="text-align: right;">(6)</p>
<p>5.3</p>	$\sin 3x \cdot \cos y + \cos 3x \cdot \sin y$ $\sin(3x + y)$ $= \sin 270^\circ$ $= -1$	<ul style="list-style-type: none"> <li>✓ compound angle</li> <li>✓ answer</li> </ul> <p style="text-align: right;">(2)</p>
<p>5.4.1</p>	$2 \cos x = 3 \tan x$ $2 \cos x = \frac{3 \sin x}{\cos x}$ $2 \cos^2 x = 3 \sin x$ $2(1 - \sin^2 x) = 3 \sin x$ $2 - 2 \sin^2 x = 3 \sin x$ $2 \sin^2 x + 3 \sin x - 2 = 0$	<ul style="list-style-type: none"> <li>✓ <math>\tan x = \frac{\sin x}{\cos x}</math></li> <li>✓ multiplying by <math>\cos \theta</math></li> <li>✓ <math>\cos^2 x = 1 - \sin^2 x</math></li> </ul> <p style="text-align: right;">(3)</p>
<p>5.4.2</p>	$2 \sin^2 x + 3 \sin x - 2 = 0$ $(2 \sin x - 1)(\sin x + 2) = 0$ $\sin x = \frac{1}{2} \text{ or } \sin x = -2 \text{ (no solution)}$ $x = 30^\circ + k \cdot 360^\circ \text{ or } x = 150^\circ + k \cdot 360^\circ ; k \in \mathbb{Z}$	<ul style="list-style-type: none"> <li>✓ factors</li> <li>✓ both values of <math>\sin x</math></li> <li>✓ no solution</li> <li>✓ <math>30^\circ + k \cdot 360^\circ</math></li> <li>✓ <math>150^\circ + k \cdot 360^\circ ; k \in \mathbb{Z}</math></li> </ul> <p style="text-align: right;">(5)</p>
<p>5.4.3</p>	$5y = 30^\circ + k \cdot 360^\circ \text{ or } 5y = 150^\circ + k \cdot 360^\circ$ $y = 6^\circ + k \cdot 72^\circ \text{ or } y = 30^\circ + k \cdot 72^\circ$ $\therefore y = 144^\circ + 6^\circ \text{ or } y = 144^\circ + 30^\circ$ $y = 150^\circ \text{ or } y = 174^\circ$ <p style="text-align: center;"><b>OR/OF</b></p> $144^\circ \leq y \leq 216^\circ$ $720^\circ \leq 5y \leq 1080^\circ$ $5y = 750^\circ \text{ or } 5y = 870^\circ$ $y = 150^\circ \text{ or } y = 174^\circ$	<ul style="list-style-type: none"> <li>✓ <math>y = 6^\circ + k \cdot 72^\circ</math></li> <li>✓ <math>y = 30^\circ + k \cdot 72^\circ</math></li> <li>✓ <math>150^\circ</math> ✓ <math>174^\circ</math></li> </ul> <p style="text-align: right;">(4)</p> <ul style="list-style-type: none"> <li>✓ <math>5y = 750^\circ</math> ✓ <math>5y = 870^\circ</math></li> <li>✓ <math>150^\circ</math> ✓ <math>174^\circ</math></li> </ul> <p style="text-align: right;">(4)</p>
<p>5.5.1</p>	$g(x) = -4 \cos(x + 30^\circ)$ <p>maximum value = 4</p>	<ul style="list-style-type: none"> <li>✓ answer</li> </ul> <p style="text-align: right;">(1)</p>

5.5.2	<p>range of/waardeversameling van <math>g(x)</math>:  <math>-4 \leq y \leq 4</math> <b>OR/OF</b> <math>y \in [-4 ; 4]</math></p> <p><math>\therefore</math> range of/waardeversameling van <math>g(x) + 1</math>:  <math>-3 \leq y \leq 5</math> <b>OR/OF</b> <math>y \in [-3 ; 5]</math></p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;">Answer only: full marks</div>	<p>✓ range of <math>g(x)</math></p> <p>✓ answer</p> <p style="text-align: right;">(2)</p>
5.5.3	<p><math>y = -4 \cos(x + 30^\circ)</math>  shifted to the left/skuif na links:  <math>y = -4 \cos(x + 30^\circ + 60^\circ)</math>  <math>= -4 \cos(x + 90^\circ)</math>  <math>= 4 \sin x</math></p> <p><math>\therefore h(x) = -4 \sin x</math></p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;">Answer only: full marks</div>	<p>✓ shift of <math>60^\circ</math> to the left</p> <p>✓ reduction</p> <p>✓ equation of <math>h</math></p> <p style="text-align: right;">(3)</p> <p style="text-align: right;"><b>[33]</b></p>

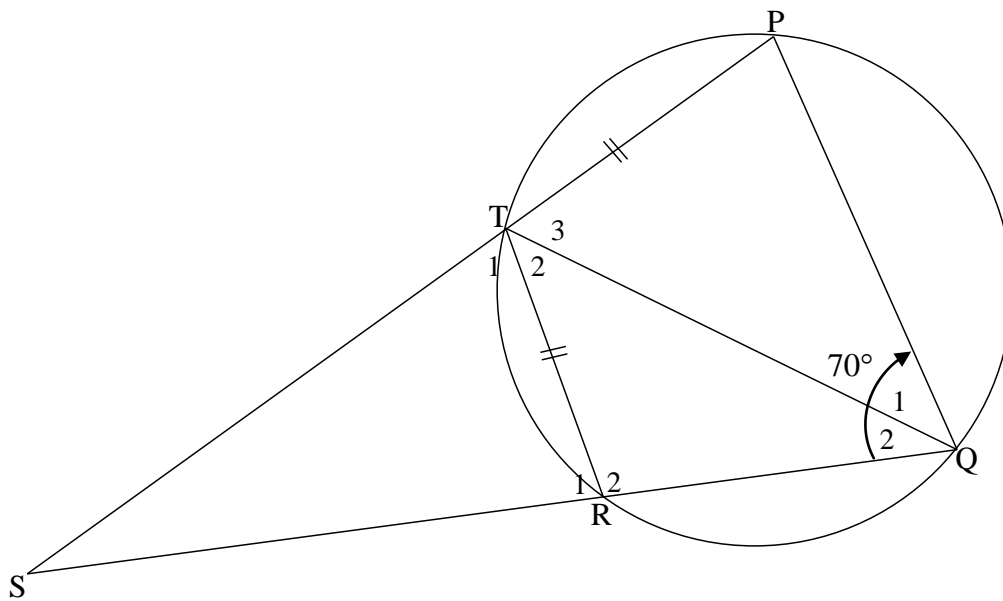
**QUESTION/VRAAG 6**



<p>6.1.1</p>	$\tan \theta = \frac{PQ}{QR} = \frac{PQ}{x}$ $\therefore PQ = x \tan \theta$ <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;">Answer only: full marks</div> <p><b>OR/OF</b></p> $\frac{QR}{\sin P} = \frac{PQ}{\sin \hat{P}RQ}$ $\therefore PQ = \frac{x \cdot \sin \theta}{\sin(90^\circ - \theta)}$	<p>✓ trig ratio ✓ answer</p> <p style="text-align: right;">(2)</p> <p>✓ trig ratio ✓ answer</p> <p style="text-align: right;">(2)</p>
<p>6.1.2</p>	$\frac{AR}{\sin \hat{A}QR} = \frac{QR}{\sin \hat{Q}AR}$ $AR = \frac{x \sin(90^\circ + \theta)}{\sin \theta}$ <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;">Answer only: full marks</div>	<p>✓ use of sine rule ✓ substitution into sine rule correctly</p> <p style="text-align: right;">(2)</p>

6.2	$\sin 2\theta = \frac{AB}{AR}$ $AB = AR \sin 2\theta$ $= \frac{x \sin(90^\circ + \theta) \cdot \sin 2\theta}{\sin \theta}$ $= \frac{x \cos \theta \cdot \sin 2\theta}{\sin \theta}$ $= \frac{x \cos \theta \cdot 2 \sin \theta \cos \theta}{\sin \theta}$ $= 2x \cos^2 \theta$	<ul style="list-style-type: none"> <li>✓ substitution into trig ratio and AB as subject</li> <li>✓ substitution of AR</li> <li>✓ co-ratio</li> <li>✓ <math>\sin 2\theta = 2 \sin \theta \cos \theta</math></li> </ul> <p style="text-align: right;">(4)</p>
6.3	$\frac{AB}{QP} = \frac{2x \cos^2 12^\circ}{x \tan 12^\circ}$ $= 9$	<ul style="list-style-type: none"> <li>✓ substitution CA from 6.1.1)</li> <li>✓ answer</li> </ul> <p style="text-align: right;">(2) <b>[10]</b></p>

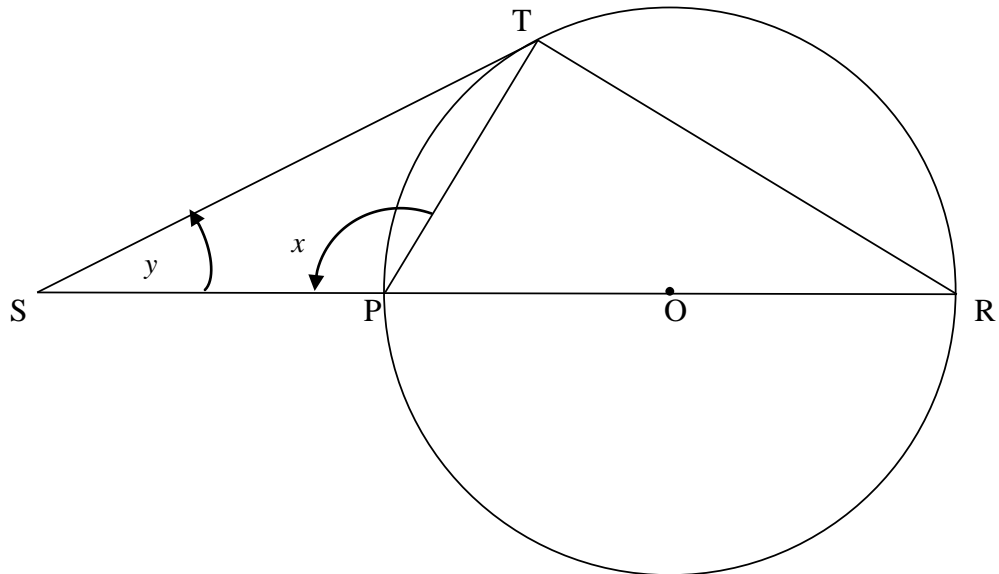
**QUESTION/VRAAG 7**



7.1.1	$\hat{T}_1 = 70^\circ$ [ext $\angle$ of cyclic quad/buite $\angle$ van koordevh]	✓ S ✓ R (2)
7.1.2	$\hat{Q}_1 = \hat{Q}_2 = 35^\circ$ [equal chords;equal $\angle$ s/gelyke koorde; gelyke $\angle$ e]	✓ S ✓ R (2)
7.2.1	$\hat{T}_2 = \hat{Q}_1 = 35^\circ$ [alt $\angle$ s/verwiss $\angle$ e; PQ $\parallel$ TR]	✓ S ✓ R (2)
7.2.2	$\frac{PT}{TS} = \frac{QR}{RS}$ [prop theorem/eweredighst; PQ $\parallel$ TR] $\therefore \frac{TR}{TS} = \frac{QR}{RS}$ [PT = TR]	✓ S ✓ R (2) <b>[8]</b>

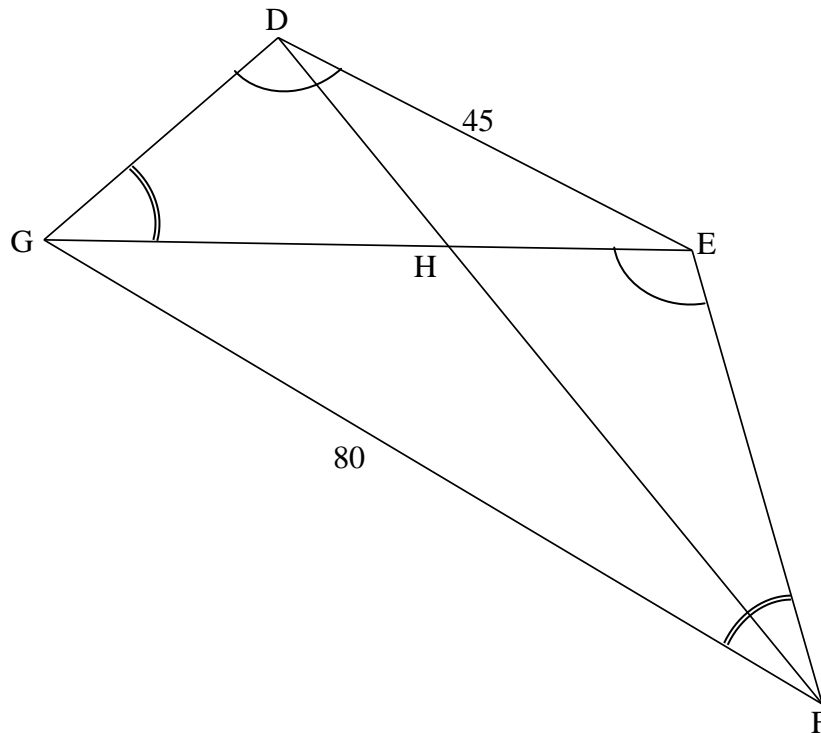


**QUESTION/VRAAG 8**



$\hat{P}TR = 90^\circ$ $x = 90^\circ + \hat{R}$ $\therefore \hat{R} = x - 90^\circ$ $\hat{S}TP = x - 90^\circ$ $x + x - 90^\circ + y = 180^\circ$ $\therefore y = 270^\circ - 2x$	[ $\angle$ in semi-circle/halfsirkel] [ext/buite $\angle$ of/van $\Delta$ ] [tan chord theorem/raakl koordstelling] [sum of/som van $\angle$ s/e in $\Delta$ ]	✓ S/R ✓ S/R ✓ S ✓ R ✓ S ✓ answer <b>[6]</b>
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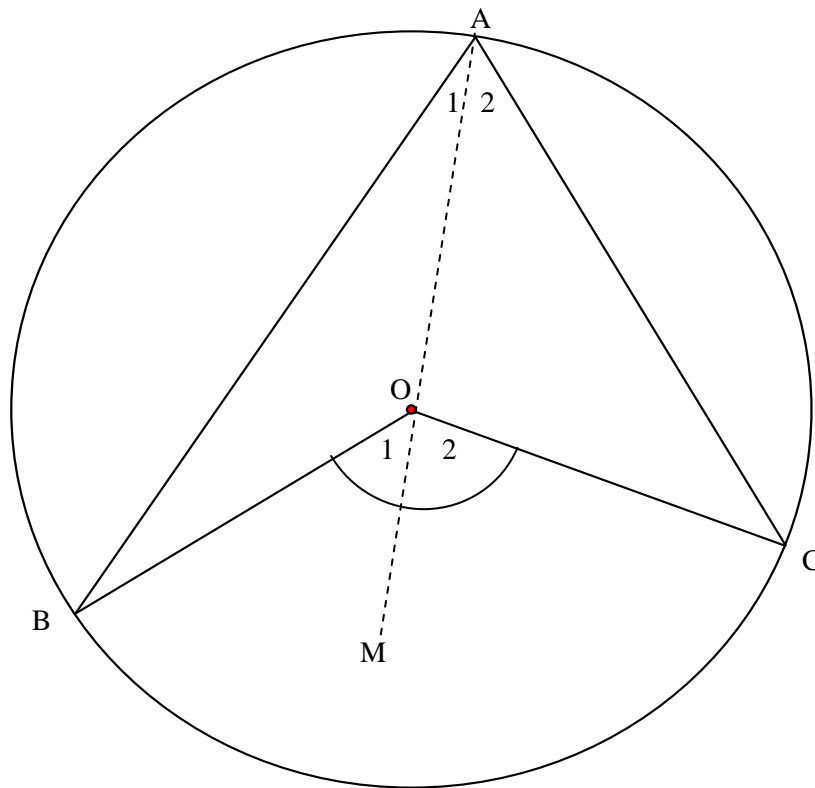
**QUESTION/VRAAG 9**



9.1	equiangular $\Delta$ s/ <i>gelykhoekige <math>\Delta</math>e</i> <b>OR/OF</b> ( $\angle\angle\angle$ )	✓ answer (1)
9.2	$\therefore \frac{GE}{GF} = \frac{DE}{GE}$ $GE^2 = 45 \times 80$ $GE = 60$ $[    \Delta s]$	✓ proportion ✓ substitution ✓ answer (3)
9.3	In $\triangle DEH$ and $\triangle FGH$ : $\hat{D}HE = \hat{F}HG$ [vert opp $\angle$ s =/regoorst $\angle$ e =] $\hat{D}EH = \hat{F}GH$ [    $\Delta$ s] $\hat{E}DH = \hat{G}FH$ [sum of/som van $\angle$ s/e in $\Delta$ ] $\therefore \triangle DEH \parallel \triangle FGH$  <b>OR/OF</b> In $\triangle DEH$ and $\triangle FGH$ : $\hat{D}HE = \hat{F}HG$ [vert opp $\angle$ s =/regoorst $\angle$ e =] $\hat{D}EH = \hat{F}GH$ [    $\Delta$ s] $\therefore \triangle DEH \parallel \triangle FGH$ [ $\angle\angle\angle$ ]	✓ S/R ✓ S/R ✓ S  ✓ S/R ✓ S/R ✓ R (3)

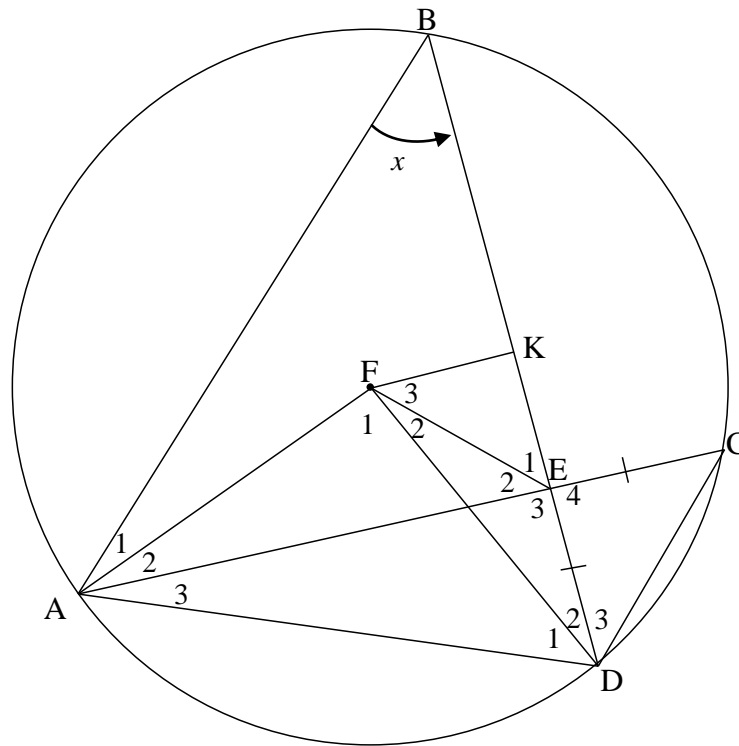


**QUESTION/VRAAG 10**



<p>10.1</p>	<p>Construction: AO is drawn and produced to M</p> $\hat{O}_1 = \hat{A}_1 + \hat{B} \quad [\text{ext } \angle \text{ of } \Delta/\text{buite } \angle \text{ van } \Delta]$ <p>But <math>\hat{A}_1 = \hat{B} \quad [\angle \text{s opp} = \text{radii}/\angle \text{e teenoor} = \text{radii}]</math></p> $\therefore \hat{O}_1 = 2\hat{A}_1$ <p>Similarly/Netso: <math>\hat{O}_2 = 2\hat{A}_2</math></p> $\therefore \hat{O}_1 + \hat{O}_2 = 2\hat{A}_1 + 2\hat{A}_2$ $= 2(\hat{A}_1 + \hat{A}_2)$ $\hat{B}\hat{O}\hat{C} = 2\hat{B}\hat{A}\hat{C}$	<p>✓ Constr</p> <p>✓ S/R</p> <p>✓ S/R</p> <p>✓ S</p> <p>✓ S</p> <p>(5)</p>
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10.2



10.2.1(a)	$\hat{F}_1 = 2x$	[ $\angle$ centre = $2\angle$ at circum/midpts $\angle = 2\text{omtreks}\angle$ ]	✓ S ✓ R (2)
10.2.1(b)	$\hat{C} = x$	[ $\angle$ s in the same seg/ $\angle$ e in dieselfde segment]	✓ S ✓ R (2)
	<b>OR/OF</b>		
	$\hat{C} = x$	[ $\angle$ centre = $2\angle$ at circum/midpts $\angle = 2\text{omtreks}\angle$ ]	✓ S ✓ R (2)
10.2.2	$\hat{D}_3 = x$	[ $\angle$ s opp equal sides/ $\angle$ e teenoor = sye]	✓ S/R
	$\hat{E}_3 = 2x$	[ext $\angle$ of $\Delta$ /buite $\angle$ van $\Delta$ ]	✓ S/R
	$\therefore \hat{F}_1 = \hat{E}_3 = 2x$		✓ S
	$\therefore$ AFED is a cyclic quadrilateral [converse $\angle$ s in the same seg]/ Is 'n koordevierhoek [omgekeerde $\angle$ e in dieselfde segm]		✓ R (4)

<p>10.2.3</p>	$\hat{A}_2 + \hat{A}_3 + \hat{D}_1 + \hat{F}_1 = 180^\circ$ [sum of $\angle$ s in $\Delta$ /som van $\angle$ e in $\Delta$ ] $\hat{A}_2 + \hat{A}_3 = D_1$ [ $\angle$ s opp = sides/ $\angle$ e teenoor = sye ] $\therefore \hat{A}_2 + \hat{A}_3 = 90^\circ - x$ $\hat{E}_1 = \hat{A}_2 + \hat{A}_3$ [ext $\angle$ of cyclic quad/buite $\angle$ v koordevh] $= 90^\circ - x$ $\hat{F}\hat{K}\hat{E} = 90^\circ$ [line from centre bisects chord]/ [lyn van midpt halveer koord] $\hat{F}_3 = x$ [sum of $\angle$ s in $\Delta$ /som van $\angle$ e in $\Delta$ ]	<p>✓ S</p> <p>✓ S</p> <p>✓ R</p> <p>✓ S</p> <p>✓ S ✓ R</p> <p>(6)</p>
<p>10.2.4</p>	$\hat{B}\hat{A}\hat{C} = \hat{D}_3$ [ $\angle$ s in the same seg/ $\angle$ e in dieselfde segm ] $AE = BE$ [sides opp equal $\angle$ s/sye teenoor = $\angle$ e ] $\frac{\text{area } \Delta AEB}{\text{area } \Delta DEC} = \frac{\frac{1}{2}(BE)(AE). \sin \hat{A}\hat{E}\hat{B}}{\frac{1}{2}(EC)(ED). \sin \hat{D}\hat{E}\hat{C}}$ $6,25 = \frac{AE^2}{ED^2}$ $\therefore \frac{AE}{ED} = 2,5$	<p>✓ S</p> <p>✓ S</p> <p>✓ substitution into area rule</p> <p>✓ simplification of RHS</p> <p>✓ answer</p> <p>(5)</p> <p>[24]</p>

**TOTAL/TOTAAL: 150**