



# basic education

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

**NATIONAL  
SENIOR CERTIFICATE  
*NASIONALE  
SENIOR SERTIFIKAAT***

**GRADE/*GRAAD* 12**

**MATHEMATICS P3/*WISKUNDE V3*  
FEBRUARY/*MARCH*/*FEBRUARIE*/*MAART* 2014**

**MEMORANDUM**

**MARKS/*PUNTE*: 100**

**This memorandum consists of 11 pages.  
*Hierdie memorandum bestaan uit 11 bladsye.***

**NOTE:**

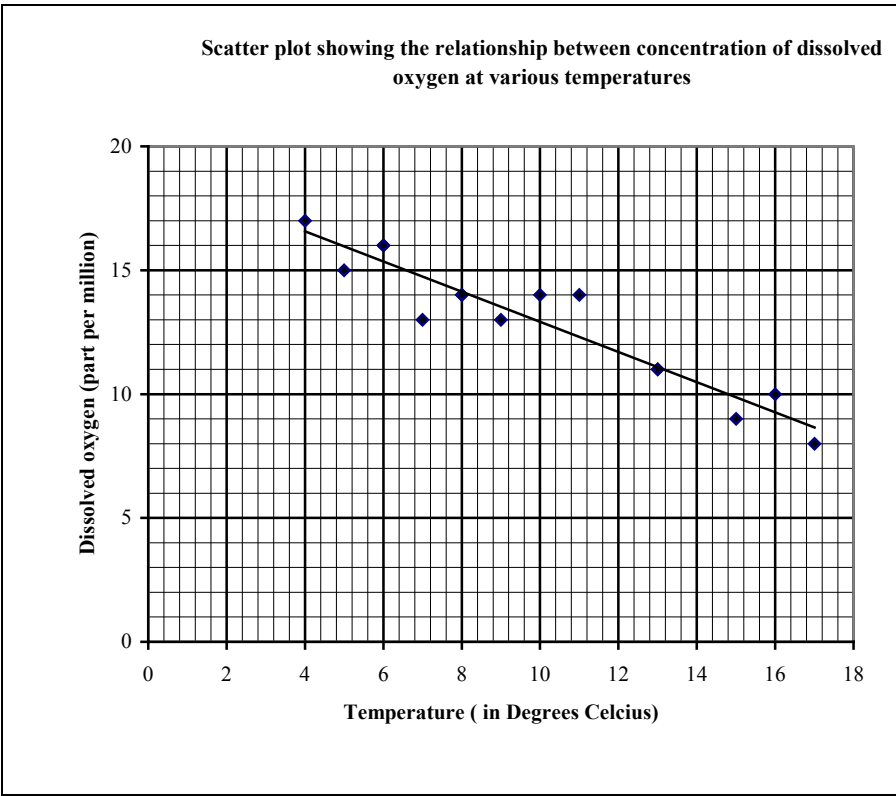
- If a candidate answers a question TWICE, only mark the first attempt.
- If a candidate has crossed out an attempt of a question and not redone the question, mark the crossed out question.
- Consistent accuracy applies in ALL aspects of the marking memorandum.

**LET WEL:**

- As 'n kandidaat 'n vraag TWEE keer beantwoord, merk net die eerste poging.
- As 'n kandidaat 'n antwoord deurhaal en nie oordoen nie, merk die deurgehaalde antwoord.
- Volgehoue akkuraatheid moet DEURGAANS in die memorandum toegepas word.

**QUESTION/VRAAG 1**

Temperature (°C) (x)	17	15	13	16	11	13	10	8	6	7	8	4	5	9	6
DO (ppm) (y)	8	9	11	10	14	11	14	14	16	13	14	17	15	13	16

<p>1.1 &amp; 1.3</p>	<p style="text-align: center;"><b>Scatter plot showing the relationship between concentration of dissolved oxygen at various temperatures</b></p> 	<p>1.1 ✓ 1 – 4 points correct ✓ 5 – 9 points correct ✓ all 12 points correct (3)</p> <p>1.3 ✓ correct gradient ✓ passing close to (8 ; 14) and (13 ; 11) (2)</p>
<p>1.2</p>	<p><math>a = 19,01</math> (19,00889878...) <math>b = -0,61</math> (-0,6090100111...) <math>y = 19,01 - 0,61x</math></p>	<p>✓✓ <math>a = 19,01</math> ✓ <math>b = -0,61</math> ✓ <math>y = 19,01 - 0,61x</math> (4)</p>

<p>1.4</p>	<p><math>\hat{y} = 19,01 - 0,61(14)</math> <math>= 10,47</math></p> <p><b>OR</b> If calculator is used <math>\hat{y} = 10,48</math> (10,48275862...)</p> <p><b>OR</b> If least squares method is used or the graph is used, <math>\hat{y} = 10,5</math></p>	<p>✓ substitute <math>x = 14</math> ✓ answer (2)</p> <p>✓✓ answer (2)</p> <p>✓✓ answer (2)</p>
<p>1.5</p>	<p><math>r = -0,94</math> (-0,9429488543...)</p>	<p>✓✓ answer (2)</p>
<p>1.6</p>	<p>There exists a very strong negative correlation between the variables. As the temperature in the lake water increases, so the concentration of dissolved oxygen decreases.</p> <p><i>Daar bestaan 'n sterk negatiewe korrelasie tussen die veranderlikes. Soos wat die temperatuur van die water in die meer verhoog, so verlaag die konsentrasie van die opgeloste suurstof.</i></p>	<p>✓ strong ✓ negative (2) <b>[15]</b></p>

**QUESTION/VRAAG 2**

<p>2.1</p>	<p><math>a = 73</math> <math>b = 42</math> <math>c = 107</math> <math>d = 68</math></p> <table border="1" data-bbox="172 1238 1026 1395"> <thead> <tr> <th></th> <th>Aged &lt; 40</th> <th>Aged ≥ 40</th> <th>Totals</th> </tr> </thead> <tbody> <tr> <td>Liked the movie</td> <td>65</td> <td>37</td> <td>102</td> </tr> <tr> <td>Did not like the movie</td> <td><math>b = 42</math></td> <td>31</td> <td><math>a = 73</math></td> </tr> <tr> <td>Totals</td> <td><math>c = 107</math></td> <td><math>d = 68</math></td> <td>175</td> </tr> </tbody> </table>		Aged < 40	Aged ≥ 40	Totals	Liked the movie	65	37	102	Did not like the movie	$b = 42$	31	$a = 73$	Totals	$c = 107$	$d = 68$	175	<p>✓ <math>a = 73</math> ✓ <math>b = 42</math> ✓ <math>c = 107</math> ✓ <math>d = 68</math> (4)</p>
	Aged < 40	Aged ≥ 40	Totals															
Liked the movie	65	37	102															
Did not like the movie	$b = 42$	31	$a = 73$															
Totals	$c = 107$	$d = 68$	175															
<p>2.2</p>	<p><math>P(\text{less than 40 and did not like the movie}) = \frac{42}{175}</math> (0,24)</p>	<p>✓ 42 ✓ 175 (2)</p>																
<p>2.3</p>	<p><math>P(\text{less than 40 and liked the movie}) = \frac{65}{175} = 0,37</math> (0,3714285714...)</p> <p><math>P(\text{Age less than 40}) = \frac{107}{175}</math></p> <p><math>P(\text{Critic liked the movie}) = \frac{102}{175}</math></p> <p><math>P(\text{Age less than 40}) \times P(\text{Critic liked the movie}) = \frac{107}{175} \times \frac{102}{175} = 0,36</math> (0,3563755102...)</p> <p>Since <math>P(\text{less than 40 and liked the movie}) \neq P(\text{Age less than 40}) \times P(\text{Critic liked the movie})</math>, we can conclude that the events are not independent/nie onafhanklik nie.</p>	<p>✓ <math>P(\text{less than 40 and liked the movie}) = \frac{65}{175}</math></p> <p>✓ <math>P(\text{Age less than 40}) = \frac{107}{175}</math></p> <p><b>OR</b></p> <p><math>P(\text{Critic liked the movie}) = \frac{102}{175}</math></p> <p>✓ <math>P(\text{Age less than 40}) \times P(\text{Critic liked the movie}) = 0,36</math></p> <p>✓ conclusion (4)</p>																

<p><b>OR</b></p> <p><math>P(\text{less than 40 and did not like the movie}) = \frac{42}{175} = 0,24</math></p> <p><math>P(\text{Age less than 40}) = \frac{107}{175}</math></p> <p><math>P(\text{Critic did not like the movie}) = \frac{73}{175}</math></p> <p><math>P(\text{Age less than 40}) \times P(\text{Critic did not like the movie})</math>  <math>= \frac{107}{175} \times \frac{73}{175} = 0,255 \quad (0,2550530612\dots)</math></p> <p>Since <math>P(\text{less than 40 and did not like the movie}) \neq P(\text{Age less than 40}) \times P(\text{Critic did not like the movie})</math>, we can conclude that the events are not independent/<i>nie onafhanklik nie</i>.</p>	<p>✓ <math>P(\text{less than 40 and did not like the movie}) = \frac{42}{175}</math></p> <p>✓ <math>P(\text{Age less than 40}) = \frac{107}{175}</math></p> <p><b>OR</b></p> <p><math>P(\text{Critic did not like the movie}) = \frac{73}{175}</math></p> <p>✓ <math>P(\text{Age less than 40}) \times P(\text{Critic liked the movie}) = 0,255</math></p> <p>✓ conclusion</p>	<p>(4)</p> <p><b>[10]</b></p>
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**QUESTION/VRAAG 3**

3.1	<p>The interval 500 to 542 hours represents 48% of the data.  <math>\Rightarrow 542</math> is at 2 standard deviations to the right of the mean.  <math>542 = 500 + 2\sigma</math>  <math>2\sigma = 42</math>  <math>\sigma = 21</math></p>	<p>✓ 2 standard deviations</p> <p>✓ 21</p> <p style="text-align: right;">(2)</p>
3.2	<p>458 is at 2 standard deviations to the left of the mean.          area between mean and 2 standard deviations = 48%  <math>521</math> is at 1 standard deviation to the right of the mean.          area between mean and 1 standard deviation = 34%  <math>\therefore</math> Total area between 458 and 521 hours = 48% + 34% = 82%</p>	<p>✓ 48%</p> <p>✓ 34%</p> <p>✓ 82%</p> <p style="text-align: right;">(3)</p>
3.3	<p>The expected minimum lifetime will occur at 3 standard deviations to the left of the mean.  <math>\therefore</math> Expected minimum lifetime = <math>500 - 3(21)\sigma = 437</math> hours</p>	<p>✓ 3 standard deviations</p> <p>✓ 437</p> <p style="text-align: right;">(2)</p> <p><b>[7]</b></p>

**QUESTION/VRAAG 4**

4.1	Different ways for 8 learners to be seated $= 8!$ $= 40\ 320$	$\checkmark 8$ $\checkmark 40\ 320$ (2)																																																
4.2	Consider the 3 learners as a single entity. These 3 learners can be seated in $3! = 6$ different ways. Now this group of 3 and the remaining 5 learners can be seated in $6! = 720$ different ways. In total there are $6 \times 720 = 4320$ different ways for the 3 learners to be seated together.  $3!6!$ $= 4\ 320$	$\checkmark 6$ $\checkmark 720$ $\checkmark 4\ 320$ (3)																																																
4.3	First let us consider the different number of ways that these 2 learners can be seated next to one another. This can be done in  $2! \times 7! = 10\ 080$ different ways.  Now these two learners may not be seated next to one another in $40\ 320 - 10\ 080$ $= 30\ 240$ different ways.  <b>OR/OF</b>  Let person A sit at the end of the row and person B not sit next to person A. This can be done in $1 \times 6 \times 6! \times 2$ different ways  <table border="1" data-bbox="172 1424 983 1541"> <tr> <td>A</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td></td><td>↑</td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td></td><td>not B</td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> </table>  Let person A not sit at the end of the row. this can be done in $1 \times 6 \times 5 \times 5! \times 6$ different ways  <table border="1" data-bbox="172 1693 983 1809"> <tr> <td></td><td>A</td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>↑</td><td></td><td>↑</td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>not B</td><td></td><td>not B</td><td></td><td></td><td></td><td></td><td></td> </tr> </table>  In total we have  $1 \times 6 \times 6! \times 2 + 1 \times 6 \times 5 \times 5! \times 6$ $= 30\ 240$ different ways	A									↑								not B								A							↑		↑						not B		not B						$\checkmark 2! \times 7!$ or $10\ 080$  $\checkmark 40\ 320 - 10\ 080$ $\checkmark$ answer (3)  $\checkmark 1 \times 6 \times 6! \times 2 = 8\ 640$  $\checkmark 1 \times 6 \times 5 \times 5! \times 6 = 21\ 600$  $\checkmark$ answer (3) <b>[8]</b>
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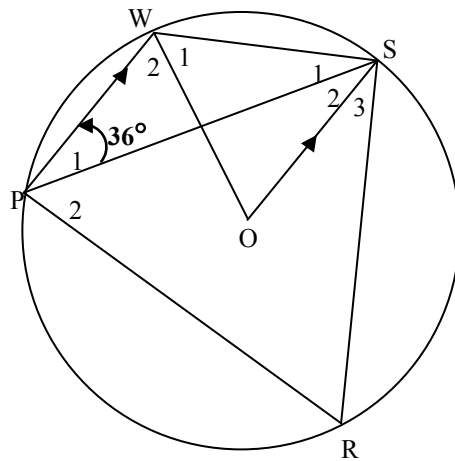
**QUESTION/VRAAG 5**

<p>5.1</p>	<p>Let A represent Alfred winning a point and B represent Barry winning a point.</p> <div style="display: flex; align-items: center;"> <div style="flex: 1;"> </div> <div style="flex: 1;"> <p><b>Outcomes</b></p> <p>(A ; A ; A)</p> <p>(A ; A ; B)</p> <p>(A ; B ; A)</p> <p>(A ; B ; B)</p> <p>(B ; A ; A)</p> <p>(B ; A ; B)</p> <p>(B ; B ; A)</p> <p>(B ; B ; B)</p> </div> </div>	<p>✓ first branch correct</p> <p>✓ second branch correct</p> <p>✓ third branch correct</p> <p>✓ probabilities at each branch</p> <p>✓ all outcomes listed (5)</p>
<p>5.2</p>	<p><math>P(\text{Barry wins three points}) = \left(\frac{1}{2}\right)\left(\frac{1}{2}\right)\left(\frac{1}{2}\right) = \frac{1}{8}</math></p>	<p>✓ <math>\left(\frac{1}{2}\right)\left(\frac{1}{2}\right)\left(\frac{1}{2}\right)</math></p> <p>✓ <math>\frac{1}{8}</math> (2)</p>
<p>5.3</p>	<p><math>P(\text{Alfred wins two points and Barry wins one point})</math>  <math>= P(A; A; B) + P(A; B; A) + P(B; A; A)</math>  <math>= \left(\frac{1}{2}\right)\left(\frac{1}{2}\right)\left(\frac{1}{2}\right) + \left(\frac{1}{2}\right)\left(\frac{1}{2}\right)\left(\frac{1}{2}\right) + \left(\frac{1}{2}\right)\left(\frac{1}{2}\right)\left(\frac{1}{2}\right)</math>  <math>= \frac{3}{8}</math></p>	<p>✓ addition of <math>\left(\frac{1}{2}\right)\left(\frac{1}{2}\right)\left(\frac{1}{2}\right)</math></p> <p>✓ <math>\frac{3}{8}</math> (2)</p>
<p>5.4</p>	<p><math>P(\text{Alfred wins 3 of the four points})</math>  <math>= P(AAAB) + P(AABA) + P(ABAA) + P(BAAA)</math>  <math>= \left(\frac{1}{2}\right)\left(\frac{1}{2}\right)\left(\frac{1}{2}\right)\left(\frac{1}{2}\right) + \left(\frac{1}{2}\right)\left(\frac{1}{2}\right)\left(\frac{1}{2}\right)\left(\frac{1}{2}\right) + \left(\frac{1}{2}\right)\left(\frac{1}{2}\right)\left(\frac{1}{2}\right)\left(\frac{1}{2}\right) + \left(\frac{1}{2}\right)\left(\frac{1}{2}\right)\left(\frac{1}{2}\right)\left(\frac{1}{2}\right)</math>  <math>= 4\left(\frac{1}{2}\right)^4</math>  <math>= \frac{1}{4}</math></p>	<p>✓✓ <math>P(AAAB) + P(AABA) + P(ABAA) + P(BAAA)</math></p> <p>✓ <math>4\left(\frac{1}{2}\right)^4</math></p> <p>✓ answer (4)</p> <p><b>[13]</b></p>

**QUESTION/VRAAG 6**

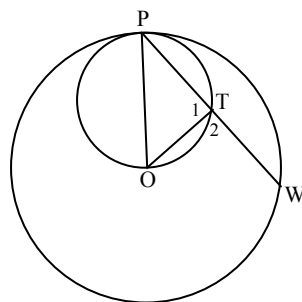
6.1	<p>By inspection</p> $T_{n+1} = T_n + T_{n-1} - 2; T_1 = 4, T_2 = 7; n \geq 1, n \in N$ $a = 1$ $b = -2$ <p><b>OR/OF</b></p> $T_{n+1} = T_n + aT_{n-1} + b$ $9 = 7 + 4a + b$ $2 = 4a + b \quad \dots (1)$ $14 = 9 + 7a + b$ $5 = 7a + b \quad \dots (2)$ $(2) - (1): \quad 3a = 3$ $a = 1$ $b = -2$	<p>✓✓✓✓ Answer only: full marks</p> <p>(4)</p> <p>✓ <math>2 = 4a + b</math></p> <p>✓ <math>5 = 7a + b</math></p> <p>✓ <math>a = 1</math></p> <p>✓ <math>b = -2</math></p> <p>(4)</p>
6.2	$T_7 = 52$	<p>✓ answer</p> <p>(1)</p> <p><b>[5]</b></p>

**QUESTION/VRAAG 7**



7.1	$\hat{S}O\hat{W} = 72^\circ$ ( $\angle$ circ cent = 2 $\angle$ circumference) ( <i>middelpunts <math>\angle</math> = 2 omtreks <math>\angle</math></i> )	✓ $\hat{S}O\hat{W} = 72^\circ$ ✓ $\angle$ circ cent = 2 $\angle$ circumference (2)
7.2	$\hat{W}_2 = 72^\circ$ (alt $\angle$ s; $PW \parallel SA$ ) / ( <i>verw <math>\angle</math>e; <math>PW \parallel SA</math></i> )	✓ $\hat{W}_2 = 72^\circ$ ✓ $PW \parallel SO$ (2)
7.3	$\hat{O}S\hat{W} = \hat{W}_1$ ( $\angle$ s opp = radii) / ( <i><math>\angle</math>e teenoor = radiusse</i> ) $2\hat{O}S\hat{W} + 72^\circ = 180^\circ$ ( $\angle$ sum $\Delta$ ) / ( <i>som van binne <math>\angle</math>e <math>\Delta</math></i> ) $2\hat{O}S\hat{W} = 108^\circ$ $\hat{O}S\hat{W} = 54^\circ$	✓ $\hat{O}S\hat{W} = \hat{W}_1$ ✓ $\angle$ s opp = radii ✓ answer (3)
7.4	$\hat{R} + \hat{W}_1 + \hat{W}_2 = 180^\circ$ (opp $\angle$ s cyclic quad) / ( <i>oorst <math>\angle</math>e koordevierhoek</i> ) $\hat{R} + 54^\circ + 72^\circ = 180^\circ$ $\hat{R} = 54^\circ$	✓ $\hat{R} + \hat{W}_1 + \hat{W}_2 = 180^\circ$ ✓ opp $\angle$ s cyclic quad ✓ answer (3) <b>[10]</b>

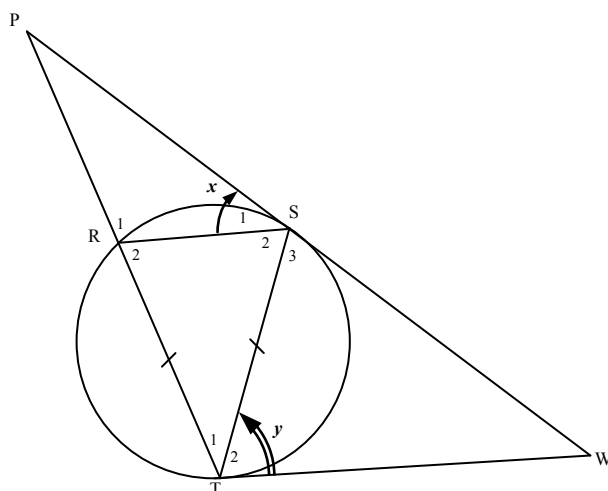
**QUESTION/VRAAG 8**



8.	$\hat{T}_1 = 90^\circ$ ( $\angle$ s in a semi-circle) / ( <i><math>\angle</math>e in 'n halwe sirkel</i> ) $PT = TW = 24$ cm (line from circ cent $\perp$ ch) ( <i>lyn van middelpunt <math>\perp</math> koord</i> ) $OP^2 = OT^2 + PT^2$ (Pythagoras) $OP^2 = (10)^2 + (24)^2$ $OP^2 = 676$ $OP = 26$ cm Radius of smaller circle = 13 cm	✓ $\hat{T}_1 = 90^\circ$ ✓ $\angle$ s in a semi-circle ✓ line from circ cent $\perp$ ch  ✓ $OP = 26$ cm ✓ answer (5)
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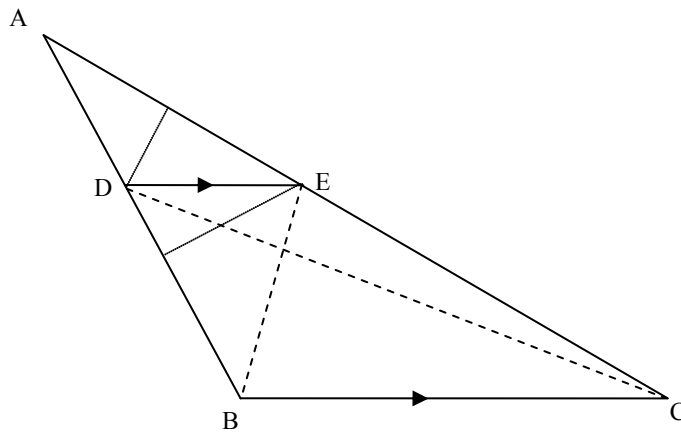


**QUESTION/VRAAG 9**

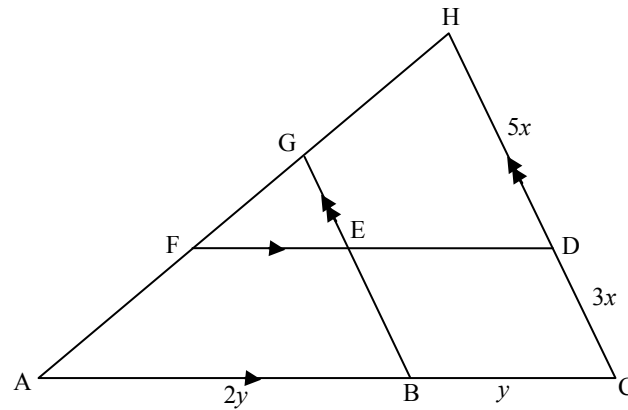


<p>9.1</p>	<p><math>\hat{R}_2 = y</math> (tan ch th) (hoek tussen raaklyn en koord)</p> <p><math>RT = ST</math> (given)</p> <p><math>\hat{S}_2 = y</math> (<math>\angle</math>s opp = sides)/(<math>\angle</math>e teenoor = sye)</p> <p><math>SW = WT</math> (tan from common point)/(<i>raaklyn vanaf selfde punt</i>)</p> <p><math>\hat{S}_3 = y</math> (<math>\angle</math>s opp = sides)/(<math>\angle</math>e teenoor = sye)</p> <p><b>OR</b></p> <p><math>SW = WT</math> (tan from common point)/(<i>raaklyn vanaf selfde punt</i>)</p> <p><math>\hat{S}_3 = y</math> (<math>\angle</math>s opp = sides)/(<math>\angle</math>e teenoor = sye)</p> <p><math>\hat{R}_2 = \hat{S}_3 = y</math> (tan ch th)/(hoek tussen raaklyn en koord)</p> <p><math>RT = ST</math> (given)</p> <p><math>\hat{S}_2 = y</math> (<math>\angle</math>s opp = sides)/(<math>\angle</math>e teenoor = sye)</p>	<p>✓ <math>\hat{R}_2 = y</math></p> <p>✓ tan ch th</p> <p>✓ <math>\hat{S}_2 = y</math></p> <p>✓ <math>\angle</math>s opp = sides</p> <p>✓ tan from common point</p> <p>✓ <math>\hat{S}_3 = y</math></p> <p>(6)</p> <p>✓ tan from common point</p> <p>✓ <math>\hat{S}_3 = y</math></p> <p>✓ <math>\hat{R}_2 = y</math></p> <p>✓ tan ch th</p> <p>✓ <math>\hat{S}_2 = y</math></p> <p>✓ <math>\angle</math>s opp = sides</p> <p>(6)</p>
<p>9.2</p>	<p>In <math>\Delta PRS</math> and <math>\Delta PST</math></p> <p>i. <math>\hat{P}</math> is common</p> <p>ii. <math>\hat{T}_1 = \hat{S}_1 = x</math> (tan ch th)/ (hoek tussen raaklyn en koord)</p> <p>iii. <math>\hat{R}_1 = \hat{PST} = x + y</math> (<math>3^{\text{rd}}</math> <math>\angle</math> of the <math>\Delta</math>)</p> <p><math>\Delta PRS \parallel \Delta PST</math> (<math>\angle\angle\angle</math>)</p>	<p>✓ <math>\hat{P}</math> is common</p> <p>✓ <math>\hat{T}_1 = \hat{S}_1 = x</math></p> <p>✓ <math>\hat{R}_1 = \hat{PST} = x + y</math> <b>OR</b> (<math>\angle\angle\angle</math>)</p> <p>(3)</p>
<p>9.3</p>	<p><math>\frac{PS}{PT} = \frac{RS}{ST}</math> (<math>\parallel \Delta</math>s)</p> <p><math>ST = RT</math> (given)</p> <p><math>\frac{PS}{PT} = \frac{RS}{RT}</math></p> <p><math>PS \times RT = RS \times PT</math></p>	<p>✓ <math>\frac{PS}{PT} = \frac{RS}{ST}</math></p> <p>✓ <math>\parallel \Delta</math>s</p> <p>✓ <math>ST = RT</math></p> <p>(3)</p> <p><b>[12]</b></p>

**QUESTION 10**



10.1	<p>Join E to B and D to C.</p> $\frac{\text{area } \triangle AED}{\text{area } \triangle DEB} = \frac{AD}{DB} \quad (\text{common altitudes})/$ <p style="text-align: center;"><i>(gemeenskaplike hoogtelyne)</i></p> $\frac{\text{area } \triangle AED}{\text{area } \triangle DEC} = \frac{AD}{EC} \quad (\text{common altitudes})$ <p>area <math>\triangle AED</math> is common</p> <p>area <math>\triangle DEB = \text{area } \triangle DEC</math> (DE <math>\parallel</math> BC; same base BC)</p> $\frac{\text{area } \triangle AED}{\text{area } \triangle DEB} = \frac{\text{area } \triangle AED}{\text{area } \triangle DEC}$ $\frac{AD}{DB} = \frac{AD}{EC}$	<p>✓ construction</p> $\checkmark \frac{\text{area } \triangle AED}{\text{area } \triangle DEB} = \frac{AD}{DB}$ <p>✓ = alts <math>\therefore</math> ratio areas = ratio bases</p> $\checkmark \frac{\text{area } \triangle AED}{\text{area } \triangle DEC} = \frac{AD}{EC}$ <p>✓ area <math>\triangle DEB = \text{area } \triangle DEC</math> and</p> <p>✓ DE <math>\parallel</math> BC; same base BC</p> $\checkmark \frac{\text{area } \triangle AED}{\text{area } \triangle DEB} = \frac{\text{area } \triangle AED}{\text{area } \triangle DEC}$ <p style="text-align: right;">(7)</p>
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10.2.1	$\frac{HF}{AH} = \frac{5}{8} \quad (\text{FD} \parallel \text{AC}; \text{Prop Th/Verhouding St})$ $HF = \frac{5}{8} AH$ $HF = \frac{5}{8} (48)$ $HF = 30 \text{ cm}$	$\checkmark \frac{HF}{AH} = \frac{5}{8}$ $\checkmark \text{FD} \parallel \text{AC}$ $\checkmark \text{answer}$ <p style="text-align: right;">(3)</p>
10.2.2	$AF = 18 \text{ cm}$ $\frac{AF + FG}{HF - FG} = \frac{2}{1} \quad (\text{BG} \parallel \text{CH}; \text{Prop Th/Verhouding St})$ $\frac{18 + FG}{30 - FG} = 2$ $18 + FG = 2(30 - FG)$ $18 + FG = 60 - 2FG$ $3FG = 42$ $FG = 14 \text{ cm}$ <p><b>OR</b></p> $\frac{GH}{AH} = \frac{BC}{AC} \quad (\text{BG} \parallel \text{CH}; \text{Prop Th/Verhouding St})$ $\frac{GH}{48} = \frac{1}{3}$ $GH = 16 \text{ cm}$ $FG = HF - GH$ $= 30 - 16$ $= 14 \text{ cm}$	$\checkmark AF = 18$ $\checkmark \frac{AF + FG}{HF - FG} = \frac{2}{1}$ $\checkmark \text{answer}$ $\checkmark \frac{GH}{AH} = \frac{BC}{AC}$ $\checkmark GH = 16 \text{ cm}$ $\checkmark \text{answer}$ <p style="text-align: right;">(3)</p>
10.2.3	$EF : ED = GF : GH \quad (\text{BG} \parallel \text{CH}; \text{Prop Th/Verhouding St})$ $EF : ED = 14 : 16$ $= 7 : 8$	$\checkmark EF : ED = GF : GH$ $\checkmark \text{answer}$ <p style="text-align: right;">(2)</p> <p style="text-align: right;"><b>[15]</b></p>

**TOTAL/TOTAAL: 100**