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**REPUBLIC OF SOUTH AFRICA**

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

**GRADE/*GRAAD* 12**

**MATHEMATICS P2/*WISKUNDE V2***

**FEBRUARY/MARCH/*FEBRUARIE/MAART* 2014**

**MEMORANDUM**

**MARKS/*PUNTE*: 150**

**This memorandum consists of 14 pages.  
*Hierdie memorandum bestaan uit 14 bladsye.***

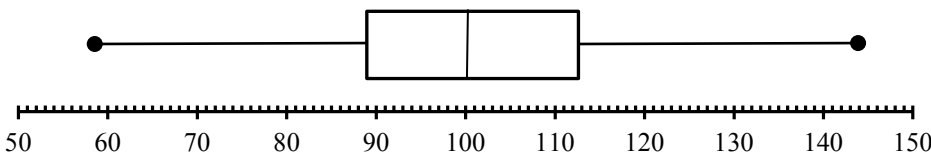
**NOTE:**

- If a candidate answered a question TWICE, mark only the first attempt.
- If a candidate crossed out an attempt of a question and did not redo the question, mark the crossed-out question.
- Consistent accuracy applies in ALL aspects of the marking memorandum.
- Assuming values/answers in order to solve a problem is unacceptable.

**LET WEL:**

- *As 'n kandidaat 'n vraag TWEE keer beantwoord het, merk slegs die eerste poging.*
- *As 'n kandidaat 'n antwoord deurgehaal en nie oorgedoen het nie, merk die deurgehaalde antwoord.*
- *Volgehoue akkuraatheid is DEURGAANS in ALLE aspekte van die memorandum van toepassing.*
- *Aanvaarding van waardes/antwoorde om 'n problem op te los, is onaanvaarbaar.*

**QUESTION/VRAAG 1**

|     |                                                                                                                                                                                                    |                                                                                                 |
|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| 1.1 | Mean/Gemiddelde = $\frac{\sum x}{n} = \frac{1522}{15} = 101,47$                                                                                                                                    | ✓ 1522<br>✓ 101,47<br>(2)                                                                       |
| 1.2 | Standard deviation/standaardafwyking = 19,07                                                                                                                                                       | ✓ 19,07<br>✓ 2 decimal places<br>(2)                                                            |
| 1.3 | lower quartile/onderste (eerste) kwartiel = 89<br>upper quartile/boonste (derde) kwartiel = 113                                                                                                    | ✓ 89<br>✓ 113<br>(2)                                                                            |
| 1.4 |                                                                                                                | ✓ M at 100<br>✓ min = 58 and max = 145<br>✓ Q <sub>1</sub> = 89 and Q <sub>2</sub> = 113<br>(3) |
| 1.5 | $(\bar{x} - 1\sigma ; \bar{x} + 1\sigma) = (82,4 ; 120,54)$<br>$\therefore$ 2 days/dae<br><div style="border: 1px solid black; padding: 5px; display: inline-block;">Answer only: full marks</div> | ✓✓ interval<br>✓ answer<br>(3)<br><b>[12]</b>                                                   |

**QUESTION/VRAAG 2**

| 2.1              | <table border="1"> <thead> <tr> <th>TIME IN MINUTES</th><th>NUMBER OF CUSTOMERS (frequency)</th><th>CUMULATIVE FREQUENCY</th></tr> </thead> <tbody> <tr> <td><math>0 &lt; x \leq 10</math></td><td>12</td><td>12</td></tr> <tr> <td><math>10 &lt; x \leq 20</math></td><td>79</td><td>91</td></tr> <tr> <td><math>20 &lt; x \leq 30</math></td><td>93</td><td>184</td></tr> <tr> <td><math>30 &lt; x \leq 40</math></td><td>48</td><td>232</td></tr> <tr> <td><math>40 &lt; x \leq 50</math></td><td>29</td><td>261</td></tr> <tr> <td><math>50 &lt; x \leq 60</math></td><td>9</td><td>270</td></tr> </tbody> </table> | TIME IN MINUTES                                                                             | NUMBER OF CUSTOMERS (frequency) | CUMULATIVE FREQUENCY | $0 < x \leq 10$ | 12 | 12 | $10 < x \leq 20$ | 79 | 91 | $20 < x \leq 30$ | 93 | 184 | $30 < x \leq 40$ | 48 | 232 | $40 < x \leq 50$ | 29 | 261 | $50 < x \leq 60$ | 9 | 270 | ✓ completing frequency column<br>✓ ✓ cumulative frequency<br>(3) |
|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|---------------------------------|----------------------|-----------------|----|----|------------------|----|----|------------------|----|-----|------------------|----|-----|------------------|----|-----|------------------|---|-----|------------------------------------------------------------------|
| TIME IN MINUTES  | NUMBER OF CUSTOMERS (frequency)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | CUMULATIVE FREQUENCY                                                                        |                                 |                      |                 |    |    |                  |    |    |                  |    |     |                  |    |     |                  |    |     |                  |   |     |                                                                  |
| $0 < x \leq 10$  | 12                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 12                                                                                          |                                 |                      |                 |    |    |                  |    |    |                  |    |     |                  |    |     |                  |    |     |                  |   |     |                                                                  |
| $10 < x \leq 20$ | 79                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 91                                                                                          |                                 |                      |                 |    |    |                  |    |    |                  |    |     |                  |    |     |                  |    |     |                  |   |     |                                                                  |
| $20 < x \leq 30$ | 93                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 184                                                                                         |                                 |                      |                 |    |    |                  |    |    |                  |    |     |                  |    |     |                  |    |     |                  |   |     |                                                                  |
| $30 < x \leq 40$ | 48                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 232                                                                                         |                                 |                      |                 |    |    |                  |    |    |                  |    |     |                  |    |     |                  |    |     |                  |   |     |                                                                  |
| $40 < x \leq 50$ | 29                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 261                                                                                         |                                 |                      |                 |    |    |                  |    |    |                  |    |     |                  |    |     |                  |    |     |                  |   |     |                                                                  |
| $50 < x \leq 60$ | 9                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 270                                                                                         |                                 |                      |                 |    |    |                  |    |    |                  |    |     |                  |    |     |                  |    |     |                  |   |     |                                                                  |
| 2.2              | <p style="text-align: center;"><b>Cumulative frequency curve of time spent shopping</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | ✓ plot against upper limit<br>✓ cumulative frequency<br>✓ anchored<br>✓ smooth curve<br>(4) |                                 |                      |                 |    |    |                  |    |    |                  |    |     |                  |    |     |                  |    |     |                  |   |     |                                                                  |
| 2.3              | Median time spent shopping is approximately 25 minutes.<br>(Allow 24–25 minutes)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | ✓ ✓ answer<br>(2)                                                                           |                                 |                      |                 |    |    |                  |    |    |                  |    |     |                  |    |     |                  |    |     |                  |   |     |                                                                  |
| 2.4              | The data is skewed to the right or positively skewed/<br><i>Die data is skeep na regs of positief skeep.</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | ✓ correct skewness<br>(1)<br><b>[10]</b>                                                    |                                 |                      |                 |    |    |                  |    |    |                  |    |     |                  |    |     |                  |    |     |                  |   |     |                                                                  |

**QUESTION/VRAAG 3**

|       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                            |
|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3.1   | (41 ; 26)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | ✓ correct outlier<br>(1)                                                                                                                                   |
| 3.2   | quadratic/kwadraties                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | ✓ correct answer<br>(1)                                                                                                                                    |
| 3.3   | <p>The younger or older the participants are, the longer they will take to complete the item. They do not have the required strength, fitness and stamina.<br/> <i>Hoe jonger of ouer die deelnemers is, hoe langer sal hulle neem om die item te voltooi. Hulle het nie die vereiste krag, fiksheid en stamina (energie) nie.</i></p> <p style="text-align: center;"><b>OR</b></p> <p>It would appear that swimmers close to 19 years completed the item in the shortest time. Swimmers of that age are normally in good physical condition and have lots of stamina.<br/> <i>Dit wil voorkom of swemmers rondom 19 jaar die item in die kortste tyd voltooi het. Swemmers van daardie ouderdom is normaalweg in goeie fisiese kondisie en het baie energie en stamina.</i></p> | <p>✓ younger/older<br/>jonger/ouer<br/>✓ lack of strength/<br/>tekort aan krag<br/>(2)</p> <p>✓ 19 years/jaar<br/>✓ peak fitness/<br/>top fiks<br/>(2)</p> |
| 3.4.1 | The standard deviation will become smaller/decrease./<br>Die standaardafwyking sal kleiner word/verminder.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | ✓ decrease/<br>verminder<br>(1)                                                                                                                            |
| 3.4.2 | The mean will become smaller/decrease./<br>Die gemiddelde sal kleiner word/verminder.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | ✓ decrease/<br>verminder<br>(1)                                                                                                                            |
|       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>[6]</b>                                                                                                                                                 |

**QUESTION/VRAAG 4**

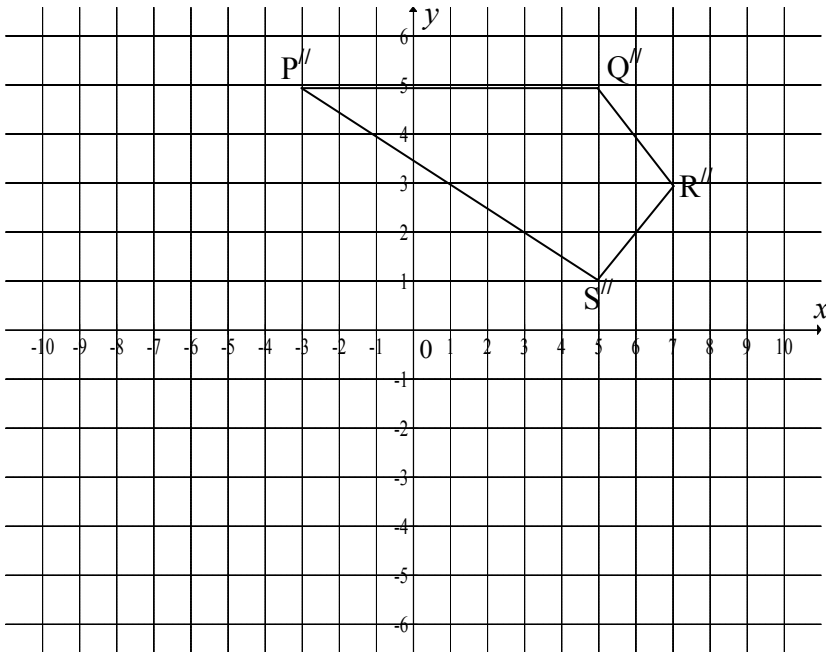
|     |                                                                                                                                                                                                                            |                                                                          |
|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|
| 4.1 | $y = -3x + k$<br>$-3 = (-3)(-1) + k$ <b>OR</b> By inspection, using the gradient: $k = -6$<br>$k = -6$                                                                                                                     | <p>✓ substitution of<br/>(-1 ; -3)<br/>✓ <math>k = -6</math><br/>(2)</p> |
| 4.2 | $\frac{x_A + x_B}{2} = x_P$ $\frac{y_A + y_B}{2} = y_P$<br>$\frac{-1 + x_B}{2} = \frac{5}{2}$ <b>and</b> $\frac{-3 + y_B}{2} = 1$ <b>OR</b> By using translation: B(6 ; 5)<br>$x_B = 6$ $y_B = 5$<br>$\therefore B(6 ; 5)$ | <p>✓ 6<br/>✓ 5<br/>(2)</p>                                               |
| 4.3 | $m_{AB} = \frac{y_2 - y_1}{x_2 - x_1}$ $m_{AB} = \frac{y_2 - y_1}{x_2 - x_1}$<br>$= \frac{5 - (-3)}{6 - (-1)}$ <b>OR</b> $= \frac{1 - (-3)}{2,5 - (-1)}$<br>$= \frac{8}{7}$ $= \frac{8}{7}$                                | <p>✓ substitution<br/>✓ gradient<br/>(2)</p>                             |

|     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                              |
|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4.4 | $\tan \beta = m_{AD} = -3$<br>$\beta = 108,43^\circ$<br>$\tan \alpha = m_{AB} = \frac{8}{7}$<br>$\alpha = 48,81^\circ$<br>$\theta = 108,43^\circ - 48,81^\circ$<br>$\theta = 59,62^\circ$<br><br><b>OR</b><br>$\tan \beta = m_{AD} = -3$<br>$\beta = 108,43^\circ$<br>$\hat{CDO} = 18,43^\circ$<br>$\tan \alpha = m_{AB} = \frac{8}{7}$<br>$\alpha = 48,81^\circ$<br>$\theta = 18,43^\circ + (90^\circ - 48,81^\circ)$<br>$\theta = 59,62^\circ$                                                               | $\checkmark \tan \beta = -3$<br>$\checkmark \beta = 108,43^\circ$<br>$\checkmark \tan \alpha = \frac{8}{7}$<br>$\checkmark \alpha = 48,81^\circ$<br><br>$\checkmark \theta = 59,62^\circ$<br>(5)<br><br>$\checkmark \tan \beta = -3$<br>$\checkmark \beta = 108,43^\circ$<br><br>$\checkmark \tan \alpha = \frac{8}{7}$<br>$\checkmark \alpha = 48,81^\circ$<br><br>$\checkmark \theta = 59,62^\circ$<br>(5) |
| 4.5 | $AD = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$<br>$= \sqrt{(0+1)^2 + (-6+3)^2}$<br>$= \sqrt{10}$                                                                                                                                                                                                                                                                                                                                                                                                                  | $\checkmark$ substitution into distance formula<br>$\checkmark \sqrt{10}$<br>(2)                                                                                                                                                                                                                                                                                                                             |
| 4.6 | $AC = 2 AD$<br>$= 2\sqrt{10}$<br>$CB^2 = AC^2 + AB^2 - 2AC \cdot AB \cdot \cos \theta$<br>$= (2\sqrt{10})^2 + (\sqrt{113})^2 - 2(2\sqrt{10})(\sqrt{113}) \cos 59,62^\circ$<br>$= 84,998...$<br>$CB = 9,22$ units.<br><br><b>OR</b><br>$D(0 ; -6), A(-1 ; -3), AC = 2AD$<br>So $x_C - x_A = 2(x_A - x_D)$ $x_C + 1 = 2(-1 - 0), x_C = -3$<br>$y_C - y_A = 2(y_A - y_D)$ $y_C + 3 = 2(-3 + 6), y_C = 3$<br><br>The coordinates of C are $(-3 ; 3)$ .<br>$CB = \sqrt{(6 - (-3))^2 + (5 - 3)^2}$<br>$= 9,22$ units | $\checkmark AC = 2\sqrt{10}$<br>$\checkmark$ using cosine rule<br>$\checkmark$ substitution<br>$\checkmark 84,998...$<br>$\checkmark 9,22$<br>(5)<br><br>$\checkmark \checkmark \checkmark C(-3 ; 3)$<br>$\checkmark$ substitution into distance formula<br>$\checkmark 9,22$<br>(5)<br><b>[18]</b>                                                                                                          |

**QUESTION/VRAAG 5**

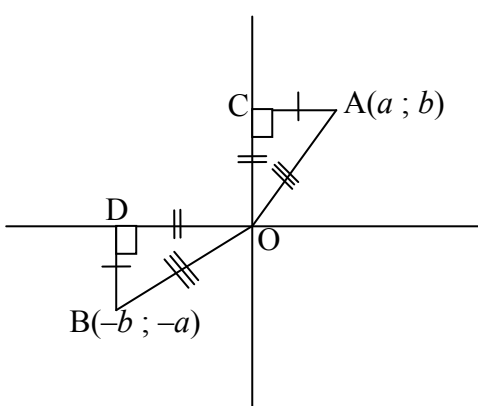
|     |                                                                                                                                                                                                                                                                                    |                                                                                                                                         |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| 5.1 | M(8 ; -4)                                                                                                                                                                                                                                                                          | ✓ coordinates<br>(1)                                                                                                                    |
| 5.2 | $OM = \sqrt{(8-0)^2 + (-4-0)^2}$<br>$= \sqrt{80} \text{ or } 4\sqrt{5} \text{ units}$                                                                                                                                                                                              | ✓ substitution into distance formula<br>✓ $\sqrt{80} \text{ or } 4\sqrt{5}$<br>(2)                                                      |
| 5.3 | $ON = OM - NM$<br>$= \sqrt{80} - \sqrt{45}$<br>$= 4\sqrt{5} - 3\sqrt{5}$<br>$= \sqrt{5} \text{ units}$                                                                                                                                                                             | ✓ $ON = OM - NM$<br>✓ length of NM<br>✓ answer<br>(3)                                                                                   |
| 5.4 | $\hat{MTP} = 90^\circ$ (tangent/raaklyn $\perp$ radius)<br>$\therefore \hat{OMT} = 90^\circ$ (alternate $\angle$ 's /verwissellende $\angle$ 'e ; TP $\parallel$ OM)                                                                                                               | ✓ Statement + reason<br>✓ answer<br>(2)                                                                                                 |
| 5.5 | $m_{MT} \cdot m_{OM} = -1$<br>$m_{OM} = \frac{-4-0}{8-0} = -\frac{1}{2}$<br><b>OR</b><br>$m_{MT} = 2$<br>$y + 4 = 2(x - 8)$<br>$y = 2x - 20$<br>$y = 2x + c$<br>$-4 = 2(8) + c$<br>$c = -20$<br>$y = 2x - 20$                                                                      | ✓ ✓ $m_{OM}$<br>✓ $m_{MT}$<br>✓ substitution of $m$ and (8 ; -4)<br>✓ equation MT<br>(5)                                                |
| 5.6 | $(x-8)^2 + (y+4)^2 = 45$<br>$(x-8)^2 + (2x-20+4)^2 = 45$<br>$(x-8)^2 + (2x-16)^2 = 45$<br>$x^2 - 16x + 64 + 4x^2 - 64x + 256 - 45 = 0$<br>$5x^2 - 80x + 275 = 0$<br>$x^2 - 16x + 55 = 0$<br>$(x-11)(x-5) = 0$<br>$x = 11$<br>$y = 2(11) - 20$<br>$y = 2$<br>$\therefore T(11 ; 2)$ | ✓ substitution<br><br>✓ expansion<br>✓ standard form<br><br>✓ factors<br><br>✓ $x = 11$<br><br>✓ substitution<br><br>(6)<br><b>[19]</b> |

**QUESTION/VRAAG 6**

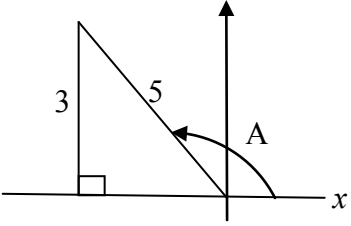
|          |                                                                                                                                                                                                                                                                                                  |                                                                                                      |
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| 6.1.1    | Rotation by $90^\circ$ anti-clockwise about the origin/<br><i>Rotasie van <math>90^\circ</math> antikloksgewys om die oorsprong.</i>                                                                                                                                                             | ✓ rotation/rotasie<br>✓ $90^\circ$ anti-clockwise/<br>antikloksgewys<br>(2)                          |
| 6.1.2    | $(x; y) \rightarrow (y; x)$                                                                                                                                                                                                                                                                      | ✓ $y$<br>✓ $x$<br>(2)                                                                                |
| 6.1.3    | $P'(-3; -5)$                                                                                                                                                                                                                                                                                     | ✓ $x$ value<br>✓ $y$ value<br>(2)                                                                    |
| 6.2.1    | $Q'(-2; 4)$                                                                                                                                                                                                                                                                                      | ✓ $x$ value and<br>$y$ value<br>(1)                                                                  |
| 6.2.2(a) | $(x; y) \rightarrow (2x; 2y) \rightarrow (-2x; 2y) \rightarrow (-2x + 3; 2y + 1)$                                                                                                                                                                                                                | ✓ $(2x; 2y)$<br>✓ $(-2x; 2y)$<br>✓ $(-2x + 3; 2y + 1)$<br>(3)                                        |
| 6.2.2(b) |  <p> <math>P'(6; 4) \rightarrow P''(-3; 5)</math><br/> <math>Q'(-2; 4) \rightarrow Q''(5; 5)</math><br/> <math>R'(-4; 2) \rightarrow R''(7; 3)</math><br/> <math>S'(-2; 0) \rightarrow S''(5; 1)</math> </p> | ✓ $P''(-3; 5)$<br>✓ $Q''(5; 5)$<br>✓ $R''(7; 3)$<br>✓ $S''(5; 1)$<br>✓ joining the points<br><br>(5) |

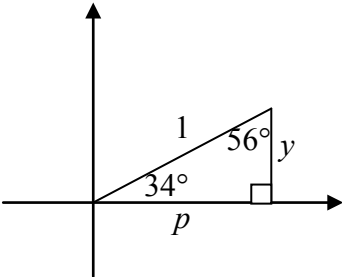
|       |                                                                                                                                                                                                                           |                                                                                                   |
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| 6.2.3 | <p>Perimeter/Omtrek PQRS = <math>t \times</math> Perimeter/Omtrek <math>P''Q''R''S''</math><br/> Perimeter/Omtrek PQRS = <math>t \times 2</math> Perimeter/Omtrek PQRS</p> <p><math>\therefore t = \frac{1}{2}</math></p> | <p>✓ 2 Perimeter PQRS/ 2 omtrek PQRS</p> <p>✓ <math>\frac{1}{2}</math></p> <p>(2)</p> <p>[17]</p> |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|

**QUESTION/VRAAG 7**

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>A regular octagon has 8 equal sides. Therefore each side subtends an angle of <math>45^\circ</math> at the centre of the octagon./'n Reëlmatige oktagoon het 8 gelyke sye. Dus elke sy onderspan 'n hoek van <math>45^\circ</math> by die middelpunt van die oktagoon.</p> <p>Angle of rotation is/Hoek van rotasie is:</p> <p><math>\hat{AOB} = 135^\circ</math></p> <p><math>x' = x \cos \theta - y \sin \theta</math><br/> <math>= 8,42 \cos 135^\circ - 20,33 \sin 135^\circ</math><br/> <math>= -20,33</math></p> <p><math>y' = y \cos \theta + x \sin \theta</math><br/> <math>= 20,33 \cos 135^\circ + 8,42 \sin 135^\circ</math><br/> <math>= -8,42</math></p> <p>B (– 20,33 ; – 8,42)</p> <p style="text-align: center;"><b>OR</b></p> <p>Draw a sketch:</p>  <p><math>\triangle AOC \equiv \triangle BOD</math> (S ; <math>\angle</math> ; S or S ; S ; S)</p> <p><math>\therefore B(-b ; -a)</math><br/> <math>\therefore B(-20,33 ; -8,42)</math></p> | <p>✓ <math>\frac{360^\circ}{8} = 45^\circ</math></p> <p>✓ rotation of <math>135^\circ</math>/rotasie van <math>135^\circ</math></p> <p>✓ substitution into correct formula</p> <p>✓ – 20,33</p> <p>✓ substitution into correct formula</p> <p>✓ – 8,42</p> <p>[6]</p> <p>✓ ✓ ✓</p> <p>Sketch drawn showing the equal parts <b>OR</b> proving the <math>\Delta</math>'s <math>\equiv</math></p> <p>✓ B(– b ; – a)</p> <p>✓ – 20,33</p> <p>✓ – 8,42</p> <p>[6]</p> |
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**QUESTION/VRAAG 8**

|       |                                                                                                                                                                                                                                                          |                                                                             |
|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| 8.1.1 | $\sin A = \frac{3}{5}$ (given)<br>$\sin(-A)$<br>$= -\sin A$<br>$= -\frac{3}{5}$                                                                                                                                                                          | ✓ sin A<br>✓ value<br>(2)                                                   |
| 8.1.2 | $\sin^2 A + \cos^2 A = 1$<br>$\cos^2 A = 1 - \frac{9}{25} = \frac{16}{25}$<br>$\cos A = -\frac{4}{5}$<br>$\tan A = \frac{\sin A}{\cos A}$<br>$= \frac{3}{5} \times -\frac{5}{4}$<br>$= -\frac{3}{4}$<br><b>OR</b><br>$x = -4$<br>$\tan A = -\frac{3}{4}$ | ✓ $\cos^2 A = \frac{16}{25}$<br>✓ $\cos A = -\frac{4}{5}$<br>✓ ratio<br>(3) |
|       |                                                                                                                                                                      | ✓ sketch in correct quadrant<br>✓ $x = -4$<br>✓ ratio<br>(3)                |
| 8.2.1 | $\cos 214^\circ$<br>$= \cos (180^\circ + 34^\circ)$<br>$= -\cos 34^\circ$<br>$= -p$                                                                                                                                                                      | ✓ $-\cos 34^\circ$<br>✓ $-p$<br>(2)                                         |
| 8.2.2 | $\cos 68^\circ$<br>$= \cos [2(34^\circ)]$<br>$= 2\cos^2 34^\circ - 1$<br>$= 2p^2 - 1$                                                                                                                                                                    | ✓ $\cos [2(34^\circ)]$<br>✓ $2p^2 - 1$<br>(2)                               |

|       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 8.2.3 | $\begin{aligned}\tan 56^\circ &= \frac{\sin 56^\circ}{\cos 56^\circ} \\ &= \frac{\cos 34^\circ}{\sin 34^\circ} \\ &= \frac{\cos 34^\circ}{\sqrt{1 - \cos^2 34^\circ}} \\ &= \frac{p}{\sqrt{1 - p^2}}\end{aligned}$ <p style="text-align: center;"><b>OR</b></p> $\begin{aligned}y^2 &= 1 - p^2 \\ y &= \sqrt{1 - p^2} \\ \therefore \tan 56^\circ &= \frac{p}{\sqrt{1 - p^2}}\end{aligned}$                                                                                                                                                                                                                                                                                                                                                                                | <ul style="list-style-type: none"> <li>✓ identity</li> <li>✓ co-functions</li> <li>✓ <math>\sqrt{1 - \cos^2 34^\circ}</math></li> <li>✓ answer (4)</li> </ul><br><ul style="list-style-type: none"> <li>✓ sketch with <math>34^\circ</math></li> <li>✓ <math>y = \sqrt{1 - p^2}</math></li> <li>✓ <math>90^\circ - 34^\circ = 56^\circ</math></li> <li>✓ answer (4)</li> </ul>                                                                                                                                                |
| 8.3   | $\begin{aligned}\cos 350^\circ \sin 40^\circ - \cos 440^\circ \cos 40^\circ \\ &= \cos 10^\circ \sin 40^\circ - \cos 80^\circ \cos 40^\circ \\ &= \cos 10^\circ \sin 40^\circ - \sin 10^\circ \cos 40^\circ \\ &= \sin 40^\circ \cos 10^\circ - \cos 40^\circ \sin 10^\circ \\ &= \sin(40^\circ - 10^\circ) \\ &= \sin 30^\circ \\ &= \frac{1}{2}\end{aligned}$ <p style="text-align: center;"><b>OR</b></p> $\begin{aligned}\cos 350^\circ \sin 40^\circ - \cos 440^\circ \cos 40^\circ \\ &= \cos 10^\circ \sin 40^\circ - \cos 80^\circ \cos 40^\circ \\ &= \cos 10^\circ \cos 50^\circ - \sin 10^\circ \sin 50^\circ \\ &= \cos(10^\circ + 50^\circ) \\ &= \cos 60^\circ \\ &= \frac{1}{2}\end{aligned}$ <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p><b>NOTE:</b> There are many solutions.</p> </div> | <ul style="list-style-type: none"> <li>✓ <math>\cos 10^\circ</math></li> <li>✓ <math>\cos 80^\circ</math></li> <li>✓ <math>\sin 10^\circ</math></li> <li>✓ <math>\sin 30^\circ</math></li> <li>✓ answer (5)</li> </ul><br><ul style="list-style-type: none"> <li>✓ <math>\cos 10^\circ</math></li> <li>✓ <math>\cos 80^\circ</math></li> <li>✓ <math>\cos 50^\circ</math> and <math>\sin 50^\circ</math></li> <li>✓ <math>\cos 60^\circ</math></li> <li>✓ answer (5)</li> </ul> <p style="text-align: right;"><b>[18]</b></p> |

**QUESTION/VRAAG 9**

|     |                                                                                                                                                                                                                                                                                                                  |                                                                                            |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|
| 9.1 | $\cos(x - 45^\circ) = -2 \sin x$ $\cos x \cos 45^\circ + \sin x \sin 45^\circ = -2 \sin x$ $\frac{\sqrt{2}}{2} \cos x + \frac{\sqrt{2}}{2} \sin x = -2 \sin x$ $\sqrt{2} \cos x = (-4 - \sqrt{2}) \sin x$ $\sqrt{2} = \frac{(-4 - \sqrt{2}) \sin x}{\cos x}$ $\tan x = \frac{\sqrt{2}}{-4 - \sqrt{2}} = -0,2612$ | ✓ expansion<br>✓ $\frac{\sqrt{2}}{2}$<br>✓ simplification<br>✓ dividing by $\cos x$<br>(4) |
| 9.2 | $\tan x = -0,2612\dots$<br>$x = 165,36^\circ + 180^\circ k; k \in \mathbb{Z}$<br>$x = -14,64^\circ \text{ or } 165,36^\circ$                                                                                                                                                                                     | ✓ general solution<br>✓ ✓ values of $x$<br>(3)                                             |
| 9.3 | T (135° ; 0)                                                                                                                                                                                                                                                                                                     | ✓ $x$ value<br>✓ $y$ value<br>(2)                                                          |
| 9.4 | $f(x) \geq g(x)$<br>$-14,64^\circ \leq x \leq 165,36^\circ \quad \text{OR} \quad x \in [-14,64^\circ ; 165,36^\circ]$                                                                                                                                                                                            | ✓ extreme values<br>✓ notation<br>(2)                                                      |
| 9.5 | $-135^\circ < x < -90^\circ \quad \text{OR} \quad x \in (-135^\circ ; -90^\circ)$                                                                                                                                                                                                                                | ✓ ✓ extreme values<br>✓ notation<br>(3)                                                    |
| 9.6 | $h(x) = \cos(x - 45^\circ - 45^\circ)$<br>$= \cos(x - 90^\circ)$<br>$= \sin x$ <div style="border: 1px solid black; padding: 5px; display: inline-block; margin-top: 10px;">Answer only: full marks</div>                                                                                                        | ✓ $\cos(x - 90^\circ)$<br>✓ $\sin x$<br>(2)<br><b>[16]</b>                                 |

**QUESTION/VRAAG 10**

|      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                 |
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| 10.1 | <p>In <math>\triangle TRQ</math>:</p> $\frac{TR}{\sin \hat{RQT}} = \frac{TQ}{\sin \hat{QRT}}$ $\frac{TR}{\sin 60^\circ} = \frac{k}{\sin[180^\circ - (\theta + 60^\circ)]}$ $TR = \frac{k \sin 60^\circ}{\sin[180^\circ - (\theta + 60^\circ)]} \quad \text{or} \quad TR = \frac{k \sin 60^\circ}{\sin(120^\circ - \theta)}$                                                                                                                                                                                               | <p>✓ using sine rule</p> <p>✓ correct substitution</p> <p>✓ rewrite TR as subject</p> <p>(3)</p>                                                                                                                                                                                                                                |
| 10.2 | <p>In <math>\triangle TRS</math>:</p> $\frac{RS}{TR} = \sin \hat{RTS}$ $RS = TR \cdot \sin 60^\circ$ $= \frac{k \sin 60^\circ}{\sin[180^\circ - (\theta + 60^\circ)]} \cdot \sin 60^\circ$ $= \frac{k \sin 60^\circ}{\sin(120^\circ - \theta)} \cdot \sin 60^\circ$ $= \frac{k \left(\frac{\sqrt{3}}{2}\right)^2}{\sin 120^\circ \cos \theta - \cos 120^\circ \sin \theta}$ $= \frac{3k}{4 \left( \frac{\sqrt{3}}{2} \cos \theta + \frac{1}{2} \sin \theta \right)}$ $= \frac{3k}{2(\sqrt{3} \cos \theta + \sin \theta)}$ | <p>✓ using sine ratio</p> <p>✓ substitution of TR</p> <p>✓ simplification</p> <p>✓ <math>k\left(\frac{\sqrt{3}}{2}\right)^2</math> or <math>\frac{3k}{4}</math></p> <p>✓ expansion of denominator</p> <p>✓ value of <math>\sin 120^\circ</math></p> <p>✓ value of <math>\cos 120^\circ</math></p> <p>(7)</p> <p><b>[10]</b></p> |

## QUESTION/VRAAG 11

|           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                              |
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| 11.1.1    | $f(x) = y = 3 - 2\sin^2 x$<br>$0 \leq \sin^2 x \leq 1$<br>$-2 \leq -2\sin^2 x \leq 0$<br>$1 \leq 3 - 2\sin^2 x \leq 3$<br>$1 \leq y \leq 3$ <b>OR</b> $y \in [1 ; 3]$<br><b>OR</b><br>$f(x) = y = 3 - 2\sin^2 x$<br>$= 2 + (1 - 2\sin^2 x)$<br>$= \cos 2x + 2$<br>$-1 \leq \cos 2x \leq 1$<br>$1 \leq \cos 2x + 2 \leq 3$<br>$1 \leq y \leq 3$ <b>OR</b> $y \in [1 ; 3]$<br><b>OR</b><br>$f(x) = y = 3 - 2\sin^2 x$<br>$= 3 - 2(1 - \cos^2 x)$<br>$= 1 + 2\cos^2 x$<br>$0 \leq 2\cos^2 x \leq 2$<br>$1 \leq 1 + 2\cos^2 x \leq 3$<br>$1 \leq y \leq 3$ <b>OR</b> $y \in [1 ; 3]$ | $\checkmark \checkmark$<br>$-2 \leq -2\sin^2 x \leq 0$<br>$\checkmark \checkmark$<br>$1 \leq 3 - 2\sin^2 x \leq 3$<br>(4)<br><br>$\checkmark$ rewriting<br>$\checkmark \cos 2x + 2$<br>$\checkmark -1 \leq \cos 2x \leq 1$<br>$\checkmark$<br>$1 \leq \cos 2x + 2 \leq 3$<br>(4)<br><br>$\checkmark$ rewriting<br>$\checkmark 1 + 2\cos^2 x$<br>$\checkmark 0 \leq 2\cos^2 x \leq 2$<br>$\checkmark$<br>$1 \leq 1 + 2\cos^2 x \leq 3$<br>(4) |
| 11.1.2    | $f$ has a minimum when $\sin^2 x = 1$<br>$\therefore \sin x = \pm 1$<br>$\therefore x = 90^\circ$ or $-90^\circ$<br><b>OR</b><br>$f$ has a minimum when $\cos 2x = -1$<br>$\therefore 2x = 180^\circ$ or $-180^\circ$<br>$\therefore x = 90^\circ$ or $-90^\circ$                                                                                                                                                                                                                                                                                                                | $\checkmark \sin^2 x = 1$<br>$\checkmark 90^\circ$<br>$\checkmark -90^\circ$<br>(3)<br><br>$\checkmark \cos 2x = -1$<br>$\checkmark 90^\circ$<br>$\checkmark -90^\circ$<br>(3)                                                                                                                                                                                                                                                               |
| 11.2.1    | $LHS = 1 - \cos 2Q$<br>$= 1 - (1 - 2\sin^2 Q)$<br>$= 2\sin^2 Q$<br>$= RHS$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | $\checkmark$ identity<br>(1)                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 11.2.2(a) | $LHS = \sin 2R$<br>$= \sin 2[180^\circ - (P + Q)]$<br>$= \sin[360^\circ - 2(P + Q)]$<br>$= -\sin 2(P + Q)$<br>$= -\sin(2P + 2Q)$<br>$= RHS$                                                                                                                                                                                                                                                                                                                                                                                                                                      | $\checkmark$<br>$R = 180^\circ - (P + Q)$<br>$\checkmark$<br>$360^\circ - 2(P + Q)$<br>$\checkmark -2(P + Q)$<br>(3)                                                                                                                                                                                                                                                                                                                         |

|           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                      |
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| 11.2.2(b) | $  \begin{aligned}  LHS &= \sin 2P + \sin 2Q + \sin 2R \\  &= \sin 2P + \sin 2Q - \sin(2P + 2Q) \\  &= \sin 2P + \sin 2Q - [\sin 2P \cos 2Q + \cos 2P \sin 2Q] \\  &= \sin 2P + \sin 2Q - \sin 2P \cos 2Q - \cos 2P \sin 2Q \\  &= \sin 2P(1 - \cos 2Q) + \sin 2Q(1 - \cos 2P) \\  &= \sin 2P(2 \sin^2 Q) + \sin 2Q(2 \sin^2 P) \\  &= 2 \sin P \cos P \cdot 2 \sin^2 Q + 2 \sin Q \cos Q \cdot 2 \sin^2 P \\  &= 4 \sin P \sin Q (\sin Q \cos P + \cos Q \sin P) \\  &= 4 \sin P \sin Q (\sin(Q + P)) \\  &= 4 \sin P \sin Q (\sin[180^\circ - (Q + P)]) \\  &= 4 \sin P \sin Q \sin R \\  &= RHS  \end{aligned}  $ | ✓ substitution<br>✓ expansion<br>✓ factorising<br>✓ substitution<br>✓ identities<br>✓ factorising<br>✓ $[180^\circ - (Q + P)]$<br>(7)<br><b>[18]</b> |
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**TOTAL/TOTAAL: 150**