



education

Department of
Education
FREE STATE PROVINCE



GRADE 12

MATHEMATICS P2

JUNE EXAMINATION JUNE 2022



MARKS: 150

TIME: 3 hours

This question paper consists of 11 pages

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions:

1. This question paper consists of 8 questions.
2. Answer ALL the questions in the SPECIAL ANSWER BOOK provided.
3. Clearly show ALL calculations, diagrams, graphs, et cetera, which you have used to determine the answer.
4. An approved calculator (non-programmable and non-graphical) may be used, unless stated otherwise.
5. If necessary, answers should be rounded off to TWO decimal places, unless stated otherwise.
6. An INFORMATION SHEET with formulae is included at the end of the question paper.
7. Diagrams are NOT necessarily drawn to scale.
8. Write neatly and legibly.
9. Answers only will NOT necessarily be awarded full marks.

QUESTION 1

The table below shows the distance (in kilometers) travelled daily by a sales representative for 21 working days in a certain month.

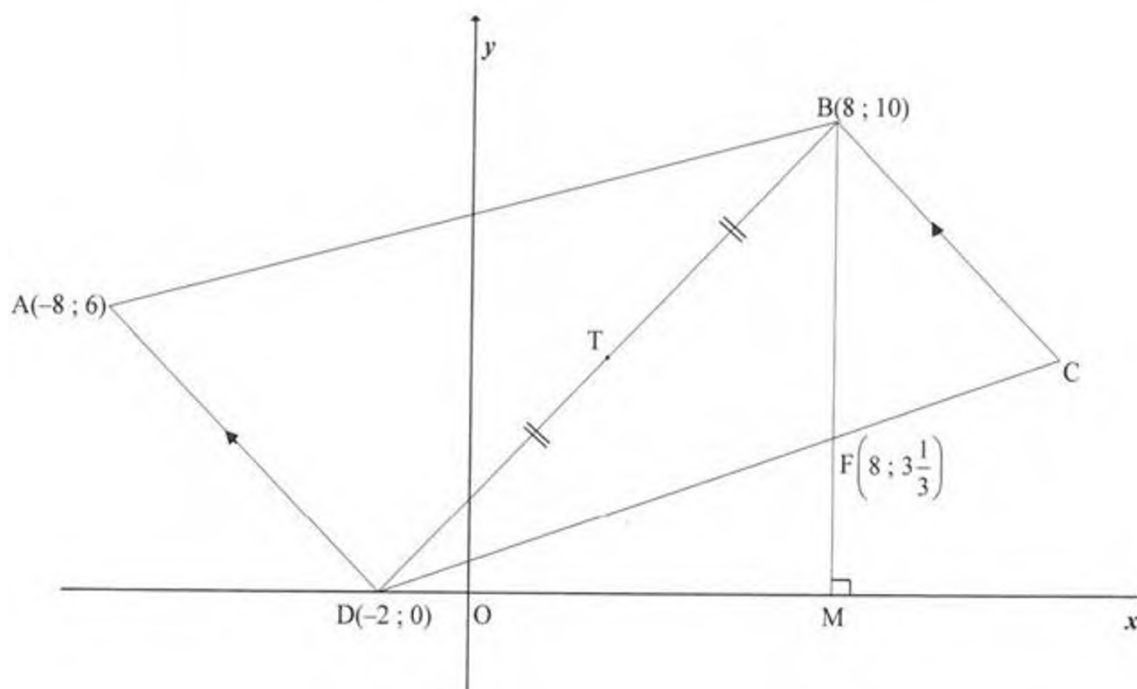
131	132	140	140	141	144	146
147	149	150	151	159	167	169
169	172	174	175	178	187	189

- 1.1 Calculate the mean distance travelled by the sales representative. (2)
- 1.2 Write down the five-number summary for the set of data. (4)
- 1.3 Use the scaled line in your ANSWER BOOK to draw a box and whisker diagram for this set of data. (2)
- 1.4 Comment on the skewness of the data. (1)
- 1.5 Calculate the standard deviation of the distance travelled. (2)
- 1.6 The sales representative discovered that his odometer was faulty. The actual reading on each of the 21 days was p km more than that which was indicated. Write down in terms of p (if applicable), the
 - 1.6.1 Actual mean (1)
 - 1.6.2 Actual deviation (1)

[13]

QUESTION 2

In the diagram below (not drawn to scale) $A(-8 ; 6)$, $B(8 ; 10)$, C and $D(-2 ; 0)$ are the vertices of a trapezium having $BC \parallel AD$. T is the midpoint of DB . From B , the straight line drawn parallel to the y -axis cuts DC at $F(8 ; 3\frac{1}{3})$ and the x -axis at M .

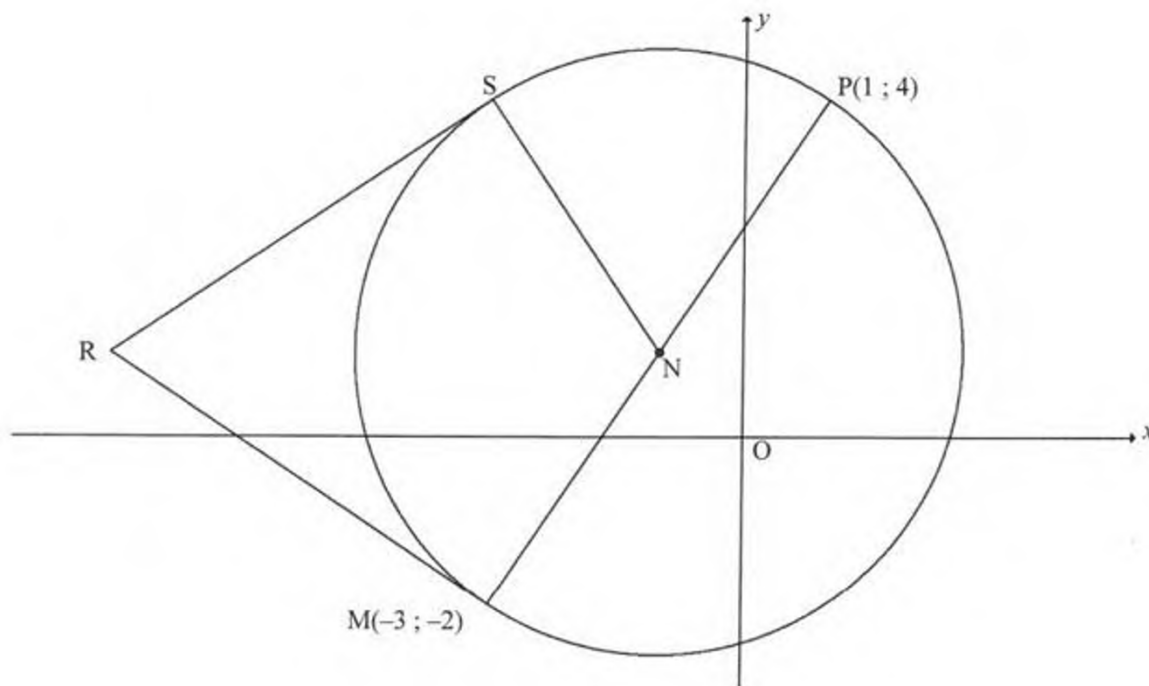


- 2.1 Calculate the gradient of AD . (2)
- 2.2 Determine the equation of BC in the form $y = mx + c$. (3)
- 2.3 Prove that $BD \perp AD$. (3)
- 2.4 Calculate the size of \widehat{BDM} . (2)
- 2.5 If it is given that $TC \parallel DM$ and points T and C are symmetrical about line BM , calculate the coordinates of C . (3)
- 2.6 Calculate the area of $\triangle BDF$. (5)

[18]

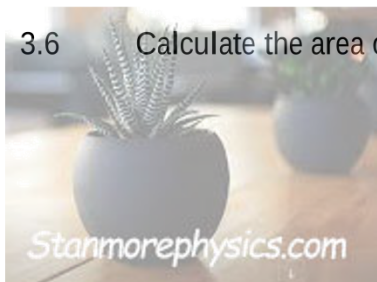
QUESTION 3

In the diagram, N is the center of the circle. M $(-3; -2)$ and P $(1; 4)$ are points on the circle. MNP is the diameter of the circle. Tangents drawn to circle from point R, outside the circle, meet the circle at S and M respectively.



- 3.1 Determine the coordinates of N. (3)
- 3.2 Determine the equation of the circle in the form $(x - a)^2 + (y - b)^2 = r^2$ (4)
- 3.3 Determine the equation of the tangent RM in the form $y = m x + c$ (5)
- 3.4 If it is given that the line joining S to M is perpendicular to the x-axis, determine the coordinates of S. (2)
- 3.5 Determine the coordinates of R, the common external point from which both tangents to the circle are drawn. (4)
- 3.6 Calculate the area of RSNM. (4)

[22]



QUESTION 4

4.1 Simplify to a single trigonometric ratio:

$$\frac{\tan(180^\circ + x) \cdot \cos(360^\circ - x)}{\sin(x - 180^\circ) \cos(90^\circ + x) + \cos(720^\circ + x) \cdot \cos(-x)} \quad (6)$$

4.2 Without using a calculator, determine the value of:

$$\frac{\sin^2 35^\circ - \cos^2 35^\circ}{4 \sin 10^\circ \cdot \cos 10^\circ} \quad (5)$$

4.3 If $\sin 35^\circ = k$, determine the following in terms of k .

4.3.1 $\cos 55^\circ$ (3)

4.3.2 $\sin 145^\circ$ (2)

4.3.3 $\sin 70^\circ$ (3)

4.3.4 $\cos 80^\circ$ (3)

4.4 Prove the identity:

$$\frac{\cos 2x + \cos^2 x + 3\sin^2 x}{2 - 2\sin^2 x} = \frac{1}{\cos^2 x} \quad (5)$$

4.5 If $\sin x - \cos x = \frac{3}{4}$, calculate the value of $\sin 2x$ WITHOUT using a calculator. (5)



[32]

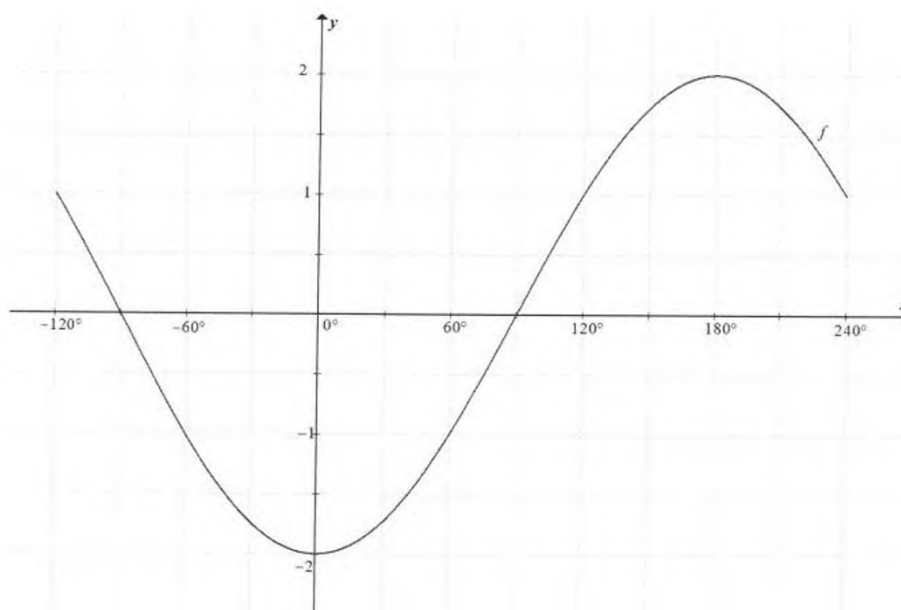
QUESTION 5

Given the equation: $\sin(x + 60^\circ) + 2 \cos x = 0$

5.1 Show that the equation can be rewritten as $\tan x = -4 - \sqrt{3}$ (4)

5.2 Determine the solutions of the equation $\sin(x + 60^\circ) + 2 \cos x = 0$ in the interval $x \in [-120^\circ; 180^\circ]$ (2)

5.3 In the diagram below, the graph of $f(x) = -2 \cos x$ is drawn for $-120^\circ \leq x \leq 240^\circ$.

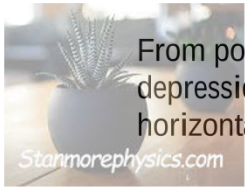


5.3.1 Draw the graph of $g(x) = \sin(x + 60^\circ)$ for $-120^\circ \leq x \leq 240^\circ$ on the grid provided in the ANSWER BOOK. (3)

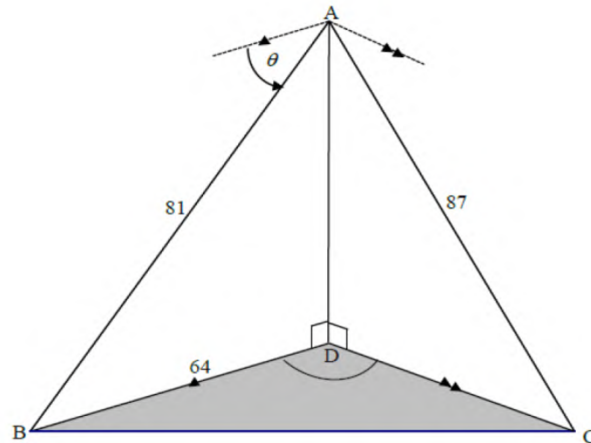
5.3.2 Determine the values of x in the interval $-120^\circ \leq x \leq 240^\circ$ for which $\sin(x + 60^\circ) + 2 \cos x > 0$. (3)

[12]

QUESTION 6



From point A an observer spots two boats, B and C, at anchor. The angle of depression of boat B from A is θ . D is a point directly below A and is on the same horizontal plane as B and C. $BD = 64\text{m}$, $AB = 81\text{m}$ and $AC = 87\text{m}$.



- 6.1 Calculate the size of θ to the nearest degree. (3)
 - 6.2 If it is given that $\widehat{BAC} = 82,6^\circ$, Calculate BC, the distance between the boats. (3)
 - 6.3 If $\widehat{BDC} = 110^\circ$, Calculate the size of \widehat{DCB} . (3)
- [9]**

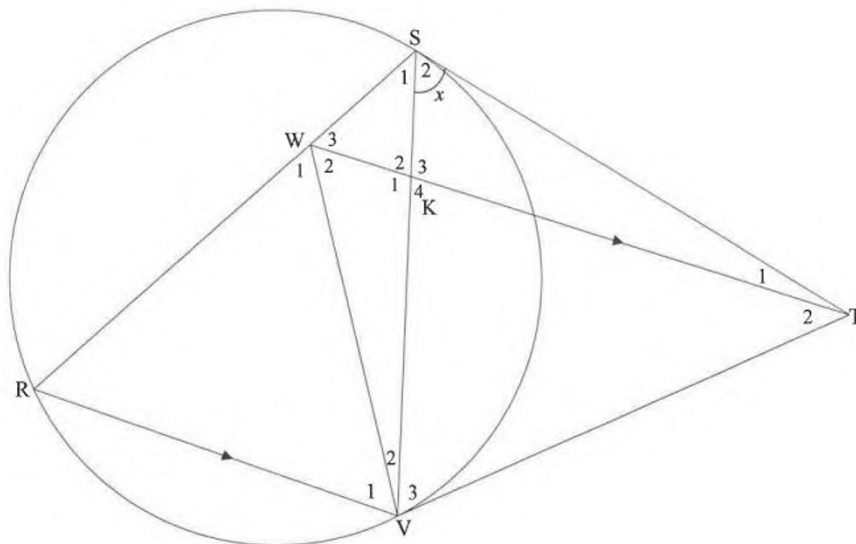
QUESTION 7

7.1 Complete the following:

7.1.1 The angle between the tangent and the chord is..... (1)

7.1.2 Equal chords subtend..... (1)

7.2 In the diagram, ST and VT are tangents to the circle at S and V respectively. R is a point on the circle and W is point on chord RS such that WT is parallel to RV. SV and WV are drawn. WT intersects SV at K. Let $\hat{S}_2 = x$ and $\widehat{WVT} = 77^\circ$



7.2.1 Write down, with reasons, THREE other angles EACH equals to x . (6)

7.2.2 WSTV is a cyclic quadrilateral. Determine with reasons \widehat{WST} . (2)

7.2.3 Prove, with reasons, that:

(a) $\triangle WRV$ is isosceles (4)

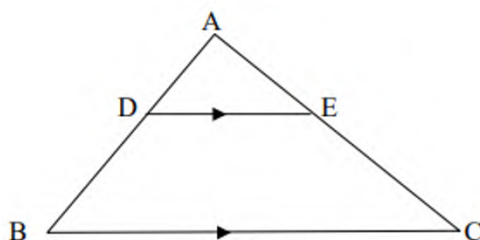
(b) $\triangle WRV \parallel \triangle TSV$ (3)

(c) $\frac{RV}{SR} = \frac{KV}{TS}$ (4)

[21]

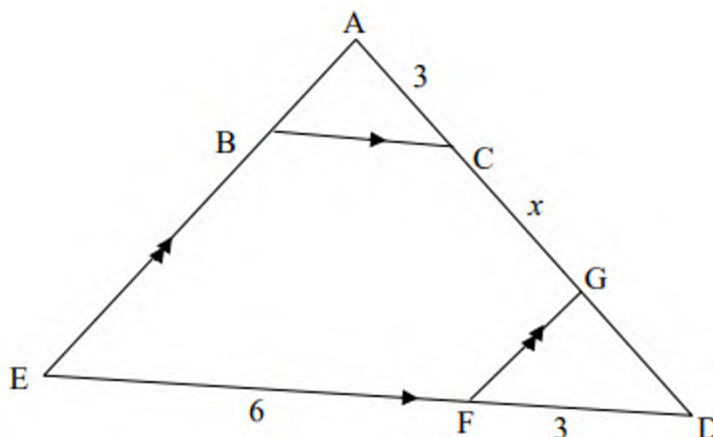
QUESTION 8

- 8.1 In the diagram, point D and E lie on side AB and AC respectively of $\triangle ABC$ such that $DE \parallel BC$. Use Euclidean Geometry methods to prove theorem which states that $\frac{AD}{DB} = \frac{AE}{EC}$.



(6)

- 8.2 In the diagram, ADE is a triangle having $BC \parallel ED$ and $AE \parallel GF$. It is also given that $AB:BE = 1:3$ and $AC = 3$ units, $EF = 6$ units, $FD = 3$ units and $CG = x$ units



Calculate, giving reasons:

- 8.2.1 The length of CD (3)
- 8.2.2 The value of x (4)
- 8.2.3 The length of BC (5)
- 8.3.4 The value of $\frac{\text{area } \triangle ABC}{\text{area } \triangle GFD}$. (5)

[23]

TOTAL 150



INFORMATION SHEET

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$A = P(1 + ni)$$

$$A = P(1 - ni)$$

$$A = P(1 - i)^n$$

$$A = P(1 + i)^n$$

$$T_n = a + (n - 1)d$$

$$S_n = \frac{n}{2} [2a + (n - 1)d]$$

$$T_n = ar^{n-1}$$

$$S_n = \frac{a(r^n - 1)}{r - 1}; r \neq 1$$

$$S_\infty = \frac{a}{1 - r}; -1 < r < 1$$

$$F = \frac{x[(1 + i)^n - 1]}{i}$$

$$P = \frac{x[1 - (1 + i)^{-n}]}{i}$$

$$f'(x) = \lim_{h \rightarrow 0} \frac{f(x + h) - f(x)}{h}$$

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$M\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$$

$$y = mx + c$$

$$y - y_1 = m(x - x_1)$$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m = \tan \theta$$

$$(x - a)^2 + (y - b)^2 = r^2$$

$$\text{In } \triangle ABC: \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\text{area } \triangle ABC = \frac{1}{2} ab \sin C$$

$$\sin(\alpha + \beta) = \sin \alpha \cos \beta + \cos \alpha \sin \beta$$

$$\sin(\alpha - \beta) = \sin \alpha \cos \beta - \cos \alpha \sin \beta$$

$$\cos(\alpha + \beta) = \cos \alpha \cos \beta - \sin \alpha \sin \beta$$

$$\cos(\alpha - \beta) = \cos \alpha \cos \beta + \sin \alpha \sin \beta$$

$$\cos 2\alpha = \begin{cases} \cos^2 \alpha - \sin^2 \alpha \\ 1 - 2\sin^2 \alpha \\ 2\cos^2 \alpha - 1 \end{cases}$$

$$\sin 2\alpha = 2\sin \alpha \cos \alpha$$

$$\bar{x} = \frac{\sum x}{n}$$

$$\sigma^2 = \frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n}$$

$$P(A) = \frac{n(A)}{n(S)}$$

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

$$\hat{y} = a + bx$$

$$b = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sum (x - \bar{x})^2}$$



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GRADE 12/GRAAD 12

MATHEMATICS P1/WISKUNDE V1

JUNE 2022

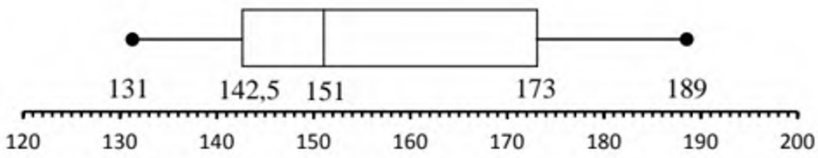
MARKING GUIDELINE/NASIENRIGLYN

MARKS: 150

PUNTE: 150

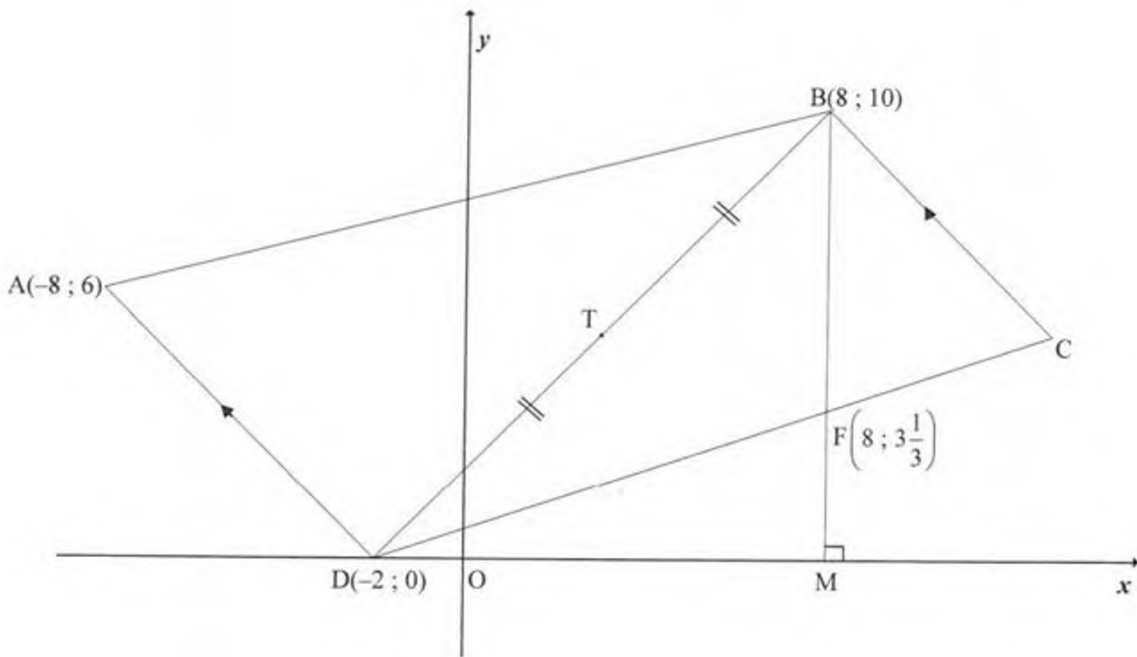
These marking guidelines consists of 15 pages.
Hierdie nasienriglyne bestaan uit 15 bladsye.


QUESTION 1

1.1	$\bar{x} = \frac{3310}{21}$ $= 157,62$ <p style="text-align: right;">Answer only : Full marks</p>	<p>✓ $\frac{3310}{21}$</p> <p>✓ answer (2)</p>
1.2	(131; 142,5; 151; 173; 189)	<p>✓ 131 and/ or 189</p> <p>✓ 142,5</p> <p>✓ 173</p> <p>✓ 151</p> <p>(4)</p>
1.3		<p>✓ box</p> <p>✓ whisker</p> <p>(2)</p>
1.4	positively skewed OR skewed to the right	<p>✓ answer (1)</p>
1.5	$\sigma = 17,27$	<p>✓✓ answer (2)</p>
1.6.1	$\bar{x} = 157,62 + p$	<p>✓ answer (1)</p>
1.6.2	$\sigma = 17,27$	<p>✓ answer (1)</p>

[13]

QUESTION 2

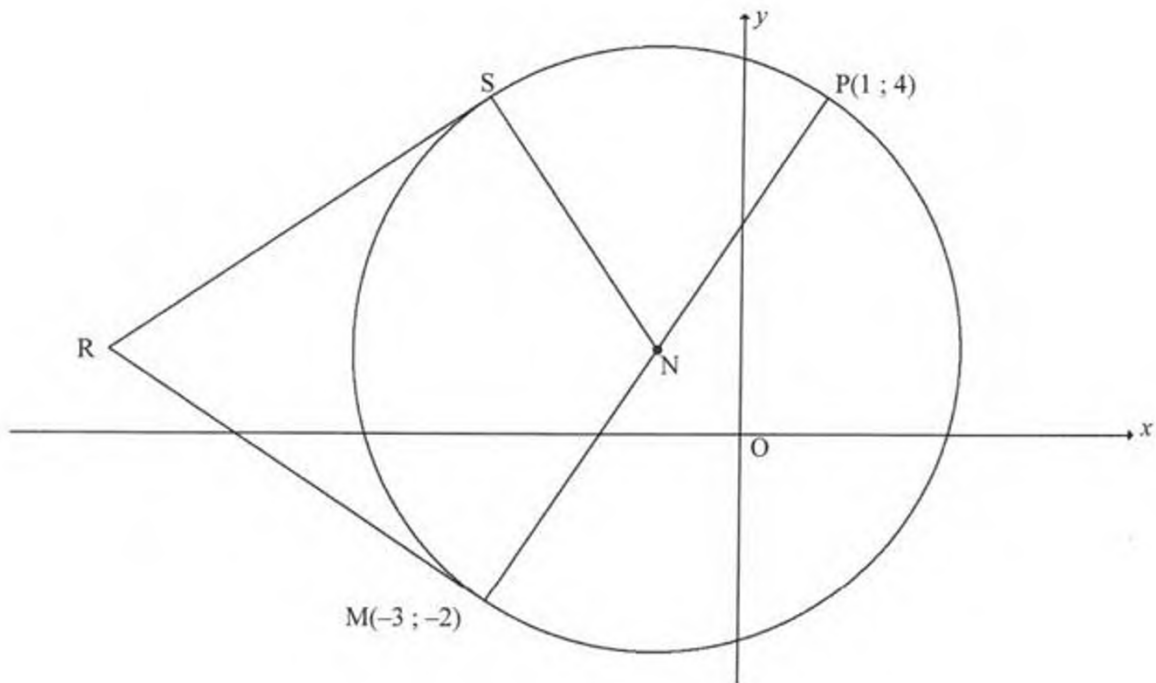


2.1	$m_{AD} = \frac{y_2 - y_1}{x_2 - x_1}$ $= \frac{0 - 6}{-2 - 8}$ $= \frac{-6}{-10}$ $= -1$ 	✓ substitution into correct formulae ✓ answer (2)
2.2	$m_{BC} = -1 \quad [BC \parallel AD]$ $y = -x + c$ $10 = -8 + c$ $c = 18$ $y_{BC} = -x + 18$ <p>OR</p> $m_{BC} = -1 \quad [BC \parallel AD]$ $y - y_1 = m(x - x_1)$ $y - 10 = -(x - 8)$ $y = -x + 18$	✓ gradient ✓ substitute m and (8 ; 10) ✓ equation (3)
		✓ gradient ✓ substitute m and (8 ; 10) ✓ equation (3)


2.3	$m_{BD} = \frac{y_2 - y_1}{x_2 - x_1}$ $= \frac{10 - 0}{8 + 2}$ $= 1$ $m_{BD} \cdot m_{AD} = 1 \times -1 = -1$ $\therefore DB \perp AD$	<p>✓ substitution</p> <p>✓ gradient</p> <p>✓</p> $m_{BD} \cdot m_{AD} = 1 \times -1 = -1$ <p>(3)</p>
2.4	$\tan \widehat{BDM} = m_{BD} = 1$ $\therefore \widehat{BDM} = 45^\circ$ <p>OR</p> $\sin \widehat{BDM} = \frac{BM}{BD} = \frac{10}{10\sqrt{2}} = \frac{1}{\sqrt{2}}$ $\therefore \widehat{BDM} = 45^\circ$ <p>OR</p> $\cos \widehat{BDM} = \frac{10}{10\sqrt{2}} = \frac{1}{\sqrt{2}}$ $\therefore \widehat{BDM} = 45^\circ$	<p>✓ $\tan \widehat{BDM} = m_{BD}$</p> <p>✓ answer</p> <p>(2)</p> <p>✓ $\sin \widehat{BDM} = \frac{1}{\sqrt{2}}$</p> <p>✓ answer</p> <p>(2)</p> <p>✓ $\cos \widehat{BDM} = \frac{1}{\sqrt{2}}$</p> <p>✓ answer</p> <p>(2)</p>
2.5	$T(x; y) = \left(\frac{x_1 + x_2}{2}; \frac{y_1 + y_2}{2} \right)$ $= \left(\frac{-2 + 8}{2}; \frac{0 + 10}{2} \right)$ $= (3; 5)$ <p>T symmetrical about BM</p> <p>∴ distance of B to BM = 5 units = distance from BM to C</p> <p>∴ C (13; 5)</p>	<p>✓ T (3; 5)</p> <p>✓ value of x</p> <p>✓ value of y</p> <p>(3)</p>
2.6	<p>Area $\triangle BDF$ = Area $\triangle BDM$ – Area $\triangle DFM$</p> $= \frac{1}{2}(10)(10) - \frac{1}{2}(10)\left(\frac{10}{3}\right)$ $= \frac{100}{3}$ $= 33,3 \text{ square units}$ <p>OR</p> <p>Area $\triangle BDF = \frac{1}{2} BF \cdot DM$</p> $= \frac{1}{2} \left(\frac{20}{3} \right) (10)$	<p>✓ formula/method</p> <p>✓ 10(DM)</p> <p>✓ 10(BM)</p> <p>✓ $\frac{10}{3}$</p> <p>✓ answer</p> <p>(5)</p> <p>✓ formula/method</p> <p>✓ $\frac{20}{3}$</p>


	$= \frac{100}{3}$ $= 33,3 \text{ square units}$	✓DM(10) ✓answer (5) [18]
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QUESTION 3



3.1	$N\left(\frac{1+(-3)}{2}; \frac{4+(-2)}{2}\right)$ $N(-1; 1) \text{ is the center of the circle}$	✓substitution of M & P ✓x- value of N ✓y- value of N (3)
3.2	$r = \sqrt{(1-1)^2 + (4-1)^2}$ $r = \sqrt{13} = \text{radius}$ $(x+1)^2 + (y-1)^2 = 13$ <p>OR</p> $r = \sqrt{(-3-1)^2 + (-2-1)^2}$ $r = \sqrt{13} = \text{radius}$ $(x+1)^2 + (y-1)^2 = 13$	✓substitution of N & P ✓ $r = \sqrt{13}$ ✓LHS of equation ✓RHS of equation (4) ✓substitution of N & M ✓ $r = \sqrt{13}$ ✓LHS of equation ✓RHS of equation (4)

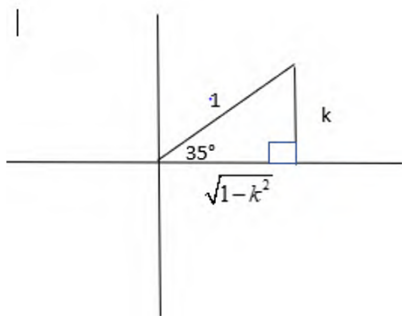
	<p>OR $(x + 1)^2 + (y - 1)^2 = r^2$ sub (1;4) $(1+1)^2 + (4-1)^2 = r^2$ $13 = r^2$ $(x + 1)^2 + (y - 1)^2 = 13$</p>	<p>✓ substitution of point ✓ $r = \sqrt{13}$ ✓ LHS of equation ✓ RHS of equation (4)</p>
3.3	<p>$m_{NM} \times m_{MR} = -1$ [radius \perp tangent]</p> <p>$m_{NM} = \frac{1-(-2)}{-1-(-3)} = \frac{3}{2}$ OR $m_{PM} = \frac{4-(-2)}{1-(-3)} = \frac{3}{2}$</p> <p>$m_{MR} = -\frac{2}{3}$ $y - y_1 = -\frac{2}{3}(x - x_1)$ OR $y = -\frac{2}{3}x + c$ $y + 2 = -\frac{2}{3}(x + 3)$ $-2 = -\frac{2}{3}(-3) + c$ $y = -\frac{2}{3}x - 4$</p>	<p>✓ correct substitution ✓ m_{NM}</p> <p>✓ m_{MR}</p> <p>✓ substitution of m_{MR} & $(-3; -2)$</p> <p>✓ equation (5)</p>
3.4	<p>Symmetry of a kite: S(-3 ; 4)</p> <p>OR $\widehat{PSM} = 90^\circ$ [\angle in semi circle] $PS \perp SM$ $\therefore S(-3 ; 4)$</p> <p>OR $(NS)^2 = (\text{radius})^2$ $(-3 + 1)^2 + (y - 1)^2 = 13$ $(y - 1)^2 = 9$ $y - 1 = \pm 3$ $y = 4$ or $y = -2$ $\therefore S(-3; 4)$</p>	<p>✓ x-value of S ✓ y-value of S (2)</p> <p>✓ x-value of S ✓ y-value of S (2)</p> <p> ✓ x-value of S ✓ y-value of S (2)</p>
3.5	<p>$(SR)^2 = (RM)^2$..tang from common pt $(x + 3)^2 + (y - 4)^2 = (x + 3)^2 + (y + 2)^2$ $y^2 - 8y + 16 = y^2 + 4y + 4$ $-12y = 12$ $y = 1$ $\frac{2}{3}x = -4 - 1$ OR $1 = -\frac{2}{3}x - 4$ $x = -\frac{15}{2}$ $x = -7\frac{1}{2}$ $\therefore R\left(-7\frac{1}{2}; 1\right)$</p>	<p>✓ equating lengths ✓ simplification</p> <p>✓ x-value of R ✓ y-value of R</p>

	<p>OR</p> <p>$R(x; 1)$ [RN is a horizontal line]</p> $\therefore 1 = -\frac{2}{3}x - 4$ $5 = -\frac{2}{3}x$ $x = -\frac{15}{2}$ $\therefore R\left(-\frac{15}{2}; 1\right)$  <p>OR</p> $m_{NS} = \frac{1 - 4}{-1 + 3} = -\frac{3}{2}$ $\therefore m_{RS} = \frac{2}{3}$ $y - 4 = \frac{2}{3}(x + 3)$ $y = \frac{2}{3}x + 6$ $-\frac{2}{3}x - 4 = \frac{2}{3}x + 6$ $x = -7\frac{1}{2}$ $y = \frac{2}{3}\left(-\frac{15}{2}\right) + 6 = 1$ $\therefore R\left(-\frac{15}{2}; 1\right)$	<p>(4)</p> <p>✓ $y_R = 1$ ✓ horizontal line OR R lies on $y = 1$ ✓ equating</p> <p>✓ x-value of R $(x < -4,6)$</p> <p>(4)</p>
3.6	<p>$RS = \sqrt{(-3 + 7,5)^2 + (4 - 1)^2} = \frac{3\sqrt{13}}{2} = 5,41$</p> <p>OR</p> <p>$RM = \sqrt{(-3 + 7,5)^2 + (-2 - 1)^2} = \frac{3\sqrt{13}}{2} = 5,41$</p> <p>Area of RSNM = 2area of ΔRSN</p> $= 2\left(\frac{1}{2}\right)\sqrt{13}\left(\frac{3\sqrt{13}}{2}\right)$ $= \frac{39}{2} \text{ or } 19,5 \text{ square units}$ <p>OR</p> <p>SM = 6</p> <p>Area of RSNM = Area of ΔSMN + Area of ΔRSM</p> $= \frac{1}{2}(6)(2) + \frac{1}{2}(6)\left(4\frac{1}{2}\right)$ $= 6 + 13,5$ $= 19,5$ <p>Area kite = $\frac{1}{2}$ RN. MS</p>	<p>✓ RS OR RM</p> <p>✓ method ✓ $\sqrt{13}$ and $\left(\frac{3\sqrt{13}}{2}\right)$ ✓ answer</p> <p>(4)</p> <p>✓ method ✓ MS = 6 ✓ RN = 6,5 ✓ answer</p> <p>(4)</p>


	$= \frac{1}{2} (6,5)(6)$ $= 19,5 \text{ square units}$	
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QUESTION 4


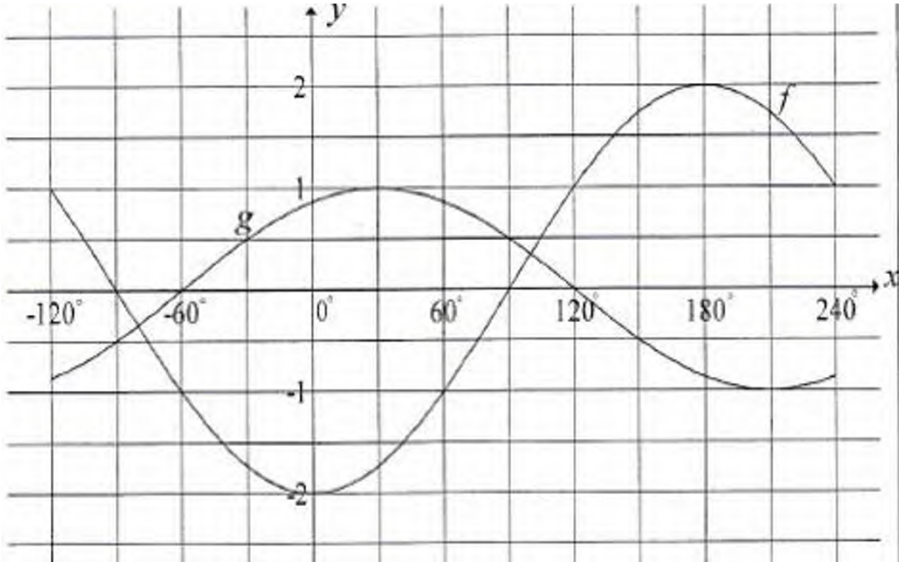
4.1	$\frac{\tan(180^\circ + x) \cdot \cos(360^\circ - x)}{\sin(x - 180^\circ) \cos(90^\circ + x) + \cos(720^\circ + x) \cdot \cos(-x)}$ $= \frac{\tan x \cos x}{-\sin x \cdot (-\sin x) + \cos x \cos x}$ $= \frac{\frac{\sin x}{\cos x} \cdot \cos x}{\sin^2 x + \cos^2 x}$ $= \sin x$	<p>✓ both $\tan x \cos x$ ✓ both $-\sin x$, and $-\sin x$ ✓ both $\cos x \cos x$</p> <p>✓ $\frac{\sin x}{\cos x}$ ✓ $\sin^2 x + \cos^2 x = 1$ ✓ answer</p> <p>(6)</p>
4.2	$= \frac{\sin^2 35^\circ - \cos^2 35^\circ}{4 \sin 10^\circ \cdot \cos 10^\circ}$ $= \frac{-(\cos^2 35^\circ - \sin^2 35^\circ)}{2(2 \sin 10^\circ \cdot \cos 10^\circ)}$ $= \frac{-\cos 70^\circ}{2 \sin 20^\circ}$ $= \frac{-\sin 20^\circ}{2 \sin 20^\circ}$ $= \frac{-1}{2}$	<p>✓ $-(\cos^2 - \sin^2 35^\circ)$</p> <p>✓ $-\cos 70^\circ$ ✓ $2 \sin 20^\circ$</p> <p>✓ cofunction</p> <p>✓ answer</p> <p>(5)</p>

4.3	 $r^2 = x^2 + y^2$ $(1)^2 = x^2 + (k)^2$ $x^2 = 1 - k^2$ $x = \pm\sqrt{1 - k^2}$ $\therefore x = \sqrt{1 - k^2}$	<p>✓ for x</p>
4.3.1	$\cos 55^\circ = \cos (90^\circ - 35^\circ)$ $= \sin 35^\circ$ $= k$ <p>OR</p> $\cos 55^\circ$ $= k$	<p>✓ $\cos (90^\circ - 35^\circ)$</p> <p>✓ answer (3)</p> <p>✓✓ answer (3)</p>

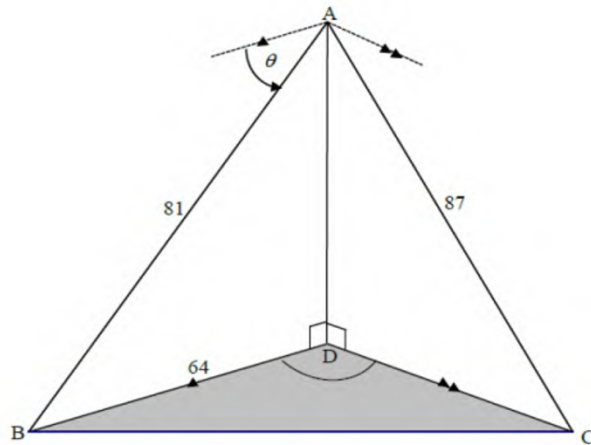
4.3.2	$\sin 145^\circ$ $= \sin (90^\circ + 55^\circ) \text{ OR } \sin (180^\circ - 35^\circ)$ $= \cos 55^\circ \qquad \qquad \qquad = \sin 35^\circ$ $= k \qquad \qquad \qquad = k$	<p>✓ $\sin (90^\circ + 55^\circ)$ or $\sin (180^\circ - 35^\circ)$</p> <p>✓ answer (2)</p>
4.3.3	$\sin 70^\circ = \sin 2(35^\circ)$ $= 2 \sin 35^\circ \cdot \cos 35^\circ$ $= 2 \cdot k \cdot \sqrt{1 - k^2}$	<p>✓ changing a double angle</p> <p>$k\sqrt{1 - k^2}$✓ (3)</p>

4.3.4	$\cos 80^{\circ} = \cos(45^{\circ} + 35^{\circ})$ $= \cos 45^{\circ} \cdot \cos 35^{\circ} - \sin 45^{\circ} \cdot \sin 35^{\circ}$ $= \frac{\sqrt{2}}{2} \cdot \sqrt{1 - k^2} - \frac{\sqrt{2}}{2} \cdot k$ $= \frac{\sqrt{2}}{2} (\sqrt{1 - k^2} - k)$ <p>OR</p> $= \frac{\sqrt{2 - 2k^2} - \sqrt{2}k}{2}$	 <p>✓ $\cos(45^{\circ} + 35^{\circ})$ ✓ expansion</p> <p>✓ answer</p> <p>(3)</p>
4.4	<p>LHS</p> $= \frac{\cos 2x + \cos^2 x + 3\sin^2 x}{2 - 2\sin^2 x}$ $= \frac{\cos^2 x - \sin^2 x + \cos^2 x + 3\sin^2 x}{2(1 - \sin^2 x)}$ $= \frac{2\cos^2 x + 2\sin^2 x}{2\cos^2 x}$ $= \frac{2(1)}{2\cos^2}$ $= \frac{1}{\cos^2}$ <p>∴ LHS = RHS</p>	<p>✓ $\cos^2 x - \sin^2 x$ ✓ $2(1 - \sin^2 x)$ ✓ $2\cos^2 x + 2\sin^2 x$ ✓ $\cos^2 x$</p> <p>✓ answer</p> <p>(5)</p>
4.5	$(\sin x - \cos x)^2 = \left(\frac{3}{4}\right)^2$ $\sin^2 x - 2\sin x \cos x + \cos^2 x = \left(\frac{9}{16}\right)$ $1 - 2\sin x \cos x = \left(\frac{9}{16}\right)$ $2\sin x \cos x = \frac{7}{16}$ $\therefore \sin 2x = \frac{7}{16}$	<p>✓ squaring both sides ✓ expanding LHS ✓ using identity ✓ simplifying ✓ answer</p> <p>(5) [32]</p>

QUESTION 5

5.1	$\sin(x + 60^\circ) + 2\cos x = 0$ $\sin x \cos 60^\circ + \cos x \sin 60^\circ + 2\cos x = 0$ $\frac{1}{2}\sin x + \frac{\sqrt{3}}{2}\cos x + 2\cos x = 0$ $\frac{1}{2}\sin x = -2\cos x - \frac{\sqrt{3}}{2}\cos x$ $\sin x = -4\cos x - \sqrt{3}\cos x$ $\sin x = \cos x(-4 - \sqrt{3})$ $\frac{\sin x}{\cos x} = \frac{\cos x(-4 - \sqrt{3})}{\cos x}$ $\tan x = -4 - \sqrt{3}$	<p>✓ expansion</p> <p>✓ special angle values</p> <p>✓ simplify</p> <p>✓ $\cos x(-4 - \sqrt{3})$ (4)</p>
5.2	$\tan x = -4 - \sqrt{3}$ $\tan x = -(4 + \sqrt{3})$ $\text{ref} \angle = 80,10^\circ$ $x = -80,1^\circ \text{ or } 99,9^\circ$ 	<p>✓ $99,90^\circ$</p> <p>✓ $-80,1^\circ$</p> <p>(2)</p>
5.3.1		<p>✓ $(30^\circ; 1)$ or $(210^\circ; -1)$</p> <p>✓ $(-60^\circ; 0)$ or $(120^\circ; 0)$</p> <p>✓ shape</p> <p>(3)</p>
5.3.2	$\therefore \sin(x + 60^\circ) > -2\cos x$ $x \in (-80,10^\circ; 99,99^\circ) \text{ OR } -80,10^\circ < x < 99,99^\circ$	<p>✓ $-80,10^\circ$</p> <p>✓ $99,99^\circ$</p> <p>✓ notation</p> <p>(3)</p>

QUESTION 6



6.1	$\widehat{ABD} = \theta$ [alternate \angle s; \parallel line] $\cos \theta = \frac{BD}{AB} = \frac{64}{81}$ $\theta = 38^\circ$ OR $\widehat{ABD} = \theta$ [alternate \angle s; \parallel line] $\sin \widehat{BAD} = \frac{64}{81}$ $\theta = 38^\circ$	$\checkmark \widehat{ABD} = \theta$ [alternate \angle s; \parallel line] \checkmark substitution into correct ratio \checkmark answer (to the nearest degree) (3)
6.2	$BC^2 = AB^2 + AC^2 - 2(AB)(AC)\cos \widehat{BAC}$ $= 81^2 + 87^2 - 2(81)(87)\cos 82,6^\circ$ $= 12314,754$ $= 110,97\text{m}$	\checkmark use cosine rule \checkmark correct substitution into cosine rule \checkmark answer (3)
6.3	$\frac{\sin \widehat{DCB}}{BD} = \frac{\sin \widehat{BDC}}{BC}$ $\sin \widehat{DCB} = \frac{64 \cdot \sin 110^\circ}{110,97^\circ}$ $\therefore \widehat{DCB} = 32,82^\circ$	\checkmark use sine rule \checkmark substitution \checkmark answer (3)

QUESTION 7

7.1.1	equal to the angle in the alternate segment./die hoek in die teenoorstaande sirkel segment	✓ answer (1)
7.1.2	equal angles at the circumference/ gelyke hoeke by die omtrek	✓ answer (1)
7.2.1	$\hat{V}_3 = x$ [tan from same point/ raaklyne vanaf dieslfde pt] $\hat{R} = x$ [tan chord theorem /raaklyn koordstelling] $\hat{W}_3 = x$ [corresp \angle s/ooreenkomstige \angle ; WT RV]	✓S ✓R ✓S ✓R ✓S ✓R (6)
7.2.2	$\widehat{WVT} = 77^\circ$ [given] $\widehat{WST} = 103^\circ$ opp \angle s of cyclic quad supplementary	✓ $\widehat{WST} = 103^\circ$ ✓R (2)
7.2.3	a) $\hat{W}_2 = \hat{S}_2 = x$ [\angle s in the same segment/ \angle e in dies segment] $\hat{V}_1 = \hat{W}_2 = x$ [alt \angle s/ verwisselende \angle e: WT RV] But $\hat{R} = x$ [proved in 7.2.1] $\therefore \hat{R} = \hat{V}_1 = x$ $\therefore WR = WV$ [sides opp equal \angle s/sye teenoor gelyke \angle e]	✓S/R ✓S/R ✓S ✓R (4)
	b) In $\triangle WRV$ and and/en $\triangle TSV$ $\hat{R} = \hat{S}_2 = x$ [proved OR tan chord theorem] $\hat{V}_1 = \hat{V}_3 = x$ [proved] $\therefore \triangle WRV \parallel \triangle TSV$ [\angle, \angle, \angle]	✓S/R ✓S ✓AAA (3)
	c) $\frac{RV}{SV} = \frac{WR}{TS}$ [$\triangle WRY \parallel \triangle TSV$] $\therefore WR \times SV = RV \times TS$ $\frac{WR}{SR} = \frac{KV}{SV}$ [prop theorem/ eweredigheidstelling: WT RV] $\therefore WR \times SV = KV \times SR$ $\therefore RV \times TS = KV \times SR$ (both equal to $WR \times SV$) $\therefore \frac{RV}{SR} = \frac{KV}{TS}$ OR In $\triangle RVS$ and /en $\triangle VKT$ $\angle SVR = \angle K_4$ [alt angles, WT RV] $\angle SRV = \angle V_3$ [proven] In $\triangle RVS \parallel \triangle VKT$ [AAA] $\therefore \frac{RV}{SR} = \frac{KT}{VT}$ But $VT = ST$ [tang from same point] $\therefore \frac{RV}{SR} = \frac{KV}{TS}$	✓S ✓S/R ✓ ✓S (4) ✓identifying correct triangles ✓proving ✓correct ratio ✓S (4)
		[21]

QUESTION 8

8.1	<div data-bbox="518 322 976 645" data-label="Image"> </div> <p>Construction: Join DC and BE and height k and h</p> $\frac{\text{area } \triangle ADE}{\text{area } \triangle DEB} = \frac{\frac{1}{2} \cdot AD \cdot k}{\frac{1}{2} \cdot DB \cdot k} = \frac{AD}{DB} \quad (\text{equal heights})$ $\frac{\text{area } \triangle ADE}{\text{area } \triangle DEC} = \frac{\frac{1}{2} \cdot AE \cdot h}{\frac{1}{2} \cdot EC \cdot h} = \frac{AE}{EC} \quad (\text{equal heights})$ <p>But the area of $\triangle DEB = \triangle DEC$ (same, base, same height)</p> $\frac{\text{area } \triangle ADE}{\text{area } \triangle DEB} = \frac{\frac{1}{2} \cdot AD \cdot k}{\frac{1}{2} \cdot DB \cdot k} = \frac{AD}{DB} \quad (\text{equal heights})$ $\therefore \frac{\text{area } \triangle ADE}{\text{area } \triangle DEB} = \frac{\text{area } \triangle ADE}{\text{area } \triangle DEC}$ $\frac{AD}{DB} = \frac{AE}{EC}$	<p>✓ Construction</p> $\checkmark \frac{\text{area } \triangle ADE}{\text{area } \triangle DEB} = \frac{AD}{DB}$ <p>✓</p> $\checkmark \frac{\text{area } \triangle ADE}{\text{area } \triangle DEC} = \frac{AE}{EC}$ <p>✓ area of $\triangle DEB = \triangle DEC$</p> <p>✓ same, base, same height</p> $\checkmark \frac{\text{area } \triangle ADE}{\text{area } \triangle DEB} = \frac{\text{area } \triangle ADE}{\text{area } \triangle DEC}$ <p>(6)</p>
8.2.1	$\frac{AB}{BE} = \frac{AC}{CD} \quad (\text{Prop Theorem, } BD \parallel ED)$ $\frac{1}{3} = \frac{3}{CD}$ $\therefore CD = 9 \text{ units}$	<p>✓ $\frac{AB}{BE} = \frac{AC}{CD}$ (S/R)</p> <p>✓ substitution</p> <p>✓ answer</p> <p>(3)</p>
8.2.2	$\frac{DG}{GA} = \frac{FD}{FE} \quad (\text{Prop Theorem, } FG \parallel EA)$ $\frac{9-x}{3+x} = \frac{3}{6}$ $54 - 6x = 9 + 3x$ $-9x = -45$ $x = 5$	<p>✓ $\frac{DG}{GA} = \frac{FD}{FE}$</p> <p>✓ substitution</p> <p>✓ simplification</p> <p>✓ answer</p> <p>(4)</p>

8.2.3	<p>In $\triangle ABC$ and $\triangle AED$:</p> <p>\hat{A} is common</p> <p>$\hat{ABC} = \hat{E}$ (corres \angles; $BC \parallel ED$)</p> <p>$\hat{ACB} = \hat{D}$ (corres \angles; $BC \parallel ED$)</p> <p>$\triangle ABC \parallel \triangle AED$ (\angle; \angle; \angle)</p> <p>$\therefore \frac{BC}{ED} = \frac{AC}{AD}$</p> <p>$\frac{BC}{9} = \frac{AC}{12}$</p> <p>$BC = 2\frac{1}{4}$ units</p>	<p>✓ \hat{A} is common</p> <p>✓ $\hat{ABC} = \hat{E}$ (S/R)</p> <p>✓ $\hat{ACB} = \hat{D}$ (S/R) or (\angle; \angle; \angle)</p> <p>✓ $\frac{BC}{ED} = \frac{AC}{AD}$</p> <p>✓ answer</p> <p>(5)</p>
8.2.4	<p>$\frac{\text{area } \triangle ABC}{\text{area } \triangle GFD} = \frac{\frac{1}{2} AC \cdot BC \cdot \sin \hat{ACB}}{\frac{1}{2} GD \cdot FD \sin \hat{D}}$</p> <p>$= \frac{\frac{1}{2} (3)(2\frac{1}{4}) \sin \hat{D}}{\frac{1}{2} (4)(3) \sin \hat{D}}$</p> <p>$= \frac{9}{16}$</p>	<p>✓ use of correct area rule $\triangle ABC$</p> <p>✓ use of correct area rule $\triangle GFD$</p> <p>✓ substitution of values</p> <p>✓ $\sin \hat{ACB} = \sin \hat{D}$</p> <p>✓ answer</p> <p>(5)</p> <p>[23]</p>

TOTAL 150

