

education

Lefapha la Thuto la Bokone Bophirima
Noordwes Departement van Onderwys
North West Department of Education
NORTH WEST PROVINCE



NATIONAL SENIOR CERTIFICATE

GRADE 12

MATHEMATICS P2

SEPTEMBER 2022

MARKS: 150

TIME: 3 hours

**This question paper consists of 14 pages, 1 information sheet
and an answer book of 20 pages.**

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of 10 questions.
2. Answer ALL the questions in the SPECIAL ANSWER BOOK provided.
3. Clearly show ALL calculations, diagrams, graphs, etc. that you have used in determining your answers.
4. Answers only will NOT necessarily be awarded full marks.
5. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
6. If necessary, round off answers to TWO decimal places, unless stated otherwise.
7. Diagrams are NOT necessarily drawn to scale.
8. An information sheet with formulae is included at the end of the question paper.
9. Write neatly and legibly.

QUESTION 1

A study was conducted among eight (8) employees in a company to understand the relationship between the additional number of rest days given in a year and the productivity of each employee.

The results are shown in the table below.

Additional number of rest days	5	2	9	1	3	10	4	6
Productivity of the employee (in %)	85	63	90	56	70	88	72	62

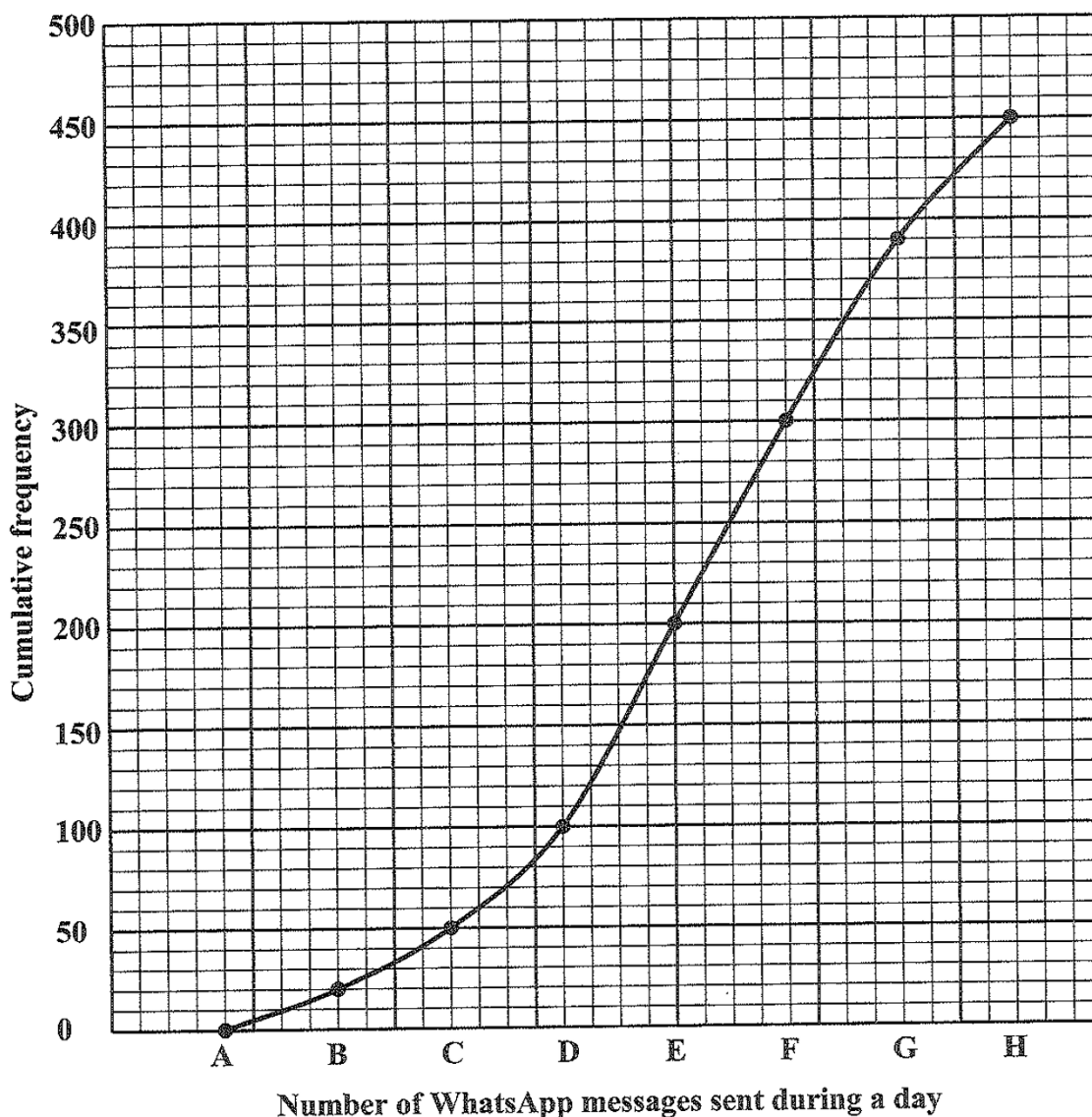
- 1.1 Calculate the correlation coefficient of the data. (1)
- 1.2 Consider the correlation coefficient calculated in QUESTION 1.1 and the four phrases below. Only write down the letter of the phrase that best describes the relationship between the variables in the given data.
- A. Fairly strong, negative correlation
- B. Very weak, positive correlation
- C. Fairly strong, positive correlation
- D. Perfect, positive correlation (1)
- 1.3 Determine the equation of the least squares regression line of the data. (3)
- 1.4 Use the equation obtained in QUESTION 1.3 to predict an employee's productivity if he/she was given eight (8) additional rest days. (2)
- 1.5 Should the regression line in QUESTION 1.3 be used to predict the productivity of an employee if he/she was given thirty (30) additional rest days in the year? Explain your answer. (2)
- [9]

QUESTION 2

A survey was conducted among a number of learners who were using the same cellphone company to establish the number of WhatsApp messages that they sent during a day. The results were summarised in the partially completed cumulative frequency graph (ogive) below.



Cumulative Frequency Graph (Ogive)

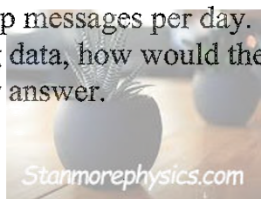


The data shown in the cumulative frequency graph is also summarised in the partially completed frequency table below.

WhatsApp messages sent	Frequency
$40 \leq x < 80$	20
$80 \leq x < 120$	30
$120 \leq x < 160$	Q
$160 \leq x < 200$	R
$200 \leq x < 240$	100
$240 \leq x < 280$	90
$280 \leq x < 320$	60

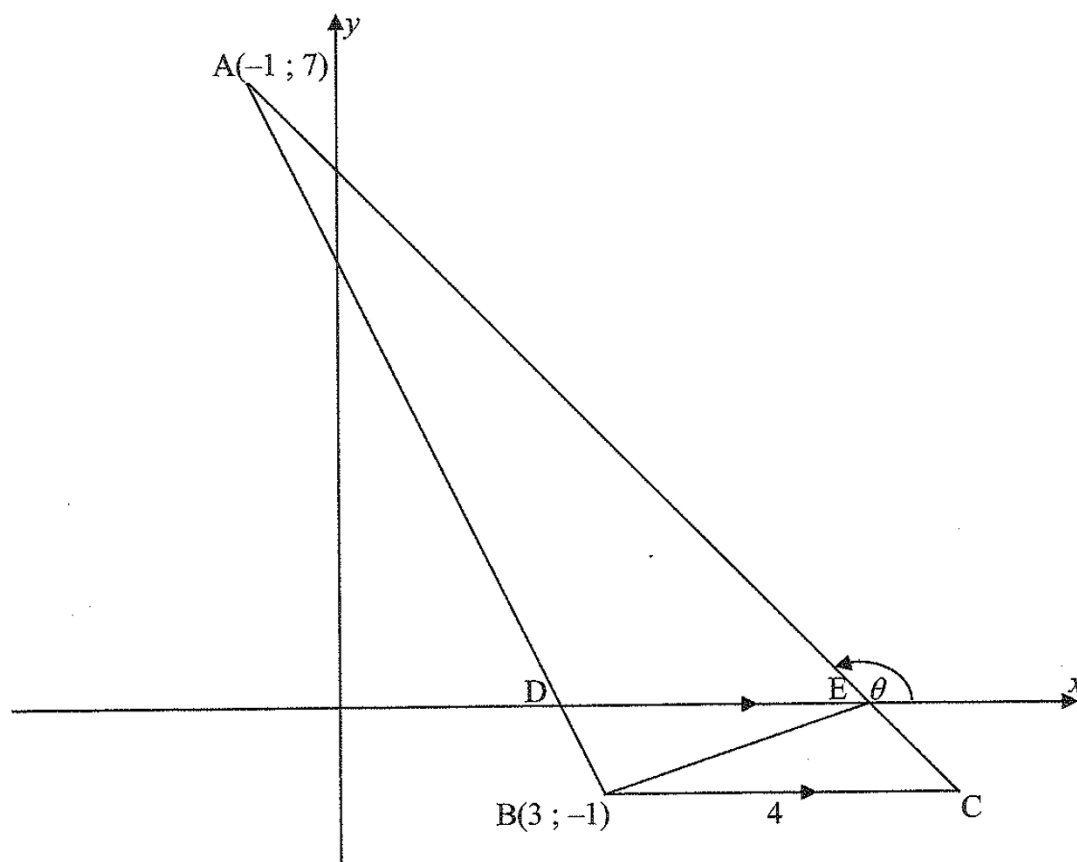
- 2.1 Write down the value of A, a tick mark on the horizontal axis of the cumulative frequency curve. (1)
- 2.2 How many learners participated in this survey? (1)
- 2.3 Calculate the values of Q and R, the frequencies in the frequency table above. (3)
- 2.4 Estimate the mean number of WhatsApp messages sent per day. (2)
- 2.5 Calculate the interquartile range. (3)
- 2.6 The cellphone company wants to introduce a new rule where you are not allowed to send more than 200 WhatsApp messages per day. If this rule is applied to this group of learners on the existing data, how would the standard deviation for the data be affected? Motivate your answer. (2)

[12]



QUESTION 3

In the diagram below, $A(-1 ; 7)$, $B(3 ; -1)$ and C are the vertices of $\triangle ABC$. The angle of inclination of AC is θ . $BC \parallel x$ -axis and $BC = 4$ units. D and E are the x -intercepts of the lines AB and AC respectively. B and E are joined.



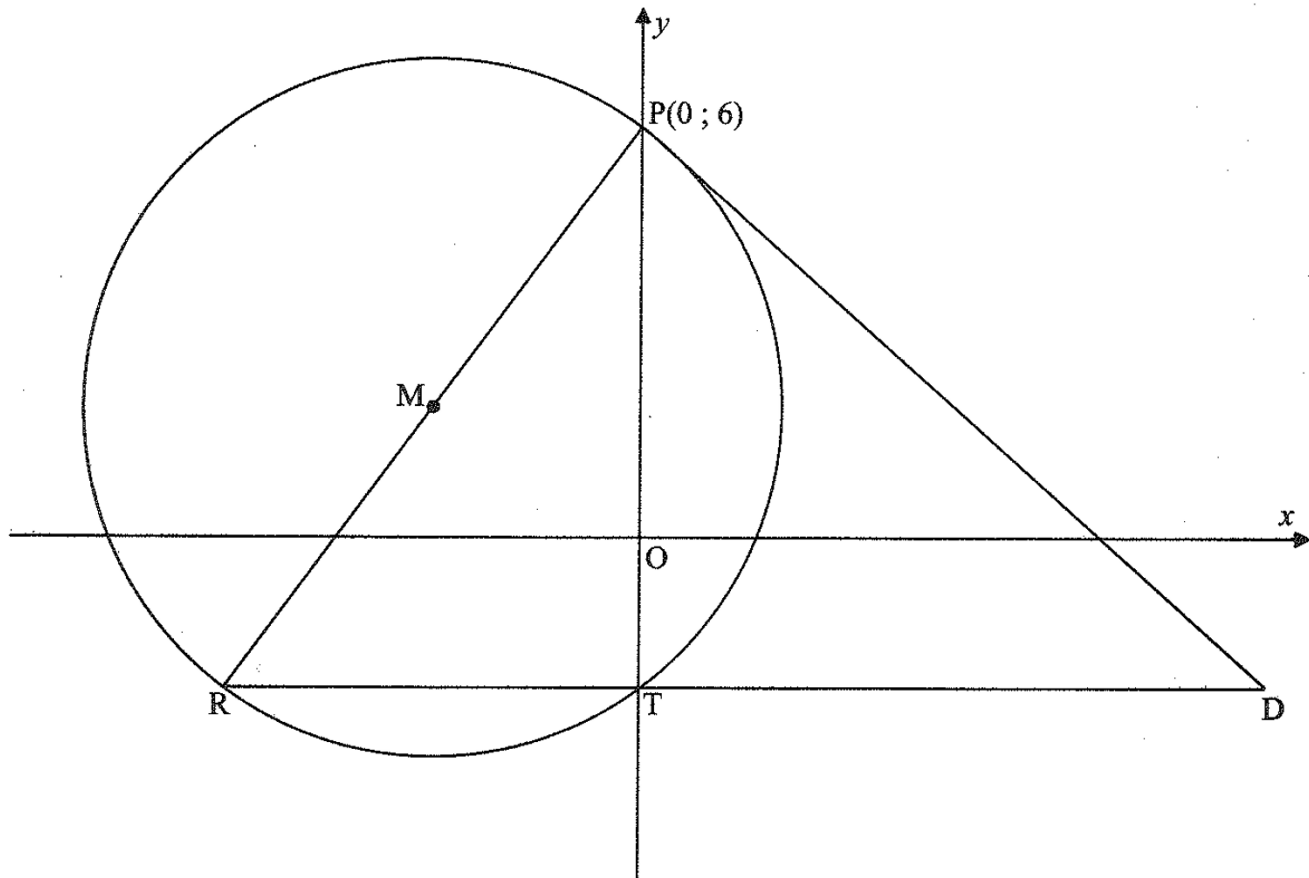
- 3.1 Write down the equation of the line BC . (1)
- 3.2 Write down the x -coordinate of C . (1)
- 3.3 Determine the equation of the line AC . (4)
- 3.4 Calculate the size of $\hat{ACB}$. (4)
- 3.5 If point K is the reflection of E in the line BC :
 - 3.5.1 Write down the coordinates of K . (3)
 - 3.5.2 Calculate the area of quadrilateral $BECK$. (3)
- 3.6 F is a point in the first quadrant, such that it forms an equilateral $\triangle BFC$. Calculate the coordinates of F . (5)

[21]

QUESTION 4

In the diagram below, a circle with centre M and a tangent PD to the circle at P(0 ; 6) are drawn. The equation of the circle is given as $x^2 + 6x + y^2 - 4y - 12 = 0$.

PR is a diameter, T is a y-intercept and chord RT is produced to D. $RTD \parallel x$ -axis.

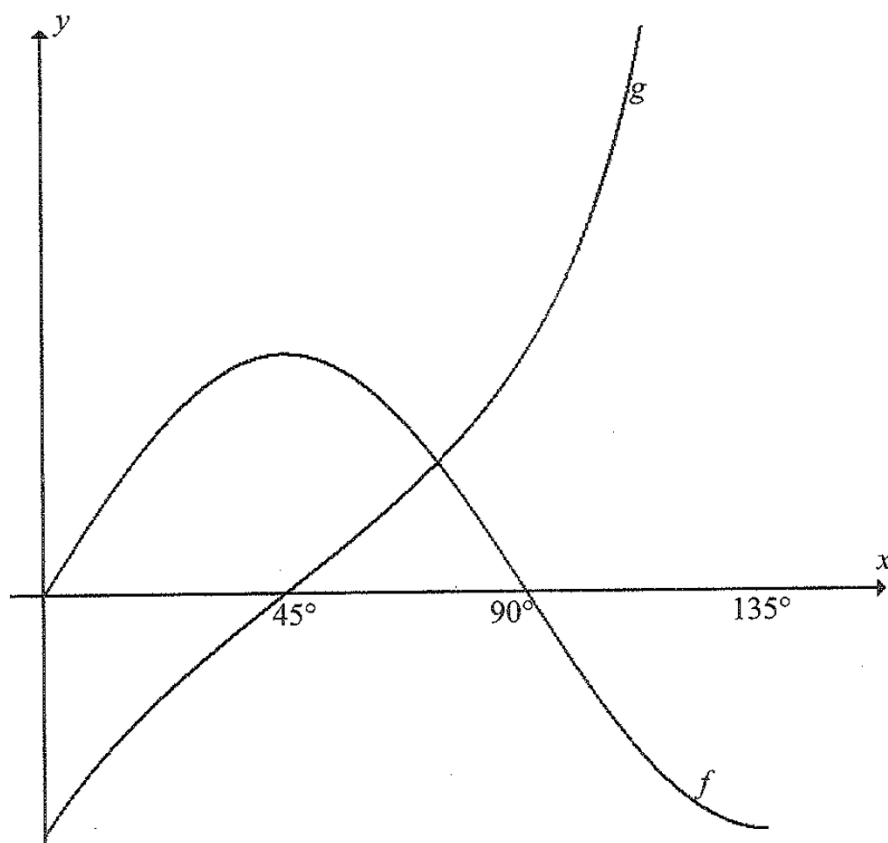


- 4.1 Determine the coordinates of M. (3)
- 4.2 Determine the length of PR. (2)
- 4.3 Determine the equation of the tangent PD. (3)
- 4.4 Determine the coordinates of D. (4)
- 4.5 The circle, having centre M, is translated to the right such that the point D lies on the translated circle. Determine the coordinates of the possible centres of the translated circle. (4)

[16]

QUESTION 5

In the diagram below, $f(x) = \sin ax$ and an incomplete $g(x) = \tan(x + b)$ are drawn for the interval $x \in [0^\circ; 135^\circ]$.

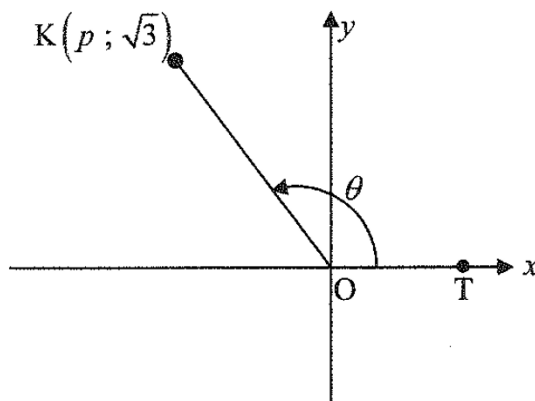


- 5.1 Write down the values of a and b . (2)
- 5.2 Write down the range of f . (2)
- 5.3 Write down the period of g . (1)
- 5.4 Write down the equation of the asymptote of g for the given interval. (1)
- 5.5 Write down TWO values of x , in the given interval, where $f(x) = 1 - g(x)$ (2)
- 5.6 For which value(s) of x , in the given interval, is $f'(x) \cdot g'(x) > 0$? (2)

[10]

QUESTION 6

- 6.1 In the diagram, $K(p; \sqrt{3})$ is a point in the 2nd quadrant. T is a point on the positive x-axis and obtuse $\widehat{KOT} = \theta$.



- 6.1.1 Write down the value of $\tan \theta$ in terms of p . (1)
- 6.1.2 If $\theta = 120^\circ$, **WITHOUT** using a calculator, calculate the value of p . (3)
- 6.2 If $\cos 42^\circ = t$, **WITHOUT** using a calculator, write the following expressions in terms of t :
- 6.2.1 $\sin 48^\circ$ (2)
- 6.2.2 $\cos 84^\circ$ (3)
- 6.2.3 $\cos 72^\circ$ (5)
- 6.3 Simplify the following expression to ONE trigonometric ratio:

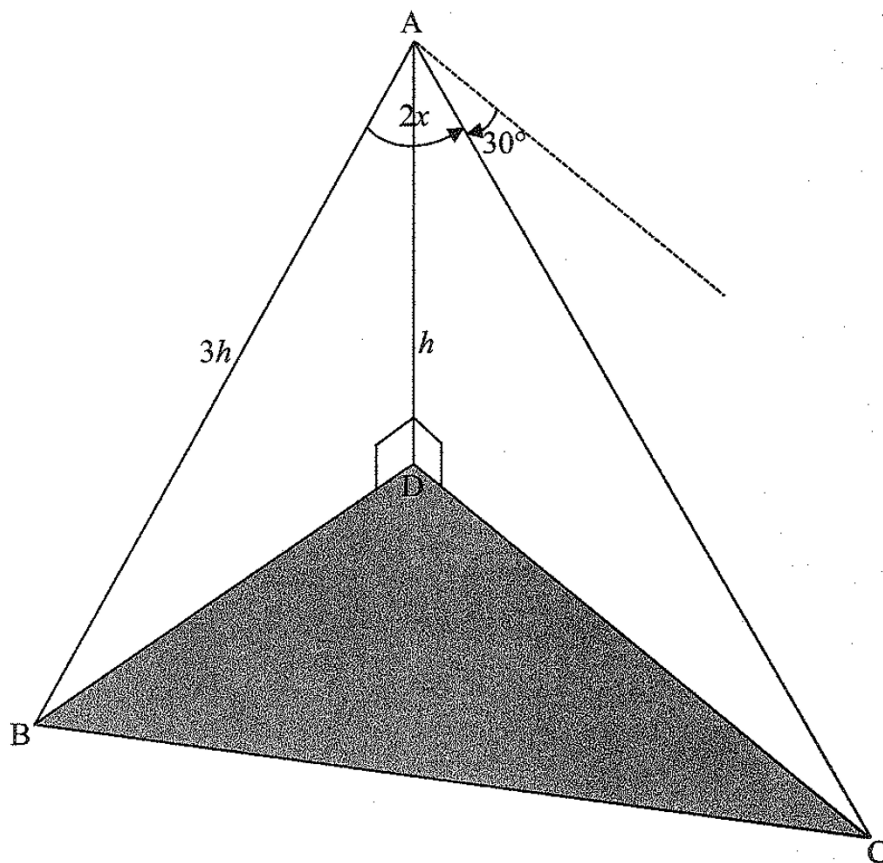
$$\frac{\sin x}{\sin 2x} + \frac{\sin(180^\circ - x)}{\cos x} - \frac{\sin^2 x + \cos^2 x}{2 \sin(90^\circ + x)} \quad (6)$$

- 6.4 Consider $f(x) = \sin(2\theta - 15^\circ) \cdot \cos(\theta - 30^\circ) + \cos(2\theta - 15^\circ) \cdot \sin(\theta - 30^\circ)$
Determine the general solution of $f(x) = 0,8$ (7)
- 6.5 It is given that $4^{\sin x} = 6$, $6^{\cos x} = 8$ and $8 = 32^{1 - 2\sin^2 x}$
WITHOUT solving for x , determine the value of $\tan 2x$. (5)

[32]

QUESTION 7

In the diagram below, AD is a vertical pole having height h metres. B, D and C are three points in the same horizontal plane. AB and AC are cables and the angle of depression from A to C is 30° . $AB = 3h$ and $\hat{BAC} = 2x$.



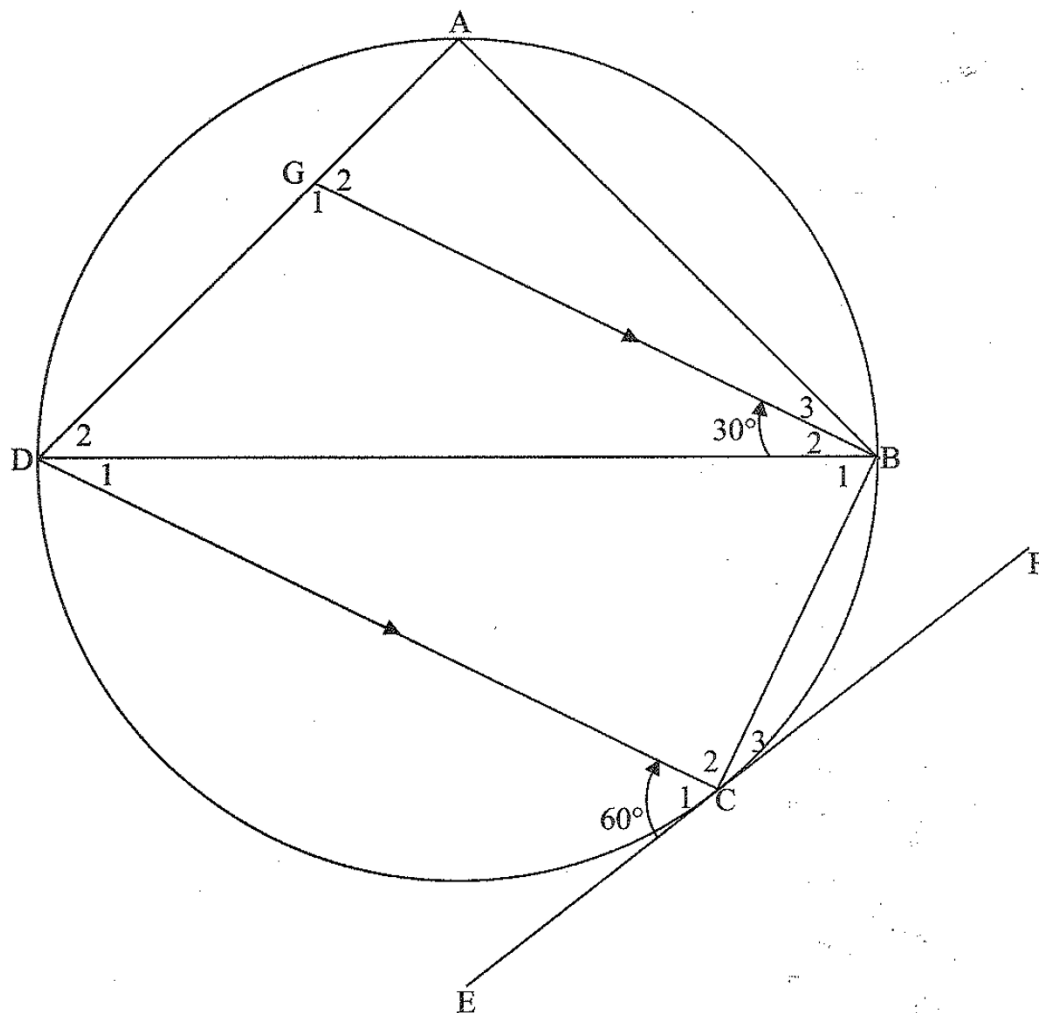
- 7.1 Write down the size of $\hat{ACD}$. (1)
- 7.2 Determine the distance AC in terms of h . (2)
- 7.3 Calculate the size of $\hat{ABD}$. (2)
- 7.4 Calculate the size of x if $BC = \sqrt{7}h$. (5)
- [10]**

Give reasons for your statements in QUESTIONS 8, 9 and 10.

QUESTION 8

In the diagram, ABCD is a cyclic quadrilateral. G is a point on AD such that $BG \parallel CD$. ECF is a tangent to the circle at C. BD is a chord of the circle.

$\hat{GBD} = 30^\circ$ and $\hat{DCE} = 60^\circ$.



8.1 Calculate, with reasons, the size of:

8.1.1 $\hat{D}_1$ (1)

8.1.2 $\hat{B}_1$ (2)

8.1.3 $\hat{C}_2$ (1)

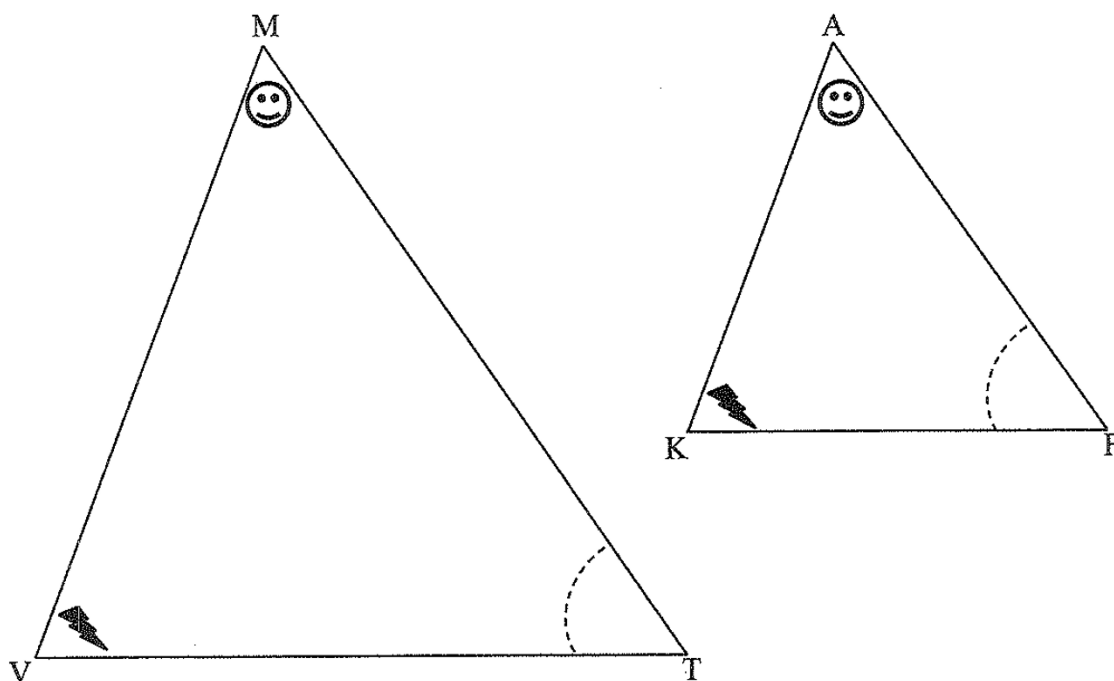
8.1.4 $\hat{DAB}$ (2)

8.2 Is BD a diameter of the circle? Motivate your answer. (2)

[8]

QUESTION 9

9.1 In the diagram below, $\triangle MVT$ and $\triangle AKF$ are drawn such that $\hat{M} = \hat{A}$, $\hat{V} = \hat{K}$ and $\hat{T} = \hat{F}$.

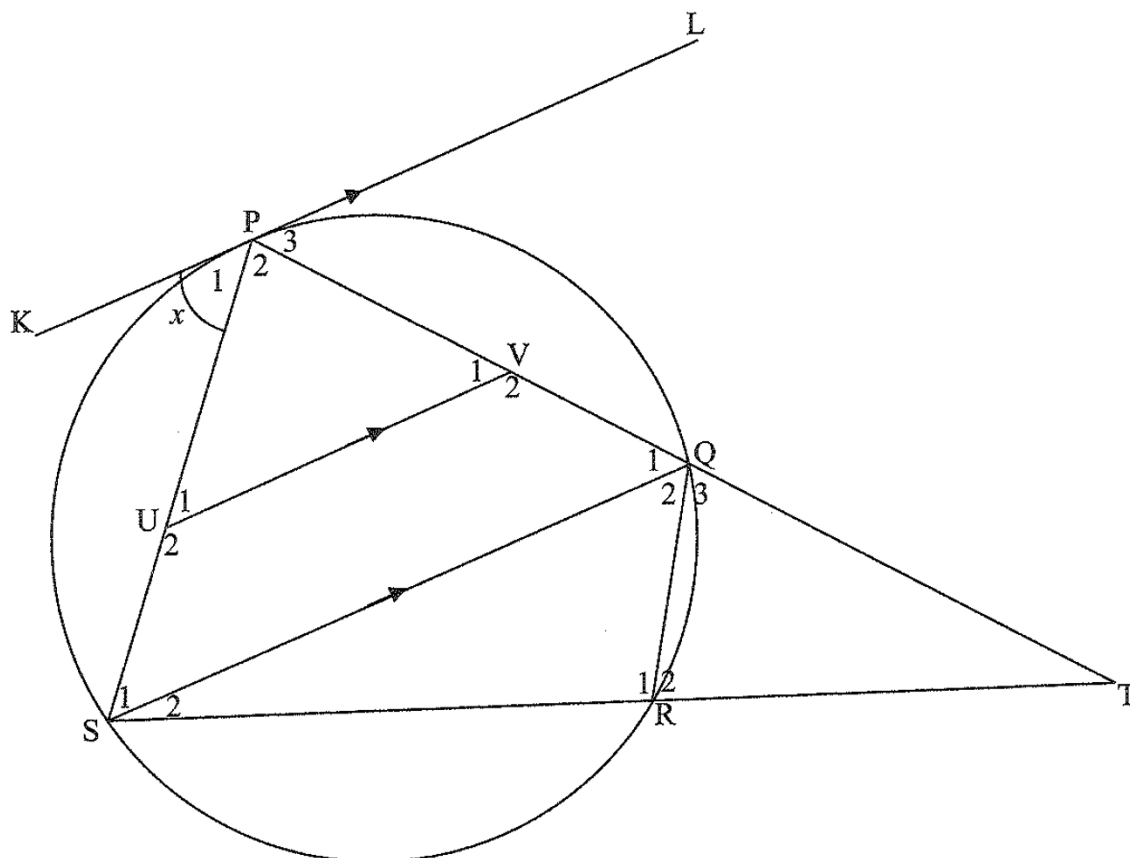


Use the diagram in the ANSWER BOOK to prove the theorem which states that if two triangles are equiangular, then the corresponding sides are in proportion,

that is $\frac{MV}{AK} = \frac{MT}{AF}$

(7)

- 9.2 In the diagram below, cyclic quadrilateral PQRS is drawn. Chord SR produced and chord PQ produced meet at T. KPL is a tangent to the circle at P. U and V are points on PS and PQ respectively such that $UV \parallel SQ \parallel KL$. Let $\hat{KPS} = x$



9.2.1 Write down, with reasons, FIVE other angles EACH equal to x . (5)

9.2.2 Prove that:

(a) $PQ = PS$ (1)

(b) KP is a tangent to the circle that passes through the points P, U and V, at P. (1)

9.2.3 Give a reason why $\frac{PU}{PS} = \frac{PV}{PQ}$ (1)

9.2.4 Prove that:

(a) $\triangle PTS \parallel \triangle RTQ$ (4)

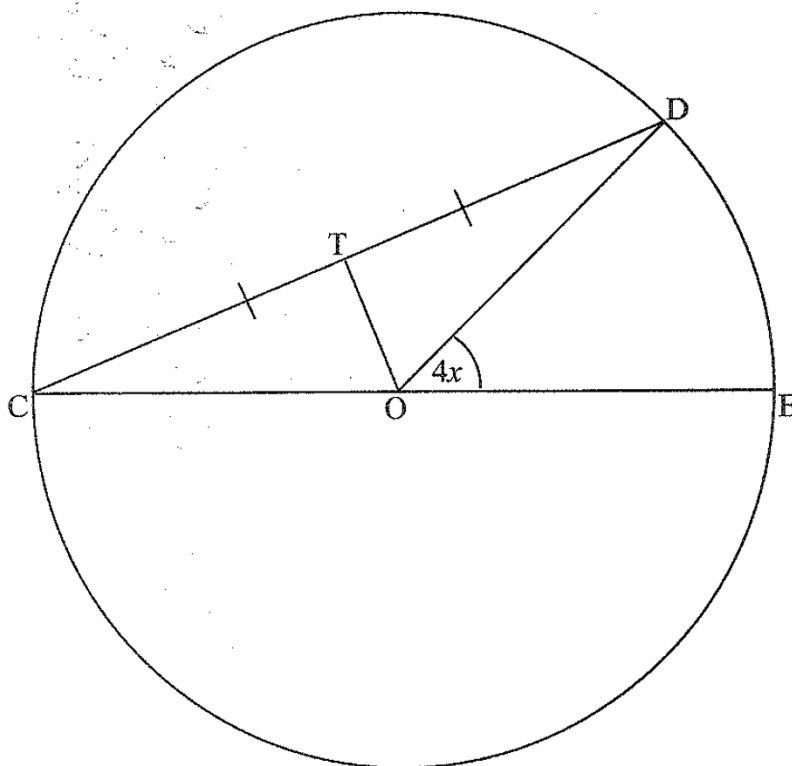
(b) $PT.RQ = PS.RT$ (2)

(c) $PQ = \sqrt{PS.PT - TS.RQ}$ (4)

[25]

QUESTION 10

In the diagram below, the circle with centre O, passes through the points C, D, and E.
OT bisects chord CD. $\angle DOE = 4x$



Prove, with reasons, that $\sin x \cdot \cos x = \frac{OT}{CE}$

[7]

TOTAL: 150

INFORMATION SHEET: MATHEMATICS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$y = mx + c$$

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

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

$$m = \tan \theta$$

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

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

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

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

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

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

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

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

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

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

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

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

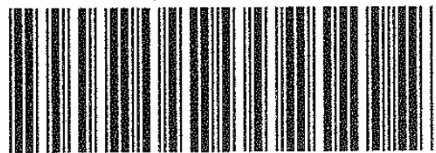
$$P(A) = \frac{n(A)}{n(S)}$$

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

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

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

NEMATHP2





education

Lefapha la Thuto la Bokone Bophirima
Noordwes Departement van Onderwys
North West Department of Education
NORTH WEST PROVINCE

**NATIONAL
SENIOR CERTIFICATE/
NATIONALE
SENIOR SERTIFIKAAT**

GRADE/GRAAD 12

MATHEMATICS P2/WISKUNDE V2

SEPTEMBER 2022

MARKING GUIDELINES/NASIENRIGLYNE

MARKS/PUNTE: 150

**These marking guidelines consist of 18 pages with 3 pages containing the cognitive grid/
Hierdie nasienriglyne bestaan uit 18 bladsye met 3 bladsye wat die kognitiewe tabel bevat.**

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 has not redone the question, mark the crossed out version.
- Consistent accuracy applies in ALL aspects of the marking memorandum. Stop marking at the second calculation error.
- Assuming answers/values in order to solve a problem is NOT acceptable.

NOTA:

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

QUESTION/VRAAG 1

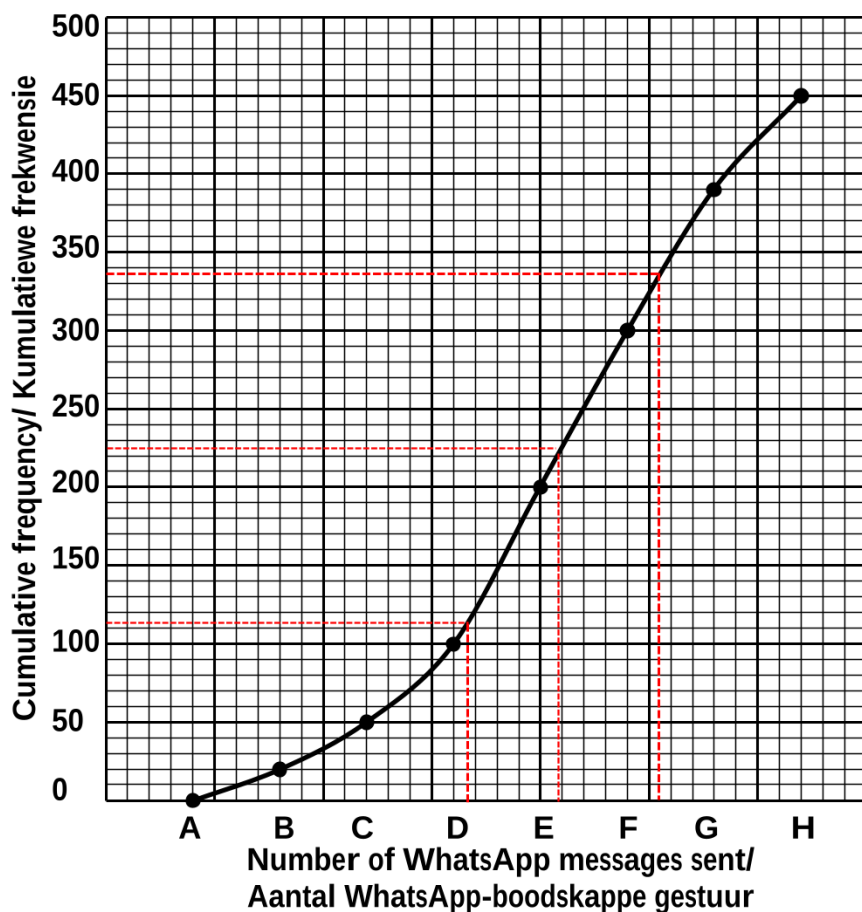
Additional rest days given/ Addisionele rusdae gegee	5	2	9	1	3	10	4	6
Productivity of the employee(in %)/ Produktiwiteit van werknemer (in %)	85	63	90	56	70	88	72	62

1.1	$r = 0,81$	✓ $r = 0,81$ (1)
1.2	C	✓ C (1)
1.3	$\hat{y} = a + bx$ $a = 56,79$ and / en $b = 3,29$ $\therefore \hat{y} = 56,79 + 3,29x$	✓ $a = 56,79$ ✓ $b = 3,29$ ✓ equation/ vergelyking (3)
1.4	$\hat{y} = 56,79 + 3,29(8)$ $\hat{y} = 83,11\%$ productivity / produktiwiteit OR/OF $\hat{y} \approx 83,13\%$ (calculator / sakrekenaar)	✓ substitute 8 into eq. / vervang 8 in vgl. ✓ 83,11 ✓✓ answer/antwoord (2)
1.5	No/Nee The line of regression is only valid for /Die regressielyn is slegs geldig vir $1 \leq x \leq 10$	✓ No/Nee ✓ explanation/ verduideliking (2)
		[9]



QUESTION/VRAAG 2

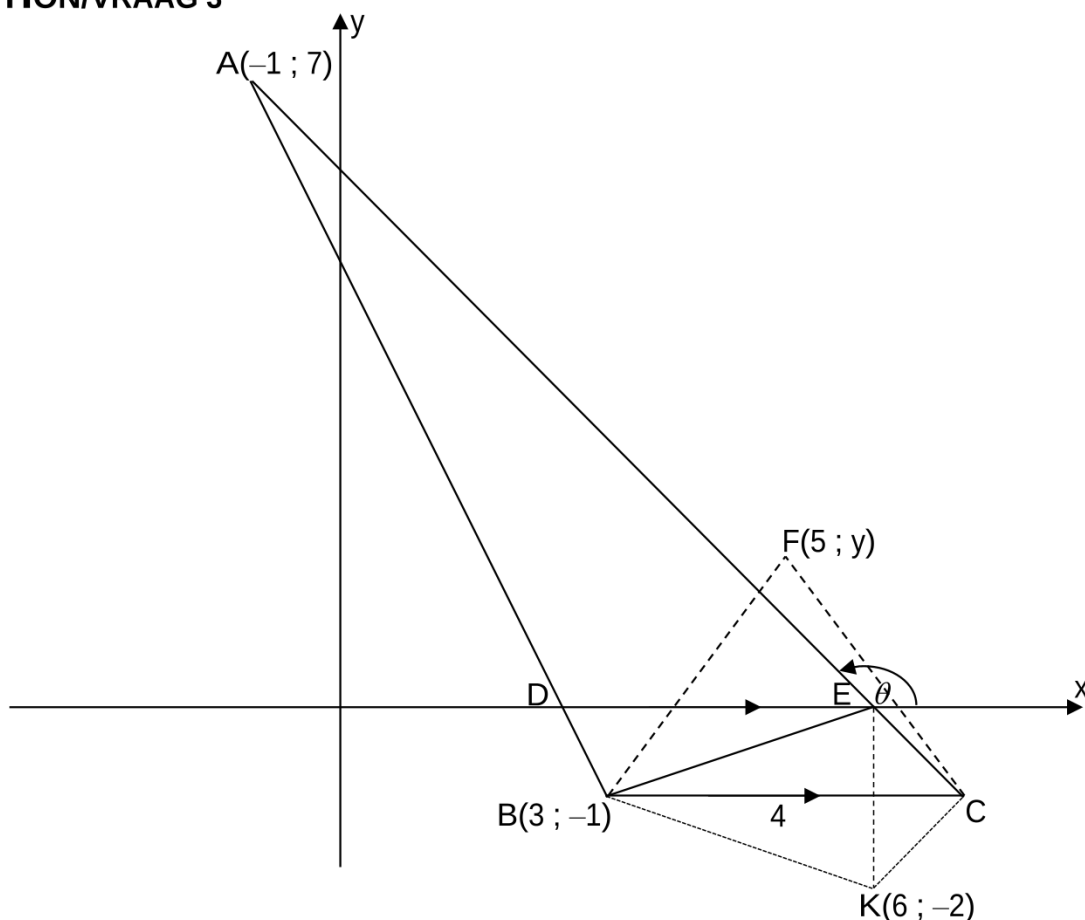
Cumulative Frequency Graph (Ogive)/ Kumulatiewefrekwensie-grafiek (Ogief)



WhatsApp messages sent / WhatsApp-boodskappe gestuur	Frequency/ Frekwensie
$40 \leq x < 80$	20
$80 \leq x < 120$	30
$120 \leq x < 160$	Q
$160 \leq x < 200$	R
$200 \leq x < 240$	100
$240 \leq x < 280$	90
$280 \leq x < 320$	60

2.1	40	✓ 40 (1)
2.2	450	✓ 450 (1)
2.3	$Q = 100 - 50 = 50$ (calculating from/bereken vanaf interval) $R = 100$	✓✓ $Q = 50$ ✓ $R = 100$ (3)
2.4	209	✓✓ 209 (2)
2.5	$Q_1 = 168$ $Q_3 = 255$ $\therefore \text{IQR / IKO} = 255 - 168$ $= 87$ Also accept/Aanvaar ook $Q_1 \in [167; 169]$ $Q_3 \in [254; 256]$	✓ $Q_1 = 168$ ✓ $Q_3 = 255$ ✓ answer/antwoord (3)
2.6	The standard deviation will be smaller/Die standaardafwyking sal kleiner wees. Because three intervals are taken away, the data becomes more closely grouped together/Omdat drie intervale verwyder word, sal die data nader aan mekaar gegroepeer wees.	✓ smaller/kleiner ✓ explanation/verduideliking (2)
		[12]

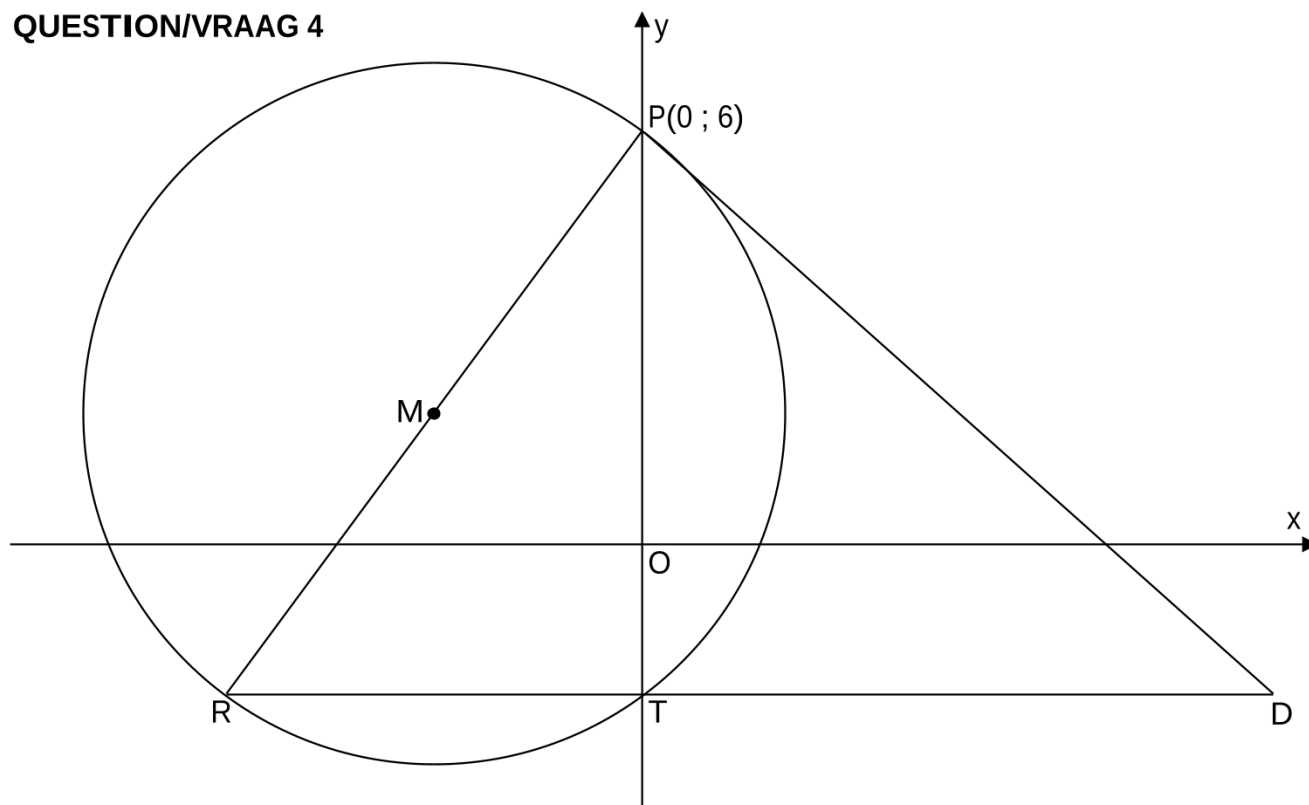
QUESTION/VRAAG 3



3.1	$y = -1$	✓ $y = -1$ (1)
3.2	$x_C = 3 + 4 = 7$	✓ 7 (1)
3.3	$C(7; -1)$ $m_{AC} = \frac{7 - (-1)}{-1 - 7}$ $= -1$ Through / Deur $(-1; 7)$ OR / OF $(7; -1)$ $y - 7 = -1(x - (-1))$ $y - (-1) = -1(x - 7)$ $y - 7 = -1(x + 1)$ $y + 1 = -x + 7$ $\therefore y = -x + 6$	✓ method gradient/metode gradiënt ✓ $m_{AC} = -1$ ✓ Subst./Vervang $(-1; 7)$ OR / OF $(7; -1)$ ✓ $y = -x + 6$ (4)
3.4	$\tan \theta = m_{AC}$ $\tan \theta = -1$ $\tan^{-1}(-1) = \theta$ $\theta = -45^\circ + 180^\circ$ $\therefore \theta = 135^\circ$ $\hat{A}ED = 45^\circ$ [$\angle$ s on straight line / $\angle$ e op reguit lyn] $\therefore \hat{A}CB = 45^\circ$ [corresp. $\angle$ s / oreenk. $\angle$ e; $DE \parallel BC$]	✓ $\tan \theta = -1$ ✓ 135° ✓ $\hat{A}ED = 45^\circ$ ✓ $\hat{A}CB = 45^\circ$ (4)

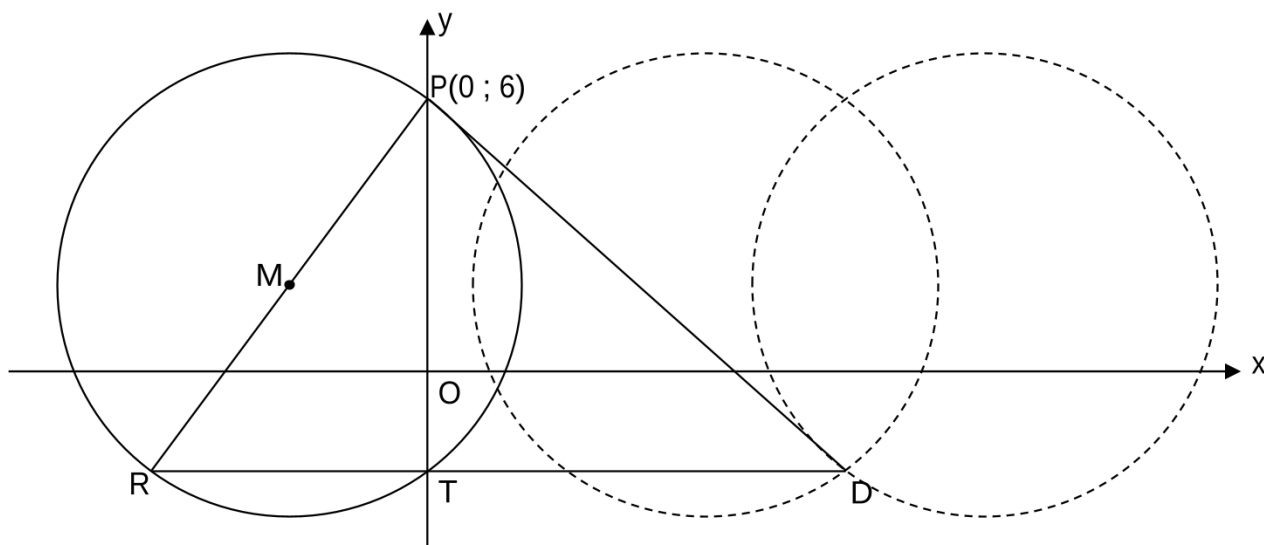
3.5.1	E (6 ; 0) K(6 ; -2)	✓ $x_E = 6$ ✓ $x_K = 6$ ✓ $y_K = -2$ (3)
3.5.2	EK = 2 units/eenhede $\text{Area BECK} = \frac{BC \times EK}{2}$ $= \frac{4 \times 2}{2}$ $= 4 \text{ units}^2 / \text{eenhede}^2$ OR/OF $\text{Area } \triangle BEC = \frac{1}{2}(4)(1)$ $= 2$ $\text{Area } \triangle BKC = \frac{1}{2}(4)(1)$ $= 2$ $\text{Area BECK} = 2 + 2 = 4 \text{ units}^2 / \text{eenhede}^2$	✓ EK = 2 ✓ method/metode ✓ answer/antwoord (3) ✓ Area $\triangle BEC = 2$ ✓ Area $\triangle BKC = 2$ ✓ answer/antwoord (3)
3.6	$x_F = \frac{x_B + x_C}{2}$ $= \frac{3 + 7}{2}$ $= 5$ $\therefore F(5; y)$ $BF = \sqrt{(5 - 3)^2 + (y + 1)^2} \quad \text{OR / OF} \quad FC = \sqrt{(5 - 7)^2 + (y + 1)^2}$ $BF = FC = BC = 4$ $16 = 4 + (y + 1)^2$ $(y + 1)^2 = 12$ $y = \pm \sqrt{12} - 1$ $\therefore y = \sqrt{12} - 1$ (first quadr. / eerste kwadr.)	✓ method/metode ✓ $x_F = 5$ ✓ distance form./afstandsformule ✓ $(y + 1)^2 = 12$ ✓ antwoord/answer (5)
		[21]

QUESTION/VRAAG 4

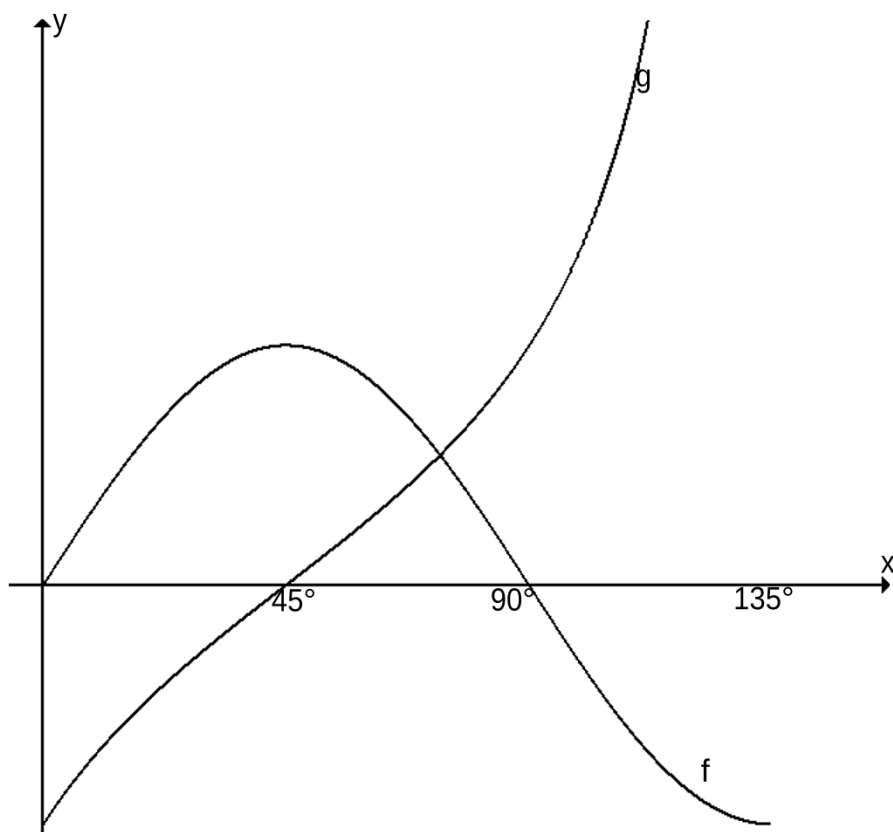


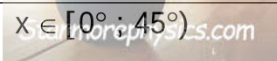
4.1	$x^2 + 6x + (y+2)^2 = 12 + 9 + 4$ $(x+3)^2 + (y+2)^2 = 25$ $\therefore M(-3; 2)$ Answer only: Full Marks	✓method/metode ✓ $x = -3$ ✓ $y = 2$ (3)
4.2	$r^2 = 12 + (3)^2 + (-2)^2 = 25$ $\therefore r = 5$ $\therefore PR = 10$	✓ $r^2 = 25$ (can also be shown in 4.1/ kan ook in 4.1 gewys word) ✓ $PR = 10$ (2)
4.3	$m_{MP} = \frac{6-2}{0-(-3)}$ $= \frac{4}{3}$ $\therefore m_{PD} = -\frac{3}{4} \text{ [rad } \perp \text{ tangent / rad } \perp \text{ raaklyn]}$ $y = -\frac{3}{4}x + c$ $\therefore y = -\frac{3}{4}x + 6$	✓ $m_{MP} = \frac{4}{3}$ ✓ $m_{PD} = -\frac{3}{4}$ ✓equation / vergelyking (3)

4.4	$\frac{y_P + y_R}{2} = y_M$ $\frac{6 + y_R}{2} = 2$ $y_R = -2$ $D(x; -2)$ $-2 = -\frac{3}{4}x + 6$ $x = \frac{32}{3}$ $\therefore D\left(\frac{32}{3}; -2\right)$	✓ method/metode ✓ $y_R = -2$ ✓ subst. $y = -2$ into equation/vervang $y = -2$ in vergelyking ✓ $D\left(\frac{32}{3}; -2\right)$ (4)
4.5	$T_x \rightarrow D_x = \frac{32}{3} \text{ units / eenhede}$ new centre / nuwe middelpunt $\left(\frac{23}{3}; 2\right)$ $R_x \rightarrow D_x = \frac{50}{3} \text{ units / eenhede}$ new centre / nuwe middelpunt $\left(\frac{41}{3}; 2\right)$	✓ $\frac{32}{3}$ ✓ $\left(\frac{23}{3}; 2\right)$ ✓ $\frac{50}{3}$ ✓ $\left(\frac{41}{3}; 2\right)$ (4)
		[16]

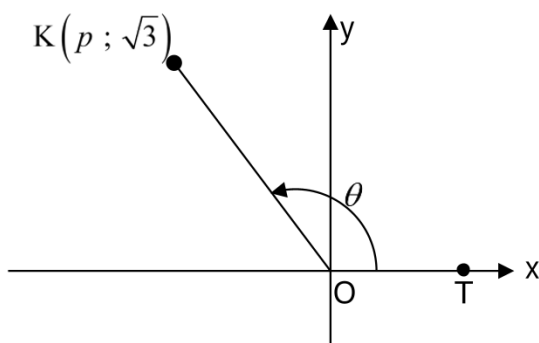


QUESTION/VRAAG 5



5.1	$a = 2$ and/en $b = -45^\circ$	✓ $a = 2$ ✓ $b = -45^\circ$ (2)
5.2	$-1 \leq y \leq 1$ OR/OF $y \in [-1; 1]$	✓ critical values/kritiese waardes ✓ notation/notasie (2)
5.3	180°	✓ 180° (1)
5.4	$x = 135^\circ$	✓ 135° (1)
5.5	$x = 0^\circ$ or/of $x = 45^\circ$ or/of $x = 90^\circ$ 	✓ ✓ any 2 correct solutions/ enige 2 korrekte oplossings (one mark per solution/ een punt per oplossing) (2)
5.6	$0^\circ \leq x < 45^\circ$ OR/OF $x \in [0^\circ; 45^\circ)$ 	✓ 0° and/en 45° ✓ notation/notasie (2)
		[10]

QUESTION/VRAAG 6

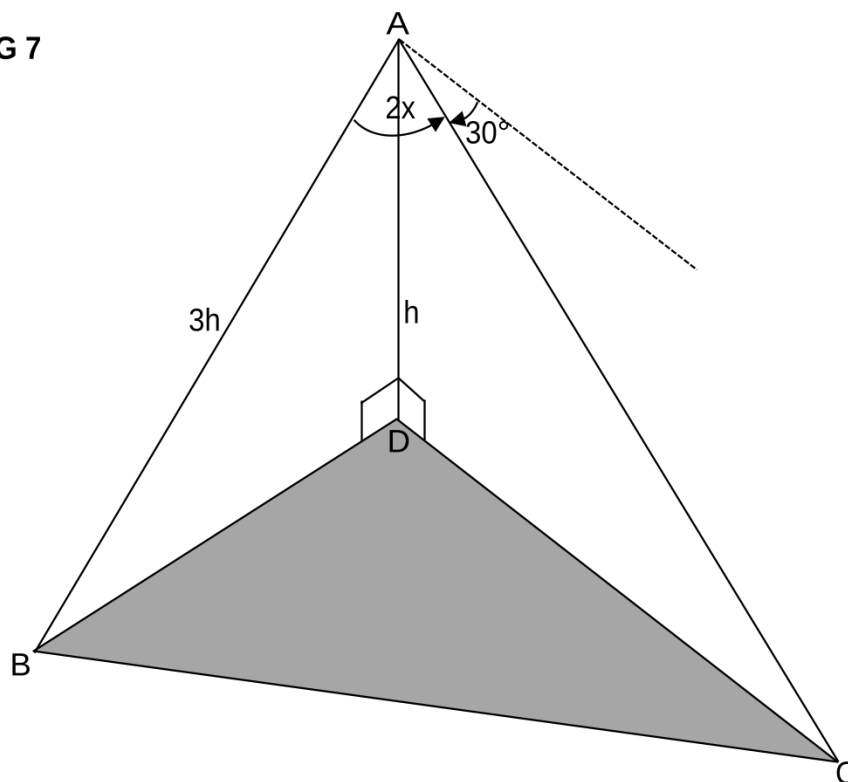


6.1.1	$\tan \theta = \frac{\sqrt{3}}{p}$	$\checkmark \frac{\sqrt{3}}{p}$ (1)
6.1.2	$\tan 120^\circ = \frac{\sqrt{3}}{p}$ $\tan (180^\circ - 60^\circ) = \frac{\sqrt{3}}{p}$ $-\tan 60^\circ = \frac{\sqrt{3}}{p}$ $-\sqrt{3} = \frac{\sqrt{3}}{p}$ $p = -1$	$\checkmark -\tan 60^\circ$ $\checkmark -\sqrt{3} = \frac{\sqrt{3}}{p}$ $\checkmark p = -1$ (3)
6.2.1	$\cos 42^\circ$ $= \sin 48^\circ$ $= t$ Answer only: Full Marks	$\checkmark \sin 48^\circ = \cos 42^\circ$ $\checkmark t$ (2)
6.2.2	$\cos 2(42^\circ)$ $= 2 \cos^2 42^\circ - 1$ $= 2t^2 - 1$ OR/OF $\cos 2(42^\circ)$ $= 1 - 2 \sin^2 42^\circ$ $= 1 - 2(\sqrt{1-t^2})^2$ $= 2t^2 - 1$	$\checkmark \cos 2(42^\circ)$ $\checkmark 2 \cos^2 42^\circ - 1$ $\checkmark 2t^2 - 1$ $\checkmark \cos 2(42^\circ)$ $\checkmark 1 - 2 \sin^2 42^\circ$ $\checkmark 2t^2 - 1$

6.2.2	OR/OF $\cos 2(42^\circ)$ $= \cos^2 42^\circ - \sin^2 42^\circ$ $= t^2 - (\sqrt{1-t^2})^2$ $= 2t^2 - 1$	$\checkmark \cos 2(42^\circ)$ $\checkmark \cos^2 42^\circ - \sin^2 42^\circ$ $\checkmark 2t^2 - 1$ (3)
6.2.3	$\cos(42^\circ + 30^\circ)$ $= \cos 42^\circ \cdot \cos 30^\circ - \sin 42^\circ \cdot \sin 30^\circ$ $= t \cdot \frac{\sqrt{3}}{2} - \sqrt{1-t^2} \cdot \frac{1}{2}$ $= \frac{\sqrt{3}t}{2} - \frac{\sqrt{1-t^2}}{2}$ $= \frac{\sqrt{3}t - \sqrt{1-t^2}}{2}$	$\checkmark$ manipulation / manipulasie $\checkmark$ expansion of identity/ uitbreiding van identiteit $\checkmark \frac{\sqrt{3}}{2} \ \& \ \frac{1}{2}$ $\checkmark t \ \& \ \sqrt{1-t^2}$ $\checkmark$ answer/antwoord (5)
6.3	$\frac{\sin x}{\sin 2x} + \frac{\sin(180^\circ - x)}{\cos x} - \frac{\sin^2 x + \cos^2 x}{2\sin(90^\circ + x)}$ $= \frac{\sin x}{2\sin x \cdot \cos x} + \frac{\sin x}{\cos x} - \frac{1}{2\cos x}$ $= \frac{1}{2\cos x} + \frac{\sin x}{\cos x} - \frac{1}{2\cos x}$ $= \frac{\sin x}{\cos x}$ $= \tan x$	$\checkmark \sin 2x = 2\sin x \cdot \cos x$ $\checkmark \sin(180^\circ - x) = \sin x$ $\checkmark \sin^2 x + \cos^2 x = 1$ $\checkmark 2\sin(90^\circ + x) = 2\cos x$ $\checkmark \frac{\sin x}{\cos x}$ $\checkmark \tan x$ (6)

6.4	$f(x) = \sin[(2\theta - 15^\circ) + (\theta - 30^\circ)]$ $f(x) = \sin[3\theta - 45^\circ]$ $\therefore \sin[3\theta - 45^\circ] = 0,8$ $3\theta - 45^\circ = 53,1301\dots^\circ + k.360^\circ, k \in \mathbb{Z}$ $3\theta = 98,1301\dots^\circ + k.360^\circ$ $\theta = 32,71^\circ + k.120^\circ$ or / of $3\theta - 45^\circ = 180^\circ - 53,1301\dots^\circ + k.360^\circ, k \in \mathbb{Z}$ $3\theta = 171,8699\dots^\circ + k.360^\circ$ $\theta = 57,29^\circ + k.120^\circ$	$\checkmark f(x) = \sin[3\theta - 45^\circ]$ $\checkmark \sin[3\theta - 45^\circ] = 0,8$ $\checkmark 3\theta - 45^\circ = 53,1301\dots^\circ$ $\checkmark \theta = 32,71^\circ + k.120^\circ$ $\checkmark$ $3\theta - 45^\circ = 180^\circ - 53,1301\dots^\circ$ $\checkmark \theta = 57,29^\circ + k.120^\circ$ $\checkmark + k.120^\circ, k \in \mathbb{Z}$ (7)
6.5	$4^{\sin x} = 2^{2\sin x} = 6$ $6^{\cos x} = (2^{2\sin x})^{\cos x} = 2^{2\sin x \cdot \cos x} = 8$ $8 = 2^{2\sin x \cdot \cos x} = 32^{1 - 2\sin^2 x}$ $\therefore 2^{2\sin x \cdot \cos x} = 2^{5(1 - 2\sin^2 x)}$ $\sin 2x = 5 \cos 2x$ $\tan 2x = 5$	$\checkmark 2^{2\sin x} = 6$ $\checkmark 2^{2\sin x \cdot \cos x} = 8$ $\checkmark 2^{2\sin x \cdot \cos x} = 2^{5(1 - 2\sin^2 x)}$ $\checkmark \sin 2x = 5 \cos 2x$ $\checkmark \tan 2x = 5$ (5)
		[32]

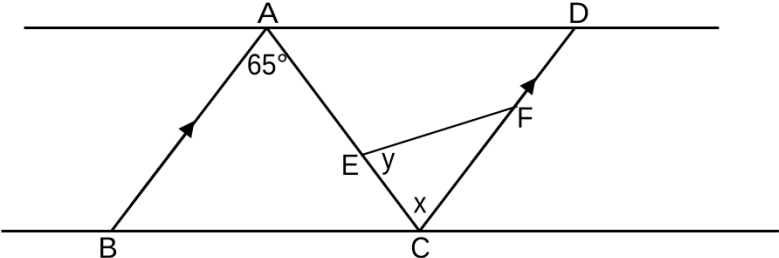
QUESTION/VRAAG 7



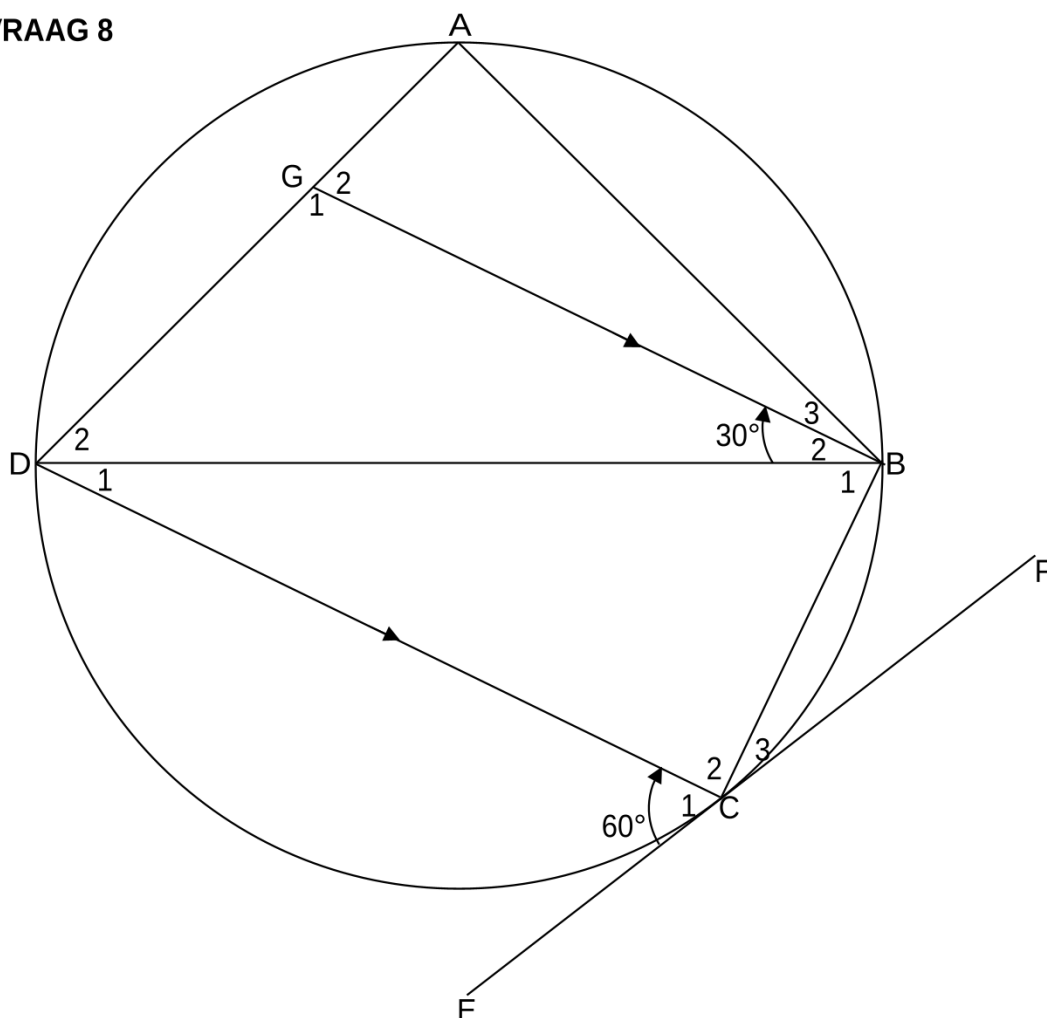
7.1	$\hat{A}CD = 30^\circ$	✓ 30° (1)
7.2	$\sin 30^\circ = \frac{h}{AC}$ $\therefore AC = 2h$	✓ $\sin 30^\circ = \frac{h}{AC}$ ✓ $AC = 2h$ (2)
7.3	$\sin \hat{A}BD = \frac{h}{3h} = \frac{1}{3}$ $\hat{A}BD = \sin^{-1}\left(\frac{1}{3}\right)$ $\hat{A}BD = 19,47^\circ$	✓ $\sin \hat{A}BD = \frac{1}{3}$ ✓ $\hat{A}BD = 19,47^\circ$ (2)
7.4	$BC^2 = AB^2 + AC^2 - 2AB \cdot AC \cdot \cos 2x$ $(\sqrt{7}h)^2 = (3h)^2 + (2h)^2 - 2(3h)(2h)\cos 2x$ $7h^2 = 9h^2 + 4h^2 - 12h^2 \cos 2x$ $-6h^2 = -12h^2 \cos 2x$ $\cos 2x = \frac{1}{2}$ $2x = 60^\circ$ $x = 30^\circ$	✓ correct use of cosine-rule/korrekte gebruik van cos-reël ✓ subst/vervanging ✓ $\cos 2x = \frac{1}{2}$ ✓ $2x = 60^\circ$ ✓ $x = 30^\circ$ (5)
		[10]

GEOMETRY/MEETKUNDE

Please read carefully through the following table before marking **QUESTION 8–10** /
 Lees asseblief sorgvuldig deur die volgende tabel alvorens **VRAAG 8–10** nagesien word.

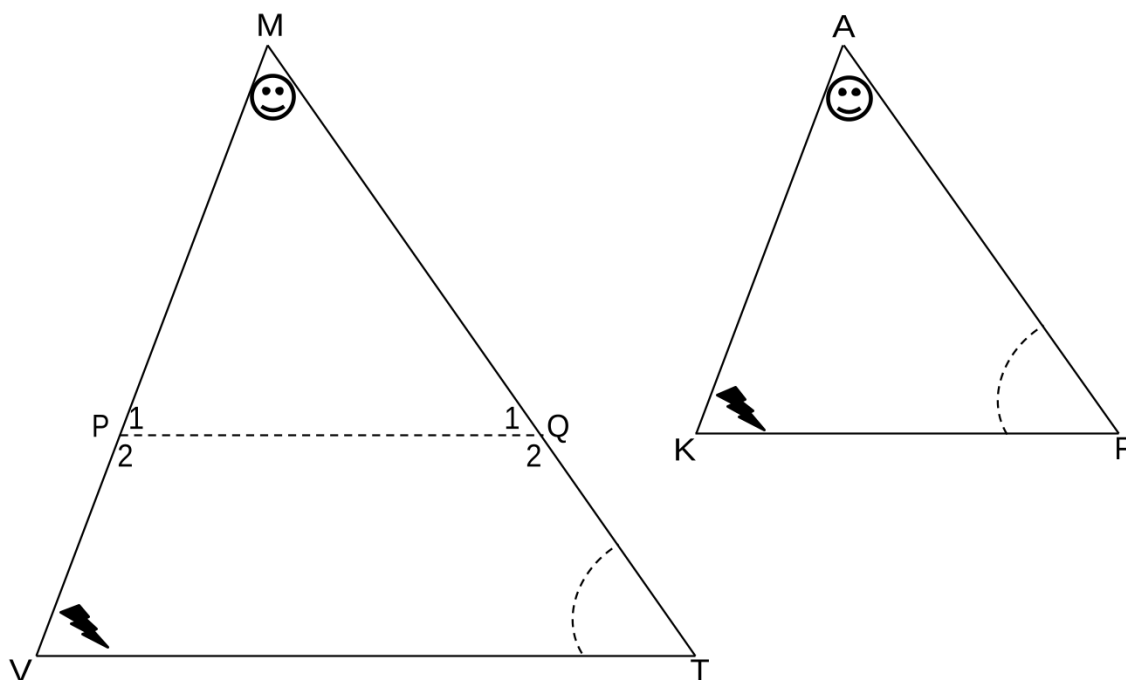
	The order in which the candidate answers a geometry question must follow logically/ Die <i>volgorde</i> waarin 'n kandidaat 'n meetkundevraag beantwoord moet logies volg. Example/Voorbeeld Given/Gegee $AB \parallel CD$ and/en $\hat{EFD} = 115^\circ$  The candidate first need to calculate x BEFORE he/she can calculate y/Die kandidaat moet eerste vir x bereken VOORDAT hy/sy vir y kan bereken.
S	A mark for a correct statement (A statement mark is independent of a reason)
	'n Punt vir 'n korrekte bewering ('n Punt vir 'n bewering is onafhanklik van die rede)
R	A mark for the correct reason (A reason mark may only be awarded if the statement is correct)
	'n Punt vir 'n korrekte rede ('n Punt word slegs vir die rede toegeken as die bewering korrek is)
S/R	Award a mark if the statement AND reason are both correct (Both MUST be correct to get one mark)
	Ken 'n punt toe as die bewering EN rede beide korrek is (Beide MOET korrek wees om een punt te kry)

QUESTION/VRAAG 8



8.1.1	$\hat{D}_1 = 30^\circ$ [alt $\angle$ s / verwiss $\angle$ e; $BG \parallel DC$]	✓S/R (1)
8.1.2	$\hat{B}_1 = 60^\circ$ [tan-chord th./raaklyn - koordst.]	✓S✓R (2)
8.1.3	$\hat{C}_2 = 90^\circ$ [$\angle$ s of Δ / binne. $\angle$ e van Δ]	✓S/R (1)
8.1.4	$\hat{D}\hat{A}\hat{B} = 90^\circ$ [opp. $\angle$ of cq / teenoorst. $\angle$ e van kvh]	✓S✓R (2)
8.2	Yes / Ja	✓yes/ja
	BD is a diameter/BD is 'n middellyn [converse / omgekeerde $\angle$ in $\frac{1}{2}\square$]	✓S/R (2)
		[8]

QUESTION/VRAAG 9



9.1	Construction: Mark P and Q such that MP = AK and MQ = AF. Draw PQ Konstruksie: Merk P en Q sodat MP = AK en MQ = AF. Trek PQ In $\triangle MPQ$ and/en $\triangle AKF$ $\hat{M} = \hat{A}$ [given / gegee] $MP = AK$ [construction / konstruksie] $MQ = AF$ [construction / konstruksie] $\therefore \triangle MPQ \equiv \triangle AKF [S, \angle, S]$ $\hat{P}_1 = \hat{K}$ [from / vanuit $\equiv$] but / maar $\hat{V} = \hat{K}$ [given / gegee] $\therefore \hat{P}_1 = \hat{V}$ $\therefore PQ \parallel VT$ [corresp. $\angle$s = / ooreenk. $\angle$e =] $\frac{MV}{MP} = \frac{MT}{MQ}$ [prop.th / eweredigheidst.; $PQ \parallel VT$] $MP = AK$ and / en $MQ = AF$ $\therefore \frac{MV}{AK} = \frac{MT}{AF}$	✓ constr/ konstr ✓ S/R ✓ S ✓ S ✓ S/R ✓ S ✓ R (7)
------------	--	---

The diagram illustrates a geometric setup for optics, likely related to the derivation of the lens formula. It features a circle with several points on its circumference: S, P, Q, R, U, and V. Lines are drawn from these points to external points K, L, and T. Key features include:

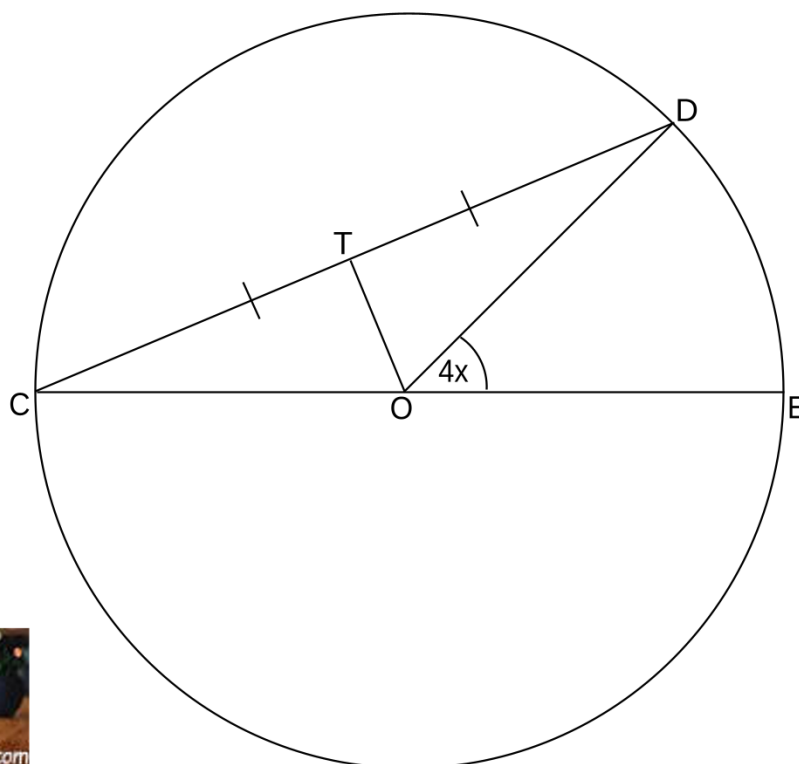
- Point S is on the left side of the circle.
- Point P is at the top left of the circle.
- Point Q is on the right side of the circle.
- Point R is at the bottom of the circle.
- Point U is inside the circle, near S.
- Point V is inside the circle, near Q.
- Line KS is tangent to the circle at S.
- Line LP is tangent to the circle at P.
- Line QT is tangent to the circle at Q.
- Lines SU, UV, and VR are drawn, with arrows indicating a path from S to U to V to R.
- Lines PQ and PR are also drawn.
- Angles are labeled with numbers 1, 2, 3 and a variable x.
- Angle 1 is at S between KS and SU.
- Angle 2 is at U between SU and UV.
- Angle 3 is at V between UV and VR.
- Angle x is at P between KP and PQ.
- At point Q, angles 1, 2, and 3 are marked between the tangent QT and lines QV, QR, and QS respectively.
- At point R, angles 1, 2, and 3 are marked between lines RS, RQ, and RP respectively.
- At point P, angles 1, 2, and 3 are marked between lines PS, PQ, and PR respectively.

In the top right corner, there is a small inset image of two potted plants on a table, with the text "Stannmorephysics.com" overlaid.

Stanmorephysics.com

9.2.4 (a)	In $\triangle PTS$ and / en $\triangle RTQ$ $\hat{T} = \hat{T}$ [common / gemeenskaplik] $\hat{T}\hat{P}S = \hat{T}\hat{R}Q$ [ext. $\angle$ of cq/buite $\angle$ van kvh] $\hat{P}\hat{S}T = \hat{T}\hat{Q}R$ [sum of $\angle$s of $\triangle$ / som van $\angle$e van $\triangle$] $\therefore \triangle TPS \parallel \triangle TRQ$ [$\angle \angle \angle$]	✓S/R ✓S✓R ✓S/R (4)
9.2.4 (b)	$\frac{TP}{TR} = \frac{PS}{RQ}$ [from / vanuit $\parallel \triangle$] $\therefore PT.RQ = PS.TR$	✓S✓R (2)
9.2.4 (c)	$\frac{PS}{RQ} = \frac{TS}{TQ}$ [from / vanuit $\parallel \triangle$] $PS.TQ = TS.RQ$ but / maar $TQ = PT - PQ$ $PS(PT - PQ) = TS.RQ$ but/maar $PQ = PS$ $PS.PT - PQ^2 = TS.RQ$ $PQ^2 = PS.PT - TS.RQ$ $\therefore PQ = \sqrt{PS.PT - TS.RQ}$	✓S ✓S ✓S ✓S (4)
		[25]

QUESTION/VRAAG 10



	$\widehat{DCE} = 2x$ $\left[\begin{array}{l} \angle \text{ at centre} = 2 \times \angle \text{ at circumference} / \\ \text{midpts.} \angle = 2 \times \text{omtreks.} \angle \end{array} \right]$	✓ S ✓ R
	$\widehat{OTC} = 90^\circ$ $\left[\begin{array}{l} \text{line from centre to midpt of chord} / \\ \text{midpt.} \square ; \text{midpt.koord} \end{array} \right]$	✓ S ✓ R
	In $\triangle OTC$	
	$\sin 2x = \frac{OT}{OC}$	✓ S
	$2 \sin x \cos x = \frac{OT}{OC}$	✓ $2 \sin x \cos x$
	$\sin x \cos x = \frac{OT}{2 \times OC}$	✓ $\frac{OT}{2 \times OC}$
	$\sin x \cos x = \frac{OT}{CE}$	
		(7)
		[7]

TOTAL/TOTAAL: 150