



# basic education

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

## NATIONAL SENIOR CERTIFICATE

**GRADE 12**

MATHEMATICS P1

NOVEMBER 2014

**MARKS: 150**

**TIME: 3 hours**

This question paper consists of 10 pages and 1 information sheet.

**INSTRUCTIONS AND INFORMATION**

Read the following instructions carefully before answering the questions.

1. This question paper consists of 12 questions.
2. Answer ALL the questions.
3. Number the answers correctly according to the numbering system used in this question paper.
4. Clearly show ALL calculations, diagrams, graphs, et cetera that you have used in determining your answers.
5. Answers only will not necessarily be awarded full marks.
6. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
7. If necessary, round off answers to TWO decimal places, unless stated otherwise.
8. Diagrams are NOT necessarily drawn to scale.
9. An information sheet with formulae is included at the end of the question paper.
10. Write neatly and legibly.

**QUESTION 1**1.1 Solve for  $x$ :

1.1.1  $(x - 2)(4 + x) = 0$  (2)

1.1.2  $3x^2 - 2x = 14$  (correct to TWO decimal places) (4)

1.1.3  $2^{x+2} + 2^x = 20$  (3)

1.2 Solve the following equations simultaneously:

$$\begin{aligned} x &= 2y + 3 \\ 3x^2 - 5xy &= 24 + 16y \end{aligned} \quad (6)$$

1.3 Solve for  $x$ :  $(x - 1)(x - 2) < 6$  (4)

1.4 The roots of a quadratic equation are:  $x = \frac{3 \pm \sqrt{-k - 4}}{2}$   
 For which values of  $k$  are the roots real? (2)  
**[21]**

**QUESTION 2**Given the arithmetic series:  $2 + 9 + 16 + \dots$  (to 251 terms).

2.1 Write down the fourth term of the series. (1)

2.2 Calculate the 251<sup>st</sup> term of the series. (3)

2.3 Express the series in sigma notation. (2)

2.4 Calculate the sum of the series. (2)

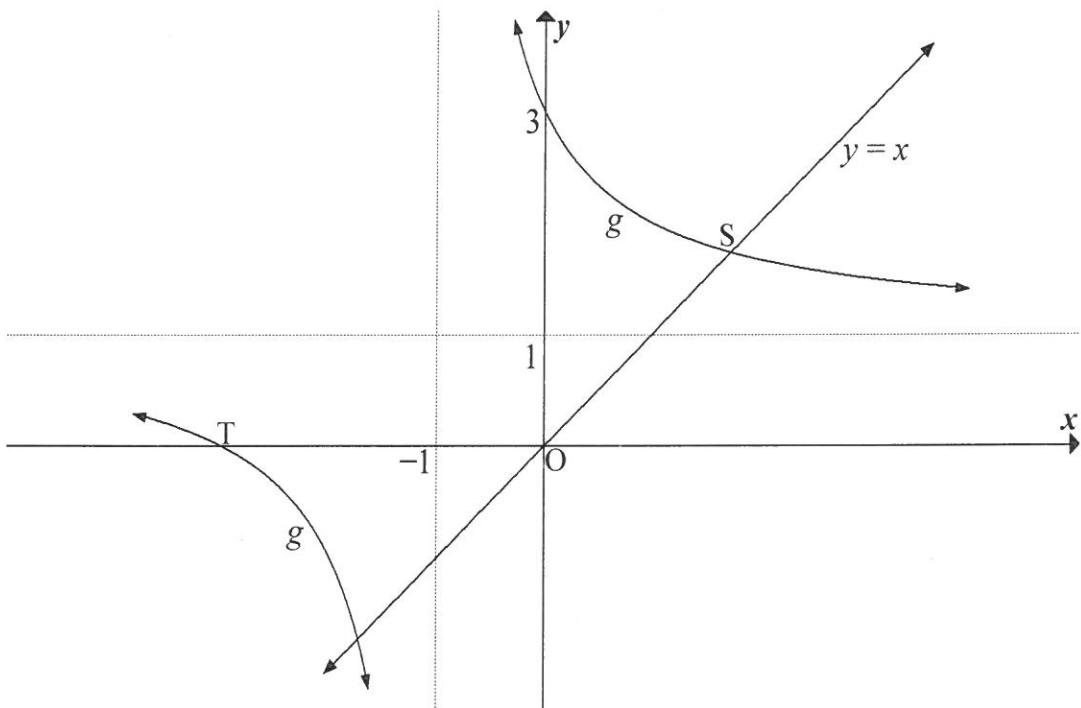
2.5 How many terms in the series are divisible by 4? (4)  
**[12]**

**QUESTION 3**

- 3.1 Given the quadratic sequence:  $-1 ; -7 ; -11 ; p ; \dots$
- 3.1.1 Write down the value of  $p$ . (2)
- 3.1.2 Determine the  $n^{\text{th}}$  term of the sequence. (4)
- 3.1.3 The first difference between two consecutive terms of the sequence is 96.  
Calculate the values of these two terms. (4)
- 3.2 The first three terms of a geometric sequence are:  $16 ; 4 ; 1$
- 3.2.1 Calculate the value of the 12<sup>th</sup> term. (Leave your answer in simplified exponential form.) (3)
- 3.2.2 Calculate the sum of the first 10 terms of the sequence. (2)
- 3.3 Determine the value of:  $\left(1 + \frac{1}{2}\right)\left(1 + \frac{1}{3}\right)\left(1 + \frac{1}{4}\right)\left(1 + \frac{1}{5}\right) \dots$  up to 98 factors. (4)  
**[19]**

**QUESTION 4**

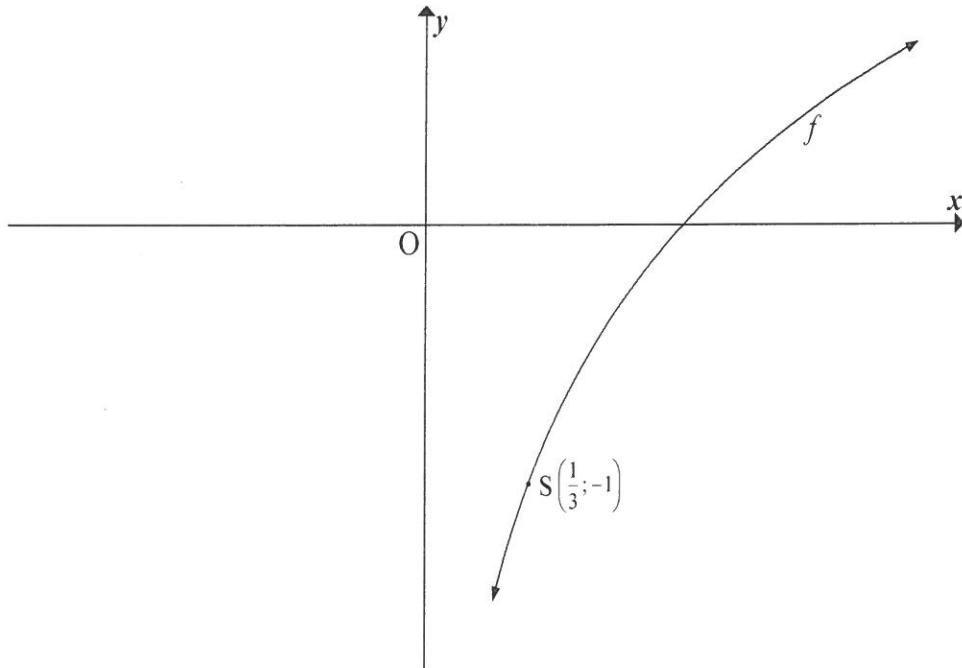
The diagram below shows the hyperbola  $g$  defined by  $g(x) = \frac{2}{x+p} + q$  with asymptotes  $y = 1$  and  $x = -1$ . The graph of  $g$  intersects the  $x$ -axis at  $T$  and the  $y$ -axis at  $(0; 3)$ . The line  $y = x$  intersects the hyperbola in the first quadrant at  $S$ .



- 4.1 Write down the values of  $p$  and  $q$ . (2)
  - 4.2 Calculate the  $x$ -coordinate of  $T$ . (2)
  - 4.3 Write down the equation of the vertical asymptote of the graph of  $h$ , if  $h(x) = g(x+5)$  (1)
  - 4.4 Calculate the length of  $OS$ . (5)
  - 4.5 For which values of  $k$  will the equation  $g(x) = x + k$  have two real roots that are of opposite signs? (1)
- [11]**

**QUESTION 5**

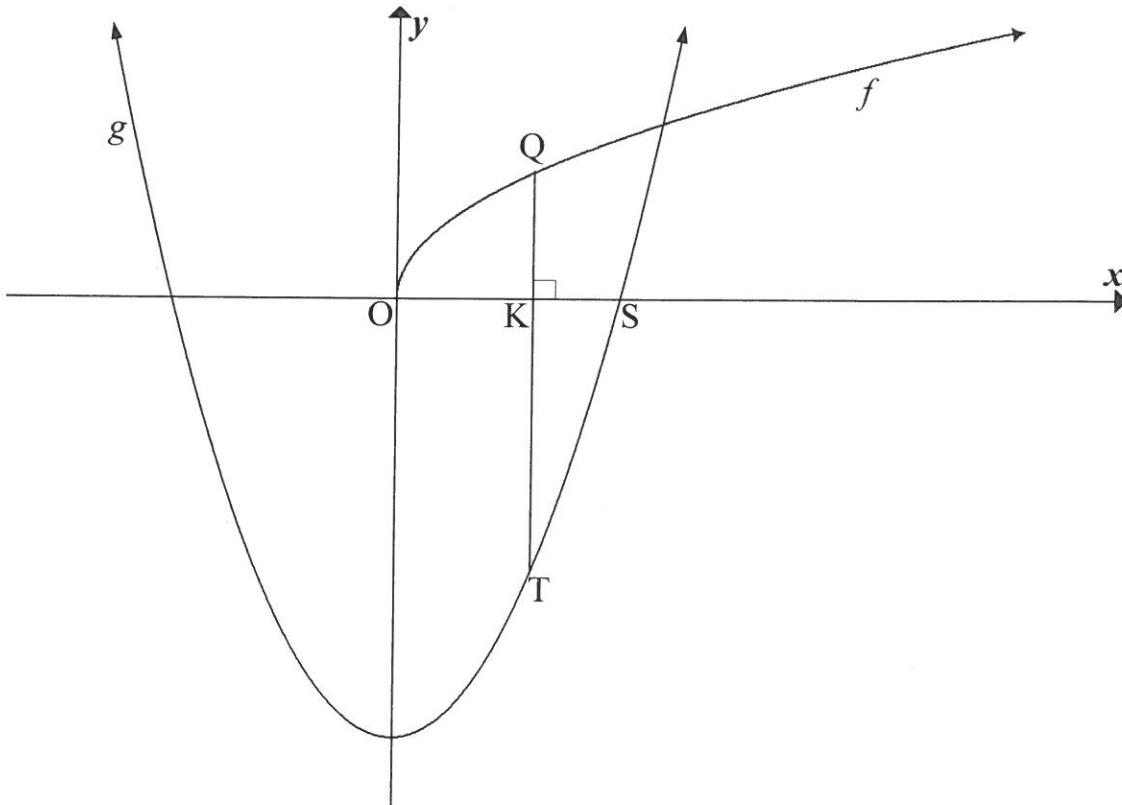
Given:  $f(x) = \log_a x$  where  $a > 0$ .  $S\left(\frac{1}{3}; -1\right)$  is a point on the graph of  $f$ .



- 5.1 Prove that  $a = 3$ . (2)
- 5.2 Write down the equation of  $h$ , the inverse of  $f$ , in the form  $y = \dots$  (2)
- 5.3 If  $g(x) = -f(x)$ , determine the equation of  $g$ . (1)
- 5.4 Write down the domain of  $g$ . (1)
- 5.5 Determine the values of  $x$  for which  $f(x) \geq -3$ . (3)
- [9]

**QUESTION 6**

Given:  $g(x) = 4x^2 - 6$  and  $f(x) = 2\sqrt{x}$ . The graphs of  $g$  and  $f$  are sketched below. S is an  $x$ -intercept of  $g$  and K is a point between O and S. The straight line QKT with Q on the graph of  $f$  and T on the graph of  $g$ , is parallel to the  $y$ -axis.



- 6.1 Determine the  $x$ -coordinate of S, correct to TWO decimal places. (2)
  - 6.2 Write down the coordinates of the turning point of  $g$ . (2)
  - 6.3
    - 6.3.1 Write down the length of QKT in terms of  $x$ , where  $x$  is the  $x$ -coordinate of K. (3)
    - 6.3.2 Calculate the maximum length of QT. (6)
- [13]

**QUESTION 7**

- 7.1 Exactly five years ago Mpume bought a new car for R145 000. The current book value of this car is R72 500. If the car depreciates by a fixed annual rate according to the reducing-balance method, calculate the rate of depreciation. (3)
- 7.2 Samuel took out a home loan for R500 000 at an interest rate of 12% per annum, compounded monthly. He plans to repay this loan over 20 years and his first payment is made one month after the loan is granted.
- 7.2.1 Calculate the value of Samuel's monthly instalment. (4)
- 7.2.2 Melissa took out a loan for the same amount and at the same interest rate as Samuel. Melissa decided to pay R6 000 at the end of every month. Calculate how many months it took for Melissa to settle the loan. (4)
- 7.2.3 Who pays more interest, Samuel or Melissa? Justify your answer. (2)  
[13]

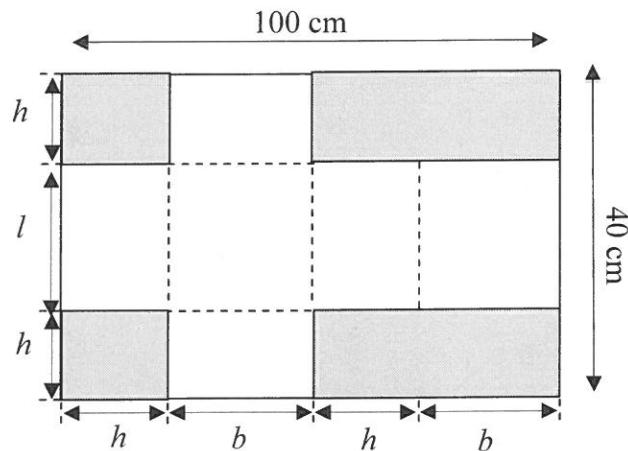
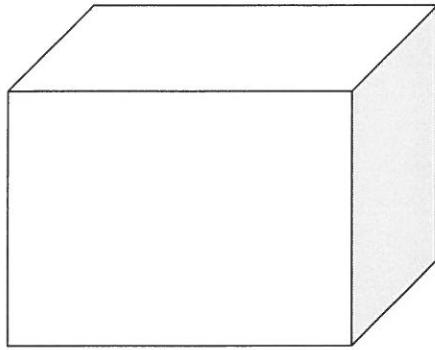
**QUESTION 8**

- 8.1 Determine  $f'(x)$  from first principles if  $f(x) = x^3$ . (5)
- 8.2 Determine the derivative of:  $f(x) = 2x^2 + \frac{1}{2}x^4 - 3$  (2)
- 8.3 If  $y = (x^6 - 1)^2$ , prove that  $\frac{dy}{dx} = 12x^5\sqrt{y}$ , if  $x > 1$ . (3)
- 8.4 Given:  $f(x) = 2x^3 - 2x^2 + 4x - 1$ . Determine the interval on which  $f$  is concave up. (4)  
[14]

**QUESTION 9**

Given:  $f(x) = (x + 2)(x^2 - 6x + 9)$   
 $= x^3 - 4x^2 - 3x + 18$

- 9.1 Calculate the coordinates of the turning points of the graph of  $f$ . (6)
- 9.2 Sketch the graph of  $f$ , clearly indicating the intercepts with the axes and the turning points. (4)
- 9.3 For which value(s) of  $x$  will  $x \cdot f'(x) < 0$ ? (3)  
[13]

**QUESTION 10**

A box is made from a rectangular piece of cardboard, 100 cm by 40 cm, by cutting out the shaded areas and folding along the dotted lines as shown in the diagram above.

- 10.1 Express the length  $l$  in terms of the height  $h$ . (1)
- 10.2 Hence prove that the volume of the box is given by  $V = h(50-h)(40-2h)$  (3)
- 10.3 For which value of  $h$  will the volume of the box be a maximum? (5)  
[9]

**QUESTION 11**

A survey concerning their holiday preferences was done with 180 staff members. The options they could choose from were to:

- Go to the coast
- Visit a game park
- Stay at home

The results were recorded in the table below:

	<b>Coast</b>	<b>Game Park</b>	<b>Home</b>	<b>Total</b>
<b>Male</b>	46	24	13	83
<b>Female</b>	52	38	7	97
<b>Total</b>	98	62	20	180

11.1 Determine the probability that a randomly selected staff member:

    11.1.1 Is male (1)

    11.1.2 Does not prefer visiting a game park (2)

11.2 Are the events 'being a male' and 'staying at home' independent events. Motivate your answer with relevant calculations.

(4)  
[7]

**QUESTION 12**

12.1 A password consists of five different letters of the English alphabet. Each letter may be used only once. How many passwords can be formed if:

    12.1.1 All the letters of the alphabet can be used (2)

    12.1.2 The password must start with a 'D' and end with an 'L' (2)

12.2 Seven cars of different manufacturers, of which 3 are silver, are to be parked in a straight line.

    12.2.1 In how many different ways can ALL the cars be parked? (2)

    12.2.2 If the three silver cars must be parked next to each other, determine in how many different ways the cars can be parked.

(3)  
[9]

**TOTAL:** 150

### INFORMATION SHEET

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$y = mx + c$$

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

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

$$m = \tan \theta$$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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



# basic education

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

## NATIONAL SENIOR CERTIFICATE

**GRADE/GRAAD 12**

**MATHEMATICS P1/WISKUNDE VI**

**NOVEMBER 2014**

**MEMORANDUM**

**MARKS: 150**

**PUNTE: 150**

This memorandum consists of 22 pages.  
*Hierdie memorandum bestaan uit 22 bladsye.*

**NOTE:**

- If a candidate answers a question TWICE, only mark the FIRST attempt.
- Consistent accuracy applies in all aspects of the marking memorandum.

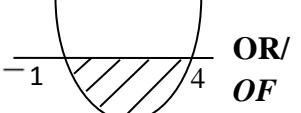
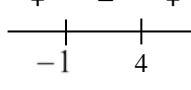
**LET WEL:**

- *Indien 'n kandidaat 'n vraag TWEE keer beantwoord, merk slegs die EERSTE poging.*
- *Volgehoue akkuraatheid is DEURGAANS op ALLE aspekte van die memorandum van toepassing.*

**QUESTION/VRAAG 1**

1.1.1	$(x - 2)(4 + x) = 0$ $x = 2 \quad \text{or} \quad x = -4$	$\checkmark x = 2$ $\checkmark x = -4$ (2)
1.1.2	$3x^2 - 2x - 14 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $x = \frac{2 \pm \sqrt{(-2)^2 - 4(3)(-14)}}{2(3)}$ $= \frac{2 \pm \sqrt{172}}{6}$ $x = 2,52 \quad \text{or/of} \quad x = -1,85$	$\checkmark$ standard form/standaardvorm $\checkmark$ substitution into correct formula/ substitusie in korrekte formule $\checkmark \checkmark$ answers/ antwoorde (4)
	<b>OR/OF</b> $x^2 - \frac{2}{3}x + \frac{1}{9} = \frac{14}{3} + \frac{1}{9}$ $\left(x - \frac{1}{3}\right)^2 = \frac{43}{9}$ $x - \frac{1}{3} = \pm \frac{\sqrt{43}}{3}$ $\therefore x = \frac{1 \pm \sqrt{43}}{3}$ $x = 2,52 \quad \text{or/of} \quad x = -1,85$	$\checkmark$ for adding $\frac{1}{9}$ on both sides/tel $\frac{1}{9}$ by aan beide kante $\checkmark x = \frac{1 \pm \sqrt{43}}{3}$ $\checkmark \checkmark$ answers (4)



	$y = \frac{x-3}{2}$ $3x^2 - 5x\left(\frac{x-3}{2}\right) = 24 + 16\left(\frac{x-3}{2}\right)$ $3x^2 - \frac{5x^2 - 15x}{2} = 24 + \frac{16x - 48}{2}$ $\times 2: 6x^2 - 5x^2 + 15x = 48 + 16x - 48$ $x^2 - x = 0$ $x(x-1) = 0$ $x = 0 \text{ or } x = 1$ $y = -\frac{3}{2} \text{ or } y = -1$	✓ substitution/ <i>substitusie</i> ✓ simplification/ <i>vereenvoudiging</i> ✓ standard form / <i>standard vorm</i> ✓ factors/ <i>faktore</i> ✓ x- values/ <i>x-waardes</i> ✓ y-values/ <i>y-waardes</i> (6)
1.3	$(x-1)(x-2) < 6$ $x^2 - 3x + 2 < 6$ $x^2 - 3x - 4 < 0$ $(x+1)(x-4) < 0$  <b>OR/OF</b>  $-1 < x < 4 \text{ or } x \in (-1; 4)$	✓ standard form/ <i>standaardvorm</i> ✓ factorisation/ <i>faktorisering</i> ✓ critical values in the context of inequality / <i>kritiese waardes in die konteks van die ongelykheid</i> ✓ notation/ <i>notasie</i> (4)
1.4	$-k - 4 \geq 0$ $k \leq -4$	✓ $-k - 4 \geq 0$ ✓ answer/ <i>antwoord</i> (2) <b>[21]</b>

**QUESTION/VRAAG 2**

2.1	$T_4 = 23$	✓ 23 (1)
2.2	$\begin{aligned} T_{251} &= a + (n-1)d \\ &= 2 + (251-1)(7) \\ &= 1752 \end{aligned}$	✓ $a = 2$ and $d = 7$ ✓ subst. into correct formula /subt. in korrekte formule ✓ 1752 (3)
2.3	$\sum_{n=1}^{251} (7n - 5)$ <p><b>OR/OF</b></p> $\sum_{p=0}^{250} (7p + 2)$	✓ general term/ algemene term ✓ complete answer /volledige antwoord (2)  ✓ general term/ algemene term ✓ complete answer / volledige antwoord (2)
2.4	$\begin{aligned} S_n &= \frac{n}{2}[a + l] \\ S_n &= \frac{251}{2}[2 + 1752] \\ &= 220127 \end{aligned}$ <p><b>OR/OF</b></p> $\begin{aligned} S_n &= \frac{n}{2}[2a + (n-1)d] \\ &= \frac{251}{2}[2(2) + (251-1)(7)] \\ &= 220127 \end{aligned}$	✓ substitution/substitusie ✓ 220127 (2)  ✓ substitution/substitusie ✓ 220127 (2)
2.5	<p>The new series/Die nuwe reeks is <math>16 + 44 + 72 + \dots + 1752</math></p> $16 + 28(n-1) = 1752$ $1736 = 28(n-1)$ $62 = n-1$ $n = 63$ <p><b>OR/OF</b></p> $2 + 9 + \underline{16} + 23 + 30 + 37 + \underline{44} + 51 + \dots + \underline{1752}$ <p><math>T_3</math> is divisible by /is deelbaar deur 4</p> <p>Then <math>T_7, T_{11}, T_{15}, \dots, T_{251}</math> are divisible by 4, thus each 4<sup>th</sup> term is divisible by 4.</p> <p>Daarna is <math>T_7, T_{11}, T_{15}, \dots, T_{251}</math> deelbaar deur 4, d.w.s. elke 4<sup>de</sup> term is deelbaar deur 4.</p> $\therefore \text{number of terms divisible by 4 will be } = \frac{251-3}{4} + 1 = 63$ $\therefore \text{aantal terme deelbaar deur 4 sal wees } = \frac{251-3}{4} + 1 = 63$ <p><b>OR/OF</b></p>	✓✓ generating new series divisible by 4/ vorming van nuwe reeks deelbaar deur 4 ✓ $T_n = 1752$ ✓ 63 (4)  ✓ $T_3$ is divisible by 4/ is deelbaar deur 4 ✓ identifying terms divisible by 4/ identifiseer terme deelbaar deur 4 ✓ reasoning/redenering ✓ 63 (4)

	<p>Position of terms divisible by 4: 3 ; 7 ; 11 ; ...; 247; 251 <math>T_n = 4n - 1 = 251</math> <math>4n = 252</math> <math>n = 63</math></p>	<p>✓✓ generating sequence involving position of terms/<i>vorming van reeks i.t.v. posisie van terme</i> ✓ <math>T_n = 251</math> ✓ 63 (4)</p>
		[12]

**QUESTION/VRAAG 3**

3.1.1	$\begin{array}{ccccccc} -1 & ; & -7 & ; & -11 & ; & p \quad ; \dots \\ \swarrow & \searrow & \swarrow & & \swarrow & & \\ -6 & & -4 & & p+11 & & \\ & \swarrow & \searrow & & & & \\ & 2 & & 2 & & & \\ p+11 - (-4) & = 2 & & & & & \\ p+15 & = 2 & & & & & \\ p & = -13 & & & & &  \end{array}$ <p><b>OR/OF</b></p> $\begin{array}{ccccccc} -1 & ; & -7 & ; & -11 & ; & p \quad ; \dots \\ \swarrow & \searrow & \swarrow & & \swarrow & & \\ -6 & & -4 & & p+11 & & \\ & \swarrow & \searrow & & & & \\ & 2 & & 2 & & & \\ p+11 & = -2 & & & & & \\ p & = -13 & & & & &  \end{array}$	$\checkmark p + 15 = 2$ $\checkmark p = -13$ (2)
3.1.2	$2a = 2$ $a = 1$  $3a + b = -6$ $3(1) + b = -6$ $b = -9$  $a + b + c = -1$ $1 - 9 + c = -1$ $c = 7$  $T_n = n^2 - 9n + 7$	$\checkmark a = 1$  $\checkmark b = -9$  $\checkmark c = 7$  $\checkmark$ answer/antwoord (4)
	<p><b>OR/OF</b></p> $\begin{aligned} T_n &= T_1 + (n-1)d_1 + \frac{(n-1)(n-2)d_2}{2} \\ &= -1 + (n-1)(-6) + \frac{(n-1)(n-2)(2)}{2} \\ &= -1 - 6n + 6 + \frac{2n^2 - 6n + 4}{2} \\ &= n^2 - 9n + 7 \end{aligned}$	$\checkmark$ formula/formule $\checkmark$ substitution of first and second differences/substitusie van eerste en tweede verskille $\checkmark$ simplification/vereenvoudiging $\checkmark$ answer/antwoord (4)

<p><b>OR/OF</b></p> $7; -1 ; -7 ; -11 ; p ; \dots$ $\begin{array}{ccccccc} & \swarrow & \searrow & \swarrow & \searrow & \\ -8 & & -6 & & -4 & & p+11 \\ & \searrow & \swarrow & \searrow & \swarrow & & \\ & 2 & & 2 & & 2 & \end{array}$ $T_0 = 7 = c$ $2a = 2 \therefore a = 1$ $3a + b = -6 \therefore b = -9$ $T_n = n^2 - 9n + 7$ <p><b>OR/OF</b></p> $a = \frac{1}{2}(2) = 1$ $\therefore T_n = n^2 + bn + c$ $T_1 = -1 \therefore 1 + b + c = -1 \dots\dots(1)$ $T_2 = -7 \therefore 4 + 2b + c = -7 \dots\dots(2)$ $(2) - (1): 3 + b = -6$ $\therefore b = -9$ $\text{sub in (1): } c = 7$ $\therefore T_n = n^2 - 9n + 7$	<p>✓ <i>c</i>-value/<i>c</i>-waarde  ✓ <i>a</i>-value/<i>a</i>-waarde  ✓ <i>b</i>-value/<i>b</i>-waarde</p> <p>✓ answer/antwoord</p> <p style="text-align: right;">(4)</p> <p>✓ <i>a</i>-value/<i>a</i>-waarde</p> <p>✓ <i>b</i>-value/<i>b</i>-waarde  ✓ <i>c</i>-value/<i>c</i>-waarde</p> <p>✓ answer/antwoord</p> <p style="text-align: right;">(4)</p>
---	---

3.1.3	<p>The sequence of first differences is/<i>Die reeks van eerste verskille is:</i></p> $-6 ; -4 ; -2 ; 0 ; \dots$ $-6+(n-1)(2) = 96$ $n = 52$ <p>∴ two terms are/<i>twee terme is:</i></p> $T_{52} = 52^2 - 9(52) + 7 = 2243$ $T_{53} = 53^2 - 9(53) + 7 = 2339$ <p><b>OR/OF</b></p> <p>The sequence of first differences is/<i>Die reeks van eerste verskille is:</i></p> $-6 ; -4 ; -2 ; 0 ; \dots$ <p>The formula for the sequence of first differences/<i>Die formule vir die reeks van eerste verskille</i> is <math>T_n = 2n - 8</math></p> <p>1<sup>st</sup> difference/1<sup>ste</sup> verskil: <math>2n - 8 = 96</math></p> $2n = 104$ $n = 52$ <p>∴ two terms are/<i>twee terme is:</i></p> $T_{52} = 52^2 - 9(52) + 7 = 2243$ $T_{53} = 53^2 - 9(53) + 7 = 2339$ <p><b>OR/OF</b></p> $T_n - T_{n-1} = 96$ $(n^2 - 9n + 7) - [(n-1)^2 - 9(n-1) + 7] = 96$ $n^2 - 9n + 7 - n^2 + 2n - 1 + 9n - 9 - 7 = 96$ $2n = 106$ $n = 53$ $T_{52} = 52^2 - 9(52) + 7 = 2243$ $T_{53} = 53^2 - 9(53) + 7 = 2339$	$\checkmark -6+(n-1)(2) = 96$ $\checkmark 52$ $\checkmark 2\ 243$ $\checkmark 2\ 339$ (4)
	<p><b>OR/OF</b></p> $T_{n+1} - T_n = 96$ $[(n+1)^2 - 9(n+1) + 7] - [n^2 - 9n + 7] = 96$ $n^2 + 2n + 1 - 9n - 9 + 7 - n^2 + 9n - 7 = 96$ $2n = 104$ $n = 52$ $T_{52} = 52^2 - 9(52) + 7 = 2243$ $T_{53} = 53^2 - 9(53) + 7 = 2339$	$\checkmark T_{n+1} - T_n = 96$ $\checkmark 52$ $\checkmark 2\ 243$ $\checkmark 2\ 339$ (4)

3.2.1	$T_{12} = 16 \left( \frac{1}{4} \right)^{12-1}$ $= \frac{1}{4^9} \quad \text{or} \quad 4^{-9} \quad \text{or} \quad \frac{1}{2^{18}} \quad \text{or} \quad 2^{-18}$	✓ $a = 16$ and $r = \frac{1}{4}$ ✓ subst. into correct formula/ <i>subt in korrekte formule</i> ✓ answer/antwoord (3)
3.2.2	$S_{10} = \frac{16 \left( 1 - \left( \frac{1}{4} \right)^{10} \right)}{1 - \frac{1}{4}}$ $= 21,33$ <p><b>OR/OF</b></p> $S_{10} = \frac{16 \left( \left( \frac{1}{4} \right)^{10} - 1 \right)}{\frac{1}{4} - 1}$ $= 21,33$	✓ substitution into correct formula / <i>substitusie in korrekte formule</i> ✓ answer/antwoord (2)
3.3	$\left( 1 + \frac{1}{2} \right) \left( 1 + \frac{1}{3} \right) \left( 1 + \frac{1}{4} \right) \dots \left( 1 + \frac{1}{99} \right)$ $= \left( \frac{3}{2} \right) \left( \frac{4}{3} \right) \left( \frac{5}{4} \right) \left( \frac{6}{5} \right) \dots \left( \frac{100}{99} \right)$ $= \left( \frac{100}{2} \right)$ $= 50$ <p><b>OR/OF</b></p> $\left( 1 + \frac{1}{2} \right) \left( 1 + \frac{1}{3} \right) \left( 1 + \frac{1}{4} \right) \dots \left( 1 + \frac{1}{99} \right)$ $T_1 = \left( 1 + \frac{1}{2} \right) = \frac{3}{2}$ $T_2 = \frac{3}{2} \left( 1 + \frac{1}{3} \right) = \frac{3}{2} \times \frac{4}{3} = 2$ $T_3 = 2 \left( 1 + \frac{1}{4} \right) = 2 \times \frac{5}{4} = \frac{5}{2}$ $\frac{3}{2}, 2, \frac{5}{2} \dots \text{ is an arithmetic sequence with } a = \frac{3}{2} \text{ and } d = \frac{1}{2}$ $\therefore T_{98} = \frac{3}{2} + (98-1) \frac{1}{2}$ $= \frac{100}{2} = 50$	✓ improper fractions/ <i>onechte breuke</i> ✓ $\left( 1 + \frac{1}{99} \right)$ or $\left( \frac{100}{99} \right)$ ✓✓ answer/antwoord (4)

**QUESTION/VRAAG 4**

4.1	$p = 1$ $q = 1$	✓ $p$ value /waarde ✓ $q$ value /waarde (2)
4.2	$0 = \frac{2}{x+1} + 1$ $-x - 1 = 2$ $x = -3$ <b>OR/OF</b> Reflect $(0 ; 3)$ across $y = -x$ to get $T(-3 ; 0)$ $x = -3$ <i>Reflekteer <math>(0 ; 3)</math> om <math>y = -1</math> om <math>T(-3 ; 0)</math> te kry</i> $x = -3$	✓ $0 = \frac{2}{x+1} + 1$ ✓ $x = -3$ (2) ✓ reflect across/ <i>reflekteer om</i> $y = -x$ ✓ $x = -3$ (2)
4.3	Shifting $g$ five units to the left shifts $(-1 ; 0)$ five units to the left. $x = -6$	✓ answer/antwoord (1)
4.4	$\frac{2}{x+1} + 1 = x$ $2 + x + 1 = x^2 + x$ $x^2 = 3$ $\therefore x = \sqrt{3}$ since at S, $x > 0$ $y = \sqrt{3} = 1,73\dots$ $OS^2 = x^2 + y^2 = 3 + 3 = 6$ $\therefore OS = \sqrt{6} = 2,45$ units/eenhede <b>OR/OF</b>	✓ equating both graphs/stel grafiese gelyk ✓ $x^2 = 3$ ✓ $x = \sqrt{3}$ and $y = \sqrt{3}$ ✓ $OS^2 = 6$ ✓ answer/antwoord (5)

	<p>Translate <math>g</math> one unit down and one unit to the right/<i>Transleer g een eenheid af en een eenheid na regs</i></p> <p>The new equation/<i>Die nuwe vergelyking</i> : <math>p(x) = \frac{2}{x}</math></p> <p>Therefore the image of <math>S</math> is <math>S'(\sqrt{2}; \sqrt{2})</math>/ <i>Daarom is die beeld van S nou <math>S'(\sqrt{2}; \sqrt{2})</math></i></p> <p>Now translate <math>p</math> back to <math>g</math>/<i>Transleer p terug na g</i>: <math>S(\sqrt{2} - 1; \sqrt{2} + 1)</math></p> $OS^2 = (\sqrt{2} - 1)^2 + (\sqrt{2} + 1)^2 = 2 - 2\sqrt{2} + 1 + 2 + 2\sqrt{2} + 1$ $\therefore OS = \sqrt{6} = 2,45 \text{ units/eenhede}$	<p>✓ <math>p(x) = \frac{2}{x}</math></p> <p>✓✓ coord. of/koörd. van <math>S'</math></p> <p>✓ coord. of/koörd. van <math>S</math></p> <p>✓ answer/antwoord (5)</p>
4.5	<p><math>k &lt; 3</math> will give roots with opposite signs/ <i><math>k &lt; 3</math> sal wortels met teenoorgestelde tekens gee</i></p>	<p>✓ <math>k &lt; 3</math> (1)</p> <p>[11]</p>

**QUESTION 5**

5.1	$y = \log_a x$ $-1 = \log_a \frac{1}{3}$ $a^{-1} = \frac{1}{3}$ $a = \left(\frac{1}{3}\right)^{-1}$ $\therefore a = 3$	✓ subt. $\left(\frac{1}{3}; -1\right)$ ✓ $a^{-1} = \frac{1}{3}$ or $a = \left(\frac{1}{3}\right)^{-1}$ (2)
5.2	$h: x = \log_3 y$ $\therefore y = 3^x$	✓ swop $x$ and $y$ /ruil $x$ en $y$ ✓ answer/antwoord (2)
5.3	$g(x) = -\log_3 x$  <b>OR/OF</b> $g(x) = \log_3 \frac{1}{x}$  <b>OR/OF</b> $g(x) = \log_{\frac{1}{3}} x$  <b>OR/OF</b> $x = 3^{-y}$  <b>OR/OF</b> $x = \left(\frac{1}{3}\right)^y$	✓ answer/antwoord (1) ✓ answer/antwoord (1) ✓ answer/antwoord (1) ✓ answer/antwoord (1) ✓ answer/antwoord (1) ✓ answer/antwoord (1)
5.4	$x > 0$  <b>OR/OF</b> $(0; \infty)$	✓ answer/antwoord (1) ✓ answer/antwoord (1)
5.5	$\log_3 x = -3$ $x = 3^{-3}$ $x = \frac{1}{27}$ $x \geq \frac{1}{27}$	✓ exponential form/ eksponensiële vorm ✓ simplification/vereenvoudiging ✓ answer/antwoord (3) [9]

**QUESTION/VRAAG 6**

6.1	$4x^2 - 6 = 0$ $x^2 = \frac{3}{2}$ $x = 1,22$ ( $x$ -coordinate of S is positive)	$\checkmark y = 0$  $\checkmark 1,22$ (2)
6.2	(0 ; -6)	$\checkmark 0$ $\checkmark -6$ (2)
6.3.1	$QT = f(x) - g(x)$ $= 2\sqrt{x} - (4x^2 - 6)$ or $= 2\sqrt{x} - 4x^2 + 6$	$\checkmark \checkmark$ correct formula/ korrekte formule $\checkmark$ substitution/substitusie (3)
6.3.2	$QT = 2x^{\frac{1}{2}} - 4x^2 + 6$ Derivative of $QT = x^{\frac{-1}{2}} - 8x = 0$ $\frac{1}{\sqrt{x}} = 8x$ $x^{\frac{3}{2}} = \frac{1}{8}$ or $\frac{1}{x} = 64x^2$ $x = \left(\frac{1}{8}\right)^{\frac{2}{3}}$ $x = \left(\frac{1}{2}\right)^2$ or $x^3 = \frac{1}{64}$ $x = \frac{1}{4} = 0,25$  Max/Maks $QT = 2\left(\frac{1}{4}\right)^{\frac{1}{2}} - 4\left(\frac{1}{4}\right)^2 + 6$ $= 6\frac{3}{4} = 6,75$ units/eenhede	$\checkmark$ derivative/afgeleide $\checkmark$ derivative equal to 0/ afgeleide gelyk aan 0  $\checkmark x^{\frac{3}{2}} = \frac{1}{8}$  $\checkmark x\text{-value}/x\text{-waarde}$  $\checkmark$ substitution/substitusie  $\checkmark$ answer/antwoord (6) [13]

**QUESTION/VRAAG 7**

7.1	$A = P(1 - i)^n$ $72\ 500 = 145\ 000(1 - i)^5$ $i = 1 - \sqrt[5]{\frac{72500}{145000}}$ $= 0,1294\dots$ <p><math>\therefore</math> Rate of interest/Rentekoers is 12,94 % p.a./p.j.</p> <p><b>OR/OF</b></p> $(1 - i)^5 = \frac{1}{2}$ $\therefore i = 1 - \left(\frac{1}{2}\right)^{\frac{1}{5}}$ $i = 0,1294$ <p><math>\therefore</math> Rate of interest/Rentekoers is 12,94 % p.a./p.j.</p>	✓ substitution/substitusie ✓ writing in terms of $i$ <i>herskryf in terme van <math>i</math></i> ✓ answer/antwoord (3)
7.2.1	$P = \frac{x[1 - (1 + i)^{-n}]}{i}$ $500\ 000 = \frac{x \left[ 1 - \left( 1 + \frac{0,12}{12} \right)^{-240} \right]}{\frac{0,12}{12}}$ $x = \frac{500000 \times \frac{0,12}{12}}{\left[ 1 - \left( 1 + \frac{0,12}{12} \right)^{-240} \right]}$ $x = \text{R}5505,43$	✓ $i = \frac{0,12}{12}$ ✓ $n = 240$ ✓ substitution into correct formula ✓ answer/antwoord (4)

7.2.2	$P = \frac{x[1 - (1 + i)^{-n}]}{i}$ $500000 = \frac{6000 \left[ 1 - \left( 1 + \frac{0,12}{12} \right)^{-n} \right]}{\frac{0,12}{12}}$ $\frac{500000}{6000} \times 0,01 = 1 - (1,01)^{-n}$ $(1,01)^{-n} = 1 - \frac{5}{6}$ $-n = \frac{\log \frac{1}{6}}{\log 1,01}$ $n = 180,07$ <p><math>\therefore</math> Melissa settles the loan in 181 months</p>	✓ 6000 ✓ substitute into correct formula/ <i>substitusie in korrekte formule</i> ✓ use of logs/ <i>gebruik van logs</i> ✓ answer/ <i>antwoord</i> (4)
7.2.3	<p>Samuel  He is paying off his loan over a longer period thus more interest will be paid./<i>Hy betaal sy lening oor 'n langer tydperk af, dus sal hy meer rente betaal.</i></p> <p><b>OR/OF</b></p> <p>Samuel  He will pay/<i>Hy betaal</i> <math>R5505,43 \times 240 - R500\ 000 = R821\ 303,20</math>  She will pay between/<i>Sy sal tussen</i> R580 000 and/<i>en</i> R586 000,00 <i>betaal</i>.</p>	✓ Samuel ✓ reason/ <i>rede</i> (2) ✓ Samuel ✓ reason/ <i>rede</i> (2) <b>[13]</b>

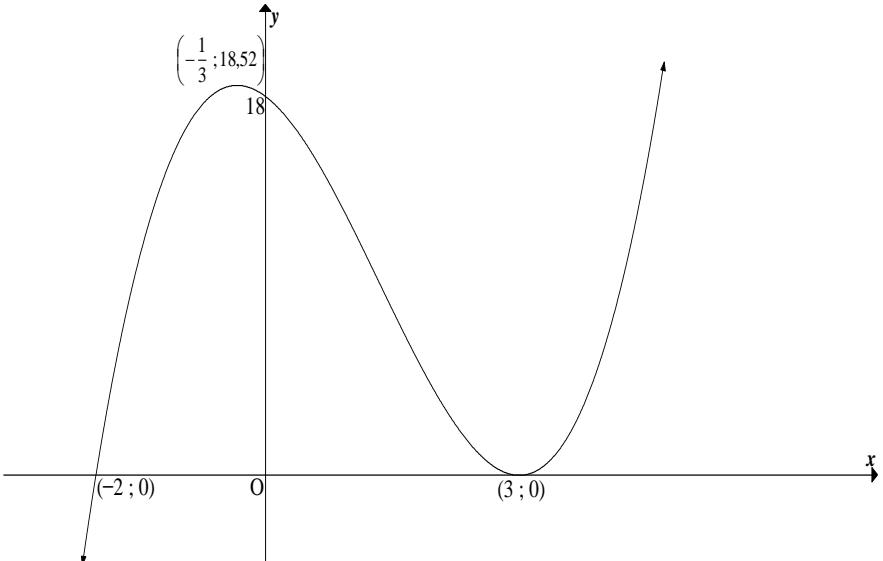
**QUESTION/VRAAG 8**

<p>8.1</p> $\begin{aligned} f(x+h) &= (x+h)^3 = (x^2 + 2xh + h^2)(x+h) \\ &= x^3 + x^2h + 2x^2h + 2xh^2 + h^2x + h^3 \\ &= x^3 + 3x^2h + 3xh^2 + h^3 \end{aligned}$ $\begin{aligned} f(x+h) - f(x) &= x^3 + 3x^2h + 3xh^2 + h^3 - x^3 \\ &= 3x^2h + 3xh^2 + h^3 \end{aligned}$ $\begin{aligned} f'(x) &= \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h} \\ &= \lim_{h \rightarrow 0} \frac{3x^2h + 3xh^2 + h^3}{h} \\ &= \lim_{h \rightarrow 0} \frac{h(3x^2 + 3xh + h^2)}{h} \\ &= \lim_{h \rightarrow 0} (3x^2 + 3xh + h^2) \\ &= 3x^2 \end{aligned}$	<p>✓ simplifying/vereenvoudiging</p> <p>✓ formula/formule</p> <p>✓ subst. into formula/subst. in formule</p> <p>✓ factorization/faktorisering</p> <p>✓ answer/antwoord</p> <p>(5)</p>
<p><b>OR/OF</b></p> $\begin{aligned} f'(x) &= \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h} \\ &= \lim_{h \rightarrow 0} \frac{(x+h)^3 - x^3}{h} \\ &= \lim_{h \rightarrow 0} \frac{(x+h)(x+h)^2 - x^3}{h} \\ &= \lim_{h \rightarrow 0} \frac{(x+h)(x^2 + 2xh + h^2) - x^3}{h} \\ &= \lim_{h \rightarrow 0} \frac{x^3 + 3x^2h + 3xh^2 + h^3 - x^3}{h} \\ &= \lim_{h \rightarrow 0} \frac{h(3x^2 + 3xh + h^2)}{h} \\ &= \lim_{h \rightarrow 0} (3x^2 + 3xh + h^2) \\ &= 3x^2 \end{aligned}$	<p>✓ formula/formule</p> <p>✓ subst. into formula/subst. in formule</p> <p>✓ simplifying/vereenvoudiging</p> <p>✓ factorization/faktorisering</p> <p>✓ answer/antwoord</p>
<p><b>OR</b></p>	<p>(5)</p>

	$  \begin{aligned}  f'(x) &= \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h} \\  &= \lim_{h \rightarrow 0} \frac{(x+h)^3 - x^3}{h} \\  &= \lim_{h \rightarrow 0} \frac{(x+h-x)(x^2 + 2xh + h^2 + x^2 + xh + h^2)}{h} \\  &= \lim_{h \rightarrow 0} \frac{h(3x^2 + 3xh + h^2)}{h} \\  &= \lim_{h \rightarrow 0} (3x^2 + 3xh + h^2) \\  &= 3x^2  \end{aligned}  $	✓ formula/formule ✓ subst. into formula/subst. in formule ✓ factorization/faktorisering ✓ simplifying/vereenvoudiging ✓ answer/antwoord (5)
--	--	--

8.2	$f'(x) = 4x + 2x^3$	✓ $4x$ ✓ $2x^3$ (2)
8.3	$  \begin{aligned}  y &= x^{12} - 2x^6 + 1 \\  \frac{dy}{dx} &= 12x^{11} - 12x^5 \\  &= 12x^5(x^6 - 1) \\  &= 12x^5\sqrt{y}  \end{aligned}  $	✓ simplification/vereenvoudiging ✓ derivative/afgeleide ✓ factors/faktore (3)
8.4	$  \begin{aligned}  f(x) &= 2x^3 - 2x^2 + 4x - 1 \\  f'(x) &= 6x^2 - 4x + 4 \\  f''(x) &= 12x - 4 \\  f \text{ is concave up when} & \text{is konkaaf op as } f''(x) > 0 \\  \therefore 12x - 4 &> 0 \\  12x &> 4 \\  x &> \frac{1}{3}  \end{aligned}  $	✓ first derivative/eerste afgeleide ✓ second derivative/tweede afgeleide ✓ $f''(x) > 0$ ✓ $x > \frac{1}{3}$ (4) [14]

**QUESTION/VRAAG 9**

9.1	$f'(x) = 3x^2 - 8x - 3 = 0$ $(3x + 1)(x - 3) = 0$ $x = -\frac{1}{3}$ or $x = 3$ $y = \frac{500}{27}$ (or $y = 18\frac{14}{27}$ or 18,52) $y = 0$ Turning points are/Draaipunte is $\left(-\frac{1}{3}; \frac{500}{27}\right)$ and $(3; 0)$	✓ derivative/afgeleide ✓ derivative/ afgeleide = 0 ✓ factors/faktore ✓ x-values/waardes ✓✓ each y- values/elke y-waarde (6)
9.2		✓ x-intercepts/afsnitte ✓ y-intercept/afsnit ✓ turning points/ draaipunte ✓ shape/vorm (4)
9.3	$x < -\frac{1}{3}$ or $0 < x < 3$ <b>OR</b> $(-\infty; -\frac{1}{3}) \cup (0; 3)$	✓ $x < -\frac{1}{3}$ ✓ both critical points/ beide kritieke-punte ✓ notation/notasie (3)

**QUESTION/VRAAG 10**

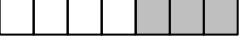
10.1	$\begin{aligned}l + 2h &= 40 \\ l &= 40 - 2h\end{aligned}$	✓ answer (1)
10.2	$\begin{aligned}2b + 2h &= 100 \\ b &= 50 - h \\ V &= lbh \\ V &= h(40 - 2h)(50 - h)\end{aligned}$	✓ $2b + 2h = 100$ ✓ $b = 50 - h$ ✓ volume formula (3)
10.3	$\begin{aligned}V &= (50h - h^2)(40 - 2h) \\ V &= 2h^3 - 140h^2 + 2000h \\ V' &= 6h^2 - 280h + 2000 = 0 \\ h &= \frac{280 \pm \sqrt{(-280)^2 - 4(6)(2000)}}{2(6)} \\ h &\neq 37,86 \text{ or } h = 8,80 \\ \therefore \text{for a box as large as possible, } h &= 8,80 \text{ cm} \\ \text{vir die grootste moontlike boks} &= 8,80 \text{ cm}\end{aligned}$	✓ simplifying/vereenvoudig ✓ derivative / afgeleide ✓ ✓ $h$ -values in any form / $h$ -waardes in enige vorm ✓ answer/antwoord (5) [9]

**QUESTION/VRAAG 11**

11.1.1	$P(\text{male/manlik}) = \frac{83}{180}$ or 0,46 or 46,11%	✓ answer/antwoord (1)
11.1.2	$\begin{aligned}P(\text{not game park/nie wildreservaat}) &= 1 - P(\text{game park/wildreservaat}) \\ &= 1 - \frac{62}{180} \\ &= \frac{59}{90} \text{ or } 0,66 \text{ or } 65,56\% \\ \textbf{OR/OF} \\ P(\text{not game park/nie wildreservaat}) &= \frac{98}{180} + \frac{20}{180} \\ &= \frac{118}{180} \\ &= \frac{59}{90} \text{ or } 0,66 \text{ or } 65,56\%\end{aligned}$	✓ $1 - \frac{62}{180}$ ✓ answer/antwoord (2)  ✓ $\frac{98}{180} + \frac{20}{180}$ ✓ answer/antwoord (2)

11.2	<p>Events are independent if <i>/Gebeure is onafhanklike indien</i>  <math>P(\text{male}) \times P(\text{home}) = P(\text{male and home})</math>  <math>P(\text{manlik}) \times P(\text{huis}) = P(\text{manlik en huis})</math></p> $P(\text{male/manlik}) = \frac{83}{180}$ <p>and/en <math>P(\text{home/huis}) = \frac{20}{180}</math> or 0,11 or 11,11%</p> $P(\text{male/manlik}) \times P(\text{home/huis})$ $= \frac{83}{180} \times \frac{20}{180}$ $= \frac{83}{1620}$ $= 0,05123 \text{ or } 5,12\%$ <p><math>P(\text{male and home/manlik en huis})</math></p> $= \frac{13}{180}$ $= 0,07222\dots \text{ or } 7,22\%$ <p>Therefore <math>P(\text{male}) \times P(\text{home}) \neq P(\text{male and home})</math>  Dus <math>P(\text{manlik}) \times P(\text{huis}) \neq P(\text{manlik en huis})</math>  Thus the events are not independent./<i>Dus is die gebeure nie onafhanklik nie</i></p> <p><b>OR/OF</b></p> <table border="1" data-bbox="244 1201 981 1387"> <thead> <tr> <th></th><th>Home/<i>Huis</i></th><th>Not Home/<i>Nie huis</i></th><th></th></tr> </thead> <tbody> <tr> <td>M</td><td>13</td><td>70</td><td>83</td></tr> <tr> <td>F</td><td>7</td><td>90</td><td>97</td></tr> <tr> <td></td><td>20</td><td>160</td><td>180</td></tr> </tbody> </table> <p><math>P(\text{female/vroulik}) \times P(\text{not home/nie huis})</math></p> $= \frac{97}{180} \times \frac{160}{180}$ $= \frac{194}{405}$ $= 0,479012345\dots \text{ or } 47,90\%$ <p><math>P(\text{female and not home/vroulik en nie-huis})</math></p> $= \frac{90}{180}$ $= 0,5 \text{ or } 50\%$ <p>Therefore <math>P(\text{female}) \times P(\text{not home}) \neq P(\text{female and not home})</math>  Thus the events are not independent.  <i>Dus P(vroulik) \times P(\text{nie-huis}) \neq P(\text{vroulik en nie-huis})</i>  <i>Dus is die gebeure nie onafhanklik nie.</i></p>		Home/ <i>Huis</i>	Not Home/ <i>Nie huis</i>		M	13	70	83	F	7	90	97		20	160	180	<p>✓ <math>P(m) \times P(h)</math> and their values/en hulle waardes</p> <p>✓ answer of product</p> <p>✓ <math>P(m \text{ and/en } h)</math> value/waarde</p> <p>✓ conclusion/afleiding (4)</p> <p>✓ <math>P(f) \times P(\text{not } h)</math> and their values/en hulle waardes</p> <p>✓ answer of product</p> <p>✓ <math>P(f \text{ and/en not } h)</math> value/waarde</p> <p>✓ conclusion/afleiding (4)</p> <p>[7]</p>
	Home/ <i>Huis</i>	Not Home/ <i>Nie huis</i>																
M	13	70	83															
F	7	90	97															
	20	160	180															

**QUESTION/VRAAG 12**

12.1.1	$26 \times 25 \times 24 \times 23 \times 22$ = 7 893 600  <b>OR/OF</b> ${}^{26}P_5 = \frac{26!}{(26-5)!} = \frac{26!}{21!} = 7\ 893\ 600$	✓ $26 \times 25 \times 24 \times 23 \times 22$ ✓ 7 893 600 (2)  ✓ formula/formule ✓ answer/antwoord (2)
12.1.2	$24 \times 23 \times 22$ = 12 144	✓ $24 \times 23 \times 22$ ✓ 12 144 (2)
12.2.1	$7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1$ = 5 040	✓ product/produk ✓ 5 040 (2)
12.2.2	( $3 \times 2 \times 1$ ) ( $5 \times 4 \times 3 \times 2 \times 1$ ) = 720  <b>OR/OF</b>  The five 'units' can be parked in $5 \times 4 \times 3 \times 2 \times 1$ ways./Die vyf 'eenhede' kan op $5 \times 4 \times 3 \times 2 \times 1$ maniere geparkeer word. The three silver cars can be parked in $3 \times 2 \times 1$ ways./Die drie silwer motors kan op $3 \times 2 \times 1$ maniere parkeer word. So there are $(3 \times 2 \times 1) (5 \times 4 \times 3 \times 2 \times 1) = 720$ ways to park the cars./Dus is daar $(3 \times 2 \times 1) (5 \times 4 \times 3 \times 2 \times 1) = 720$ maniere om die motors te parkeer.  <b>OR/OF</b>  Suppose for the moment the 3 silver cars are at one end./Veronderstel die drie silwer motors is op die punt. The 3 cars can be arranged in $3 \times 2 \times 1 = 6$ ways./Die 3 motors kan op $3 \times 2 \times 1 = 6$ maniere gerangskik word. For each of them the remaining four cars can be arranged in $4 \times 3 \times 2 \times 1 = 24$ ways./Die 4 oorblywende motors kan op $4 \times 3 \times 2 \times 1 = 24$ maniere rangskik word. So $6 \times 24 = 144$ ways if all 3 cars at one end./Dus is daar $6 \times 24 = 144$ maniere as die 3 motors op die punt is.	✓ $3 \times 2 \times 1$ ✓ $5 \times 4 \times 3 \times 2 \times 1$ ✓ 720 (3)  ✓ $5 \times 4 \times 3 \times 2 \times 1$  ✓ $3 \times 2 \times 1$ ✓ 720 (3)  ✓ $6 \times 24 = 144$
	    	Together, the silver cars can only occupy 5 different positions amongst the 7 positions. /Saam kan die silwer motors slegs 5 verskillende posisies hê tussen die 7 moontlike posisies. ∴ Total ways/Totale getal maniere = $5 \times 144 = 720$ (3) [9]

**TOTAL/TOTAAL: 150**



# **basic education**

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

## **NATIONAL SENIOR CERTIFICATE**

**GRADE 12**

**MATHEMATICS P2**

**NOVEMBER 2014**

**MARKS: 150**

**TIME: 3 hours**

**This question paper consists of 14 pages, 6 diagram sheets and 1 information sheet.**

**INSTRUCTIONS AND INFORMATION**

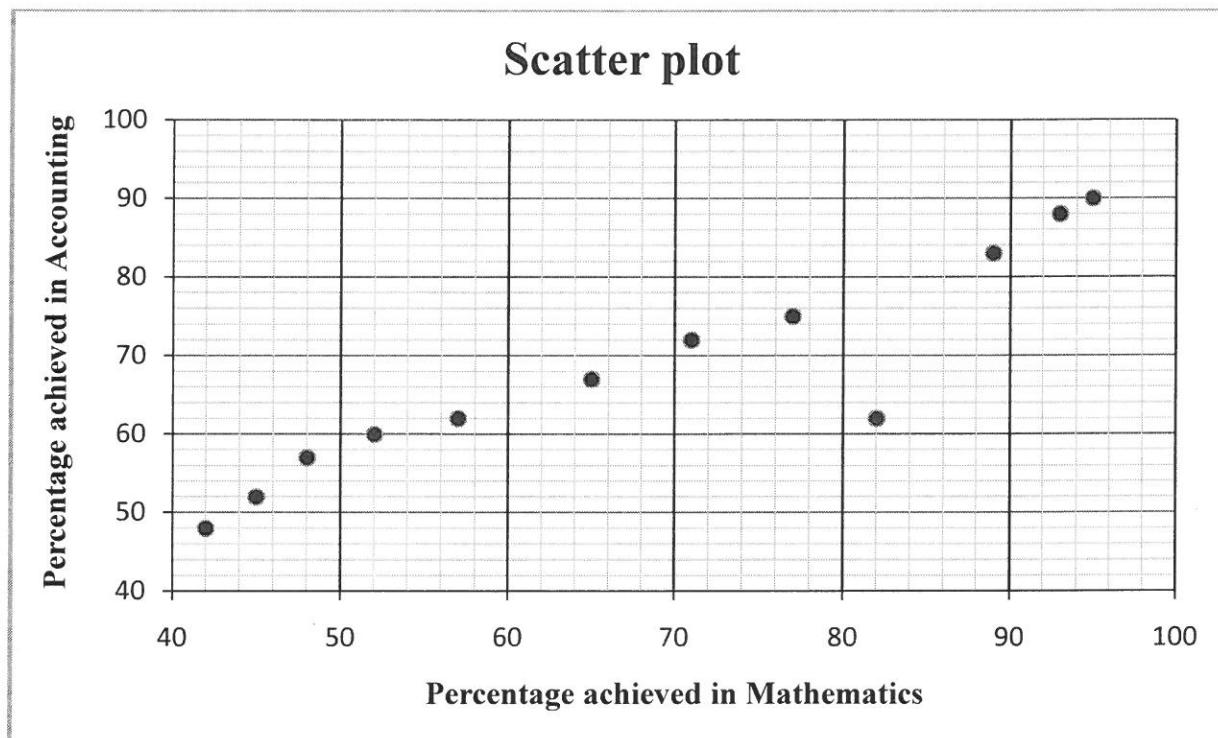
Read the following instructions carefully before answering the questions.

1. This question paper consists of 10 questions.
2. Answer ALL the questions.
3. Clearly show ALL calculations, diagrams, graphs, et cetera which you have used in determining the 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. SIX diagram sheets for QUESTIONS 2.2.1, 2.2.2, 7.4, 8.1, 8.2, 8.3, 9.1, 9.2 and 10 are attached at the end of this question paper. Write your centre number and examination number on these sheets in the spaces provided and insert them inside the back cover of your ANSWER BOOK.
8. Diagrams are NOT necessarily drawn to scale.
9. Number the answers correctly according to the numbering system used in this question paper.
10. Write neatly and legibly.

**QUESTION 1**

At a certain school, only 12 candidates take Mathematics and Accounting. The marks, as a percentage, scored by these candidates in the preparatory examinations for Mathematics and Accounting, are shown in the table and scatter plot below.

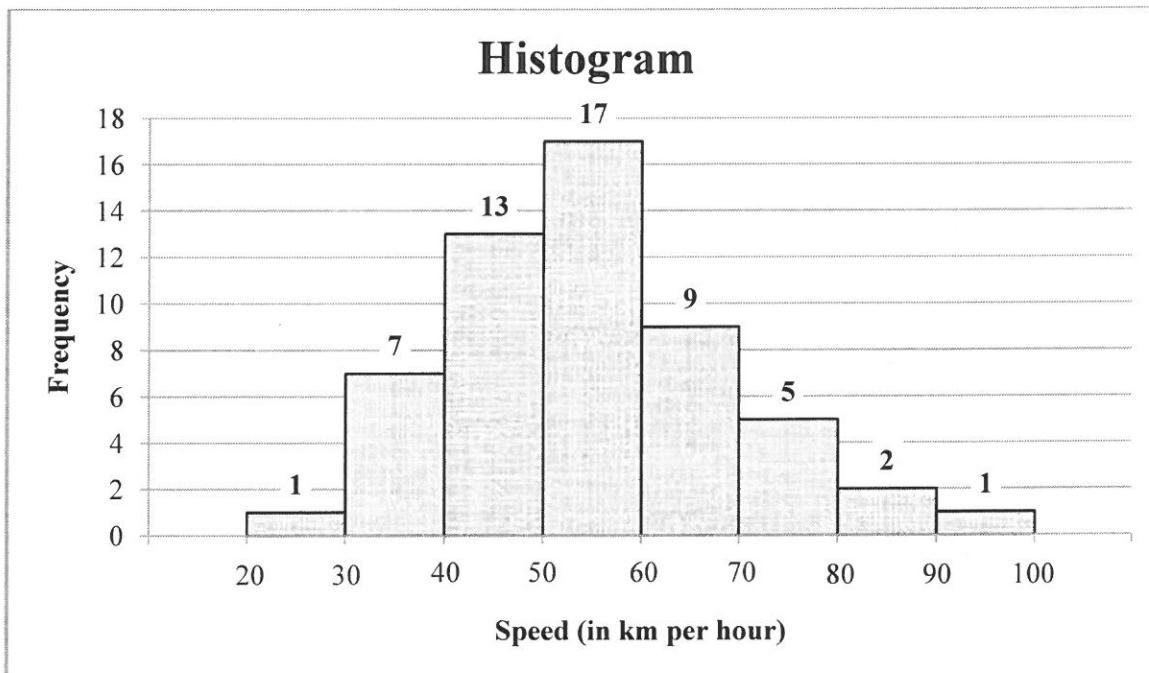
<b>Mathematics</b>	52	82	93	95	71	65	77	42	89	48	45	57
<b>Accounting</b>	60	62	88	90	72	67	75	48	83	57	52	62



- 1.1 Calculate the mean percentage of the Mathematics data. (2)
  - 1.2 Calculate the standard deviation of the Mathematics data. (1)
  - 1.3 Determine the number of candidates whose percentages in Mathematics lie within ONE standard deviation of the mean. (3)
  - 1.4 Calculate an equation for the least squares regression line (line of best fit) for the data. (3)
  - 1.5 If a candidate from this group scored 60% in the Mathematics examination but was absent for the Accounting examination, predict the percentage that this candidate would have scored in the Accounting examination, using your equation in QUESTION 1.4. (Round off your answer to the NEAREST INTEGER.) (2)
  - 1.6 Use the scatter plot and identify any outlier(s) in the data. (1)
- [12]

**QUESTION 2**

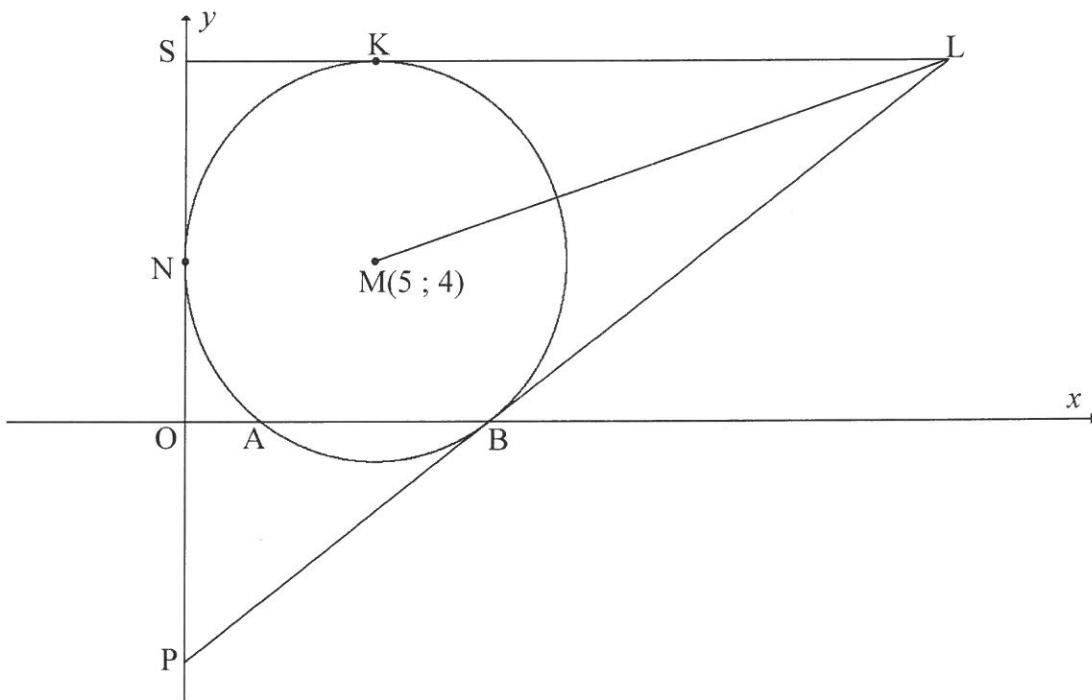
The speeds of 55 cars passing through a certain section of a road are monitored for one hour. The speed limit on this section of road is 60 km per hour. A histogram is drawn to represent this data.



- 2.1 Identify the modal class of the data. (1)
- 2.2 Use the histogram to:
  - 2.2.1 Complete the cumulative frequency column in the table on DIAGRAM SHEET 1 (2)
  - 2.2.2 Draw an ogive (cumulative frequency graph) of the above data on the grid on DIAGRAM SHEET 1 (3)
- 2.3 The traffic department sends speeding fines to all motorists whose speed exceeds 66 km per hour. Estimate the number of motorists who will receive a speeding fine. (2) [8]

**QUESTION 3**

In the diagram below, a circle with centre  $M(5 ; 4)$  touches the  $y$ -axis at  $N$  and intersects the  $x$ -axis at  $A$  and  $B$ .  $PBL$  and  $SKL$  are tangents to the circle where  $SKL$  is parallel to the  $x$ -axis and  $P$  and  $S$  are points on the  $y$ -axis.  $LM$  is drawn.

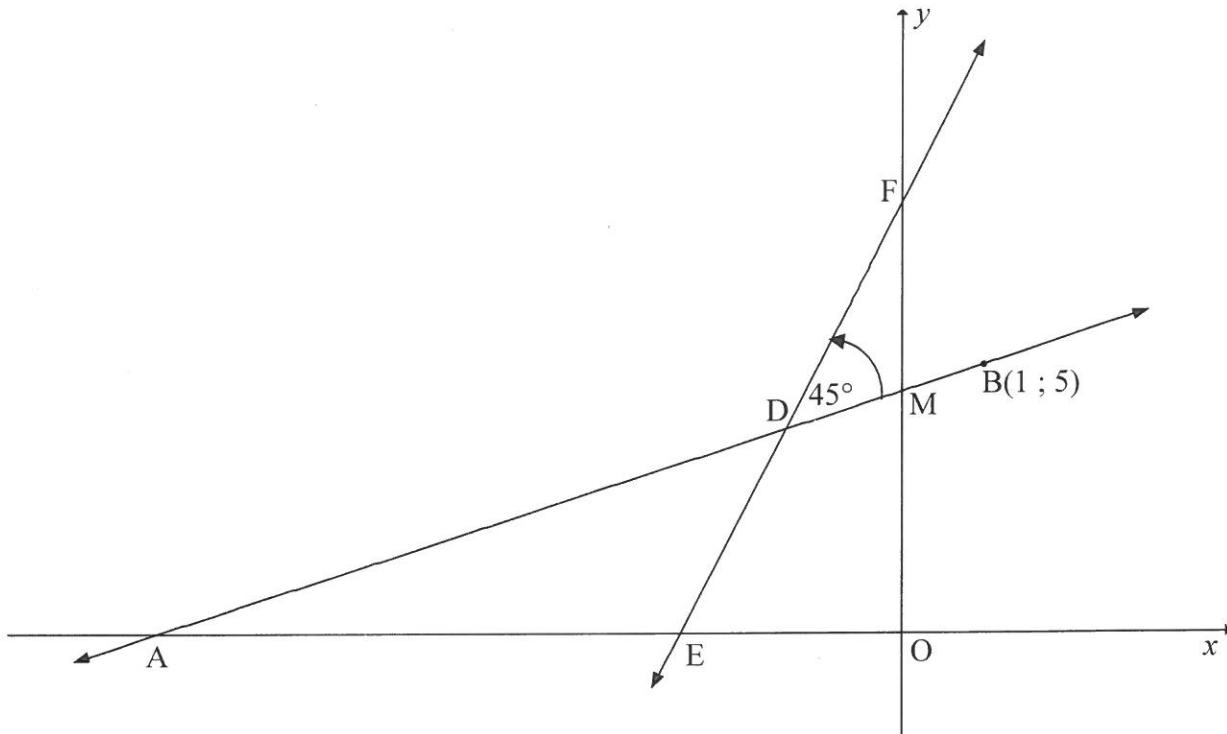


- 3.1 Write down the length of the radius of the circle having centre  $M$ . (1)
- 3.2 Write down the equation of the circle having centre  $M$ , in the form  $(x - a)^2 + (y - b)^2 = r^2$ . (1)
- 3.3 Calculate the coordinates of  $A$ . (3)
- 3.4 If the coordinates of  $B$  are  $(8 ; 0)$ , calculate:
  - 3.4.1 The gradient of  $MB$  (2)
  - 3.4.2 The equation of the tangent  $PB$  in the form  $y = mx + c$  (3)
- 3.5 Write down the equation of tangent  $SKL$ . (2)
- 3.6 Show that  $L$  is the point  $(20 ; 9)$ . (2)
- 3.7 Calculate the length of  $ML$  in surd form. (2)
- 3.8 Determine the equation of the circle passing through points  $K$ ,  $L$  and  $M$  in the form  $(x - p)^2 + (y - q)^2 = c^2$  (5)

[21]

**QUESTION 4**

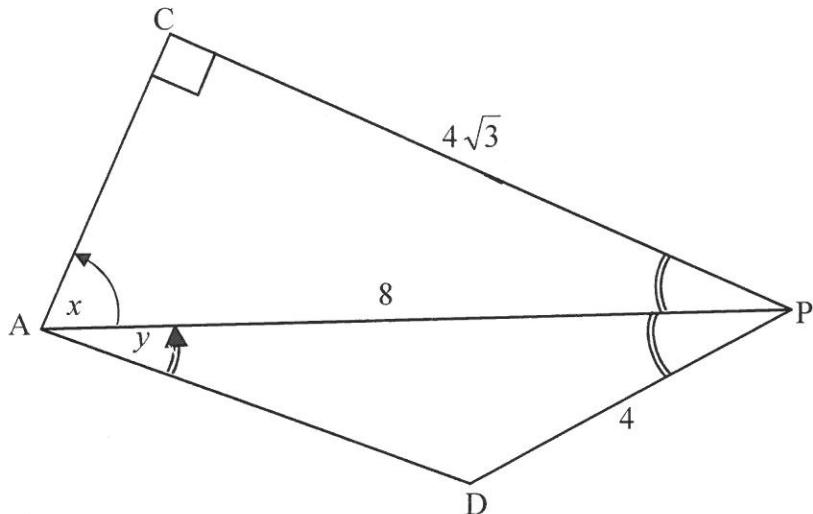
In the diagram below, E and F respectively are the  $x$ - and  $y$ -intercepts of the line having equation  $y = 3x + 8$ . The line through  $B(1 ; 5)$  making an angle of  $45^\circ$  with EF, as shown below, has  $x$ - and  $y$ -intercepts A and M respectively.



- 4.1 Determine the coordinates of E. (2)
- 4.2 Calculate the size of  $\hat{DAE}$ . (3)
- 4.3 Determine the equation of AB in the form  $y = mx + c$ . (4)
- 4.4 If AB has equation  $x - 2y + 9 = 0$ , determine the coordinates of D. (4)
- 4.5 Calculate the area of quadrilateral DMOE. (6)  
[19]

**QUESTION 5**

In the figure below,  $\triangle ACP$  and  $\triangle ADP$  are triangles with  $\hat{C} = 90^\circ$ ,  $CP = 4\sqrt{3}$ ,  $AP = 8$  and  $DP = 4$ .  
 $PA$  bisects  $\hat{DPC}$ . Let  $\hat{CAP} = x$  and  $\hat{DAP} = y$ .



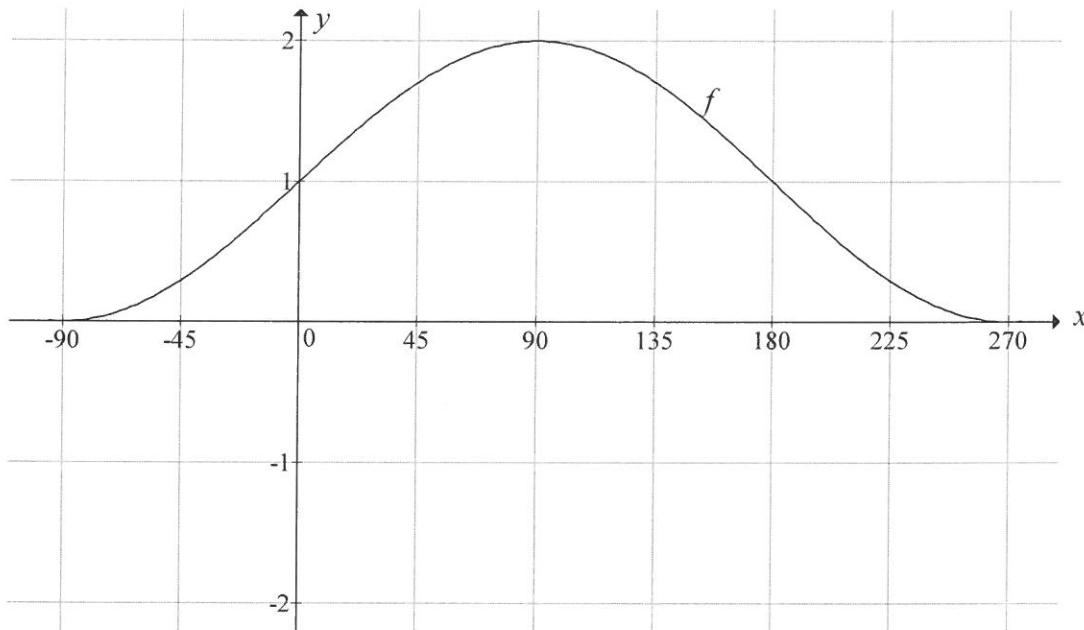
- 5.1 Show, by calculation, that  $x = 60^\circ$ . (2)
- 5.2 Calculate the length of  $AD$ . (4)
- 5.3 Determine  $y$ . (3)  
[9]

**QUESTION 6**

- 6.1 Prove the identity:  $\cos^2(180^\circ + x) + \tan(x - 180^\circ) \sin(720^\circ - x) \cos x = \cos 2x$  (5)
- 6.2 Use  $\cos(\alpha + \beta) = \cos \alpha \cos \beta - \sin \alpha \sin \beta$  to derive the formula for  $\sin(\alpha - \beta)$ . (3)
- 6.3 If  $\sin 76^\circ = x$  and  $\cos 76^\circ = y$ , show that  $x^2 - y^2 = \sin 62^\circ$ . (4)  
[12]

**QUESTION 7**

In the diagram below, the graph of  $f(x) = \sin x + 1$  is drawn for  $-90^\circ \leq x \leq 270^\circ$ .

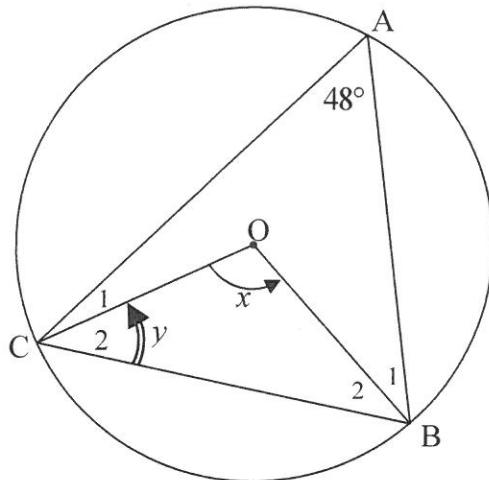


- 7.1 Write down the range of  $f$ . (2)
- 7.2 Show that  $\sin x + 1 = \cos 2x$  can be rewritten as  $(2 \sin x + 1)\sin x = 0$ . (2)
- 7.3 Hence, or otherwise, determine the general solution of  $\sin x + 1 = \cos 2x$ . (4)
- 7.4 Use the grid on DIAGRAM SHEET 2 to draw the graph of  $g(x) = \cos 2x$  for  $-90^\circ \leq x \leq 270^\circ$ . (3)
- 7.5 Determine the value(s) of  $x$  for which  $f(x + 30^\circ) = g(x + 30^\circ)$  in the interval  $-90^\circ \leq x \leq 270^\circ$ . (3)
- 7.6 Consider the following geometric series:  

$$1 + 2 \cos 2x + 4 \cos^2 2x + \dots$$
  
 Use the graph of  $g$  to determine the value(s) of  $x$  in the interval  $0^\circ \leq x \leq 90^\circ$  for which this series will converge. (5)  
**[19]**

**GIVE REASONS FOR YOUR STATEMENTS IN QUESTIONS 8, 9 AND 10.****QUESTION 8**

- 8.1 In the diagram, O is the centre of the circle passing through A, B and C.  
 $\hat{C}AB = 48^\circ$ ,  $\hat{COB} = x$  and  $\hat{C}_2 = y$ .

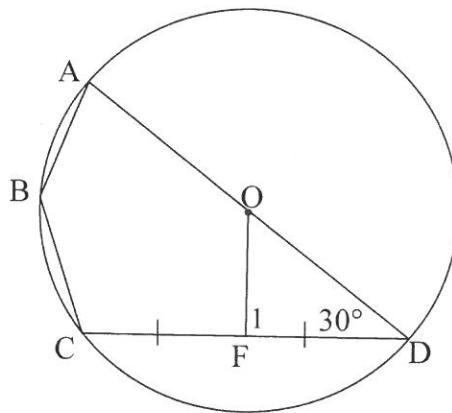


Determine, with reasons, the size of:

8.1.1  $x$  (2)

8.1.2  $y$  (2)

- 8.2 In the diagram, O is the centre of the circle passing through A, B, C and D. AOD is a straight line and F is the midpoint of chord CD.  $\hat{ODF} = 30^\circ$  and OF are joined.

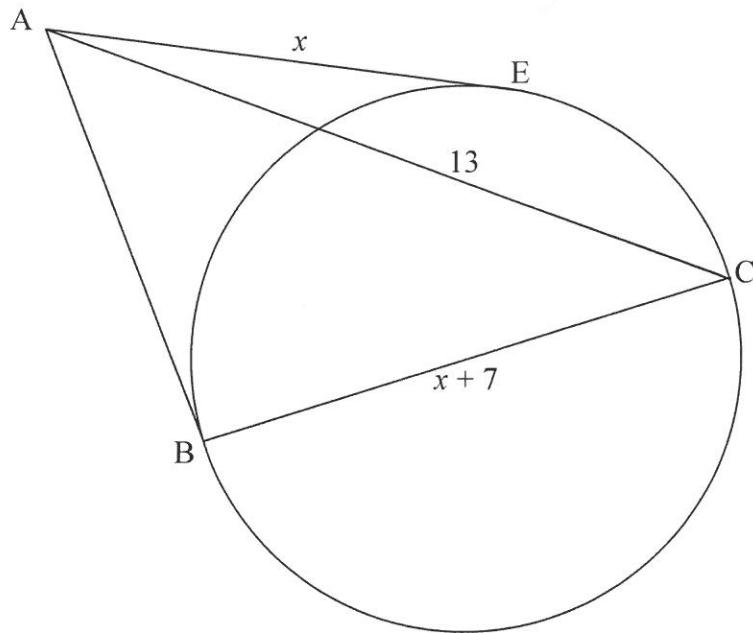


Determine, with reasons, the size of:

8.2.1  $\hat{F}_1$  (2)

8.2.2  $\hat{ABC}$  (2)

- 8.3 In the diagram, AB and AE are tangents to the circle at B and E respectively. BC is a diameter of the circle.  $AC = 13$ ,  $AE = x$  and  $BC = x + 7$ .



- 8.3.1 Give reasons for the statements below.  
**Complete the table on DIAGRAM SHEET 3.**

	<b>Statement</b>	<b>Reason</b>
(a)	$\hat{A}BC = 90^\circ$	
(b)	$AB = x$	

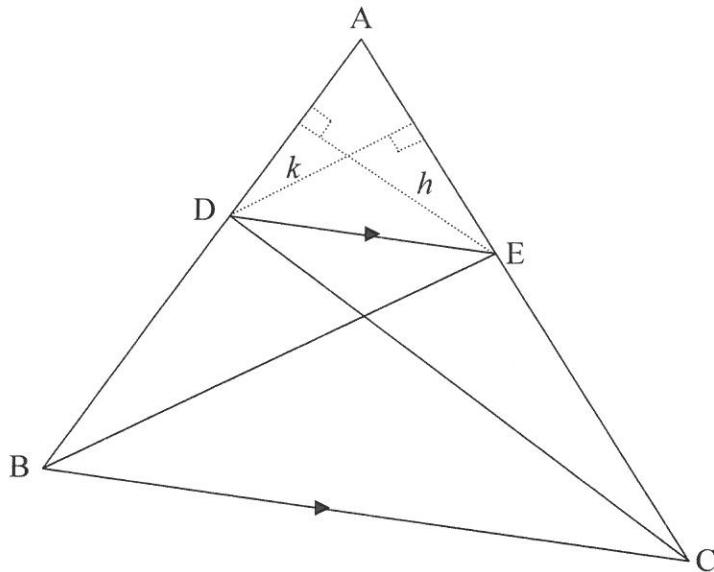
(2)

- 8.3.2 Calculate the length of AB.

(4)  
[14]

**QUESTION 9**

- 9.1 In the diagram, points D and E lie on sides AB and AC of  $\triangle ABC$  respectively such that  $DE \parallel BC$ . DC and BE are joined.



9.1.1 Explain why the areas of  $\triangle DEB$  and  $\triangle DEC$  are equal. (1)

9.1.2 Given below is the partially completed proof of the theorem that states that if in any  $\triangle ABC$  the line  $DE \parallel BC$  then  $\frac{AD}{DB} = \frac{AE}{EC}$ .

**Using the above diagram, complete the proof of the theorem on DIAGRAM SHEET 4.**

Construction: Construct the altitudes (heights)  $h$  and  $k$  in  $\triangle ADE$ .

$$\frac{\text{area } \triangle ADE}{\text{area } \triangle DEB} = \frac{\frac{1}{2}(AD)(h)}{\frac{1}{2}(BD)(h)} = \dots\dots$$

$$\frac{\text{area } \triangle ADE}{\text{area } \triangle DEC} = \dots\dots = \frac{AE}{EC}$$

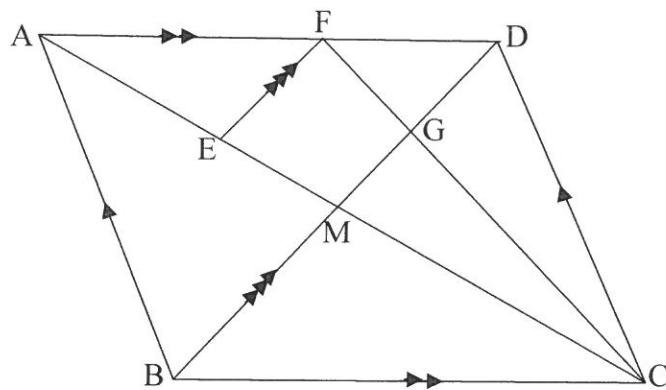
But area  $\triangle DEB$  = ..... (reason: .....)

$$\therefore \frac{\text{area } \triangle ADE}{\text{area } \triangle DEB} = \dots\dots$$

$$\therefore \frac{AD}{DB} = \frac{AE}{EC}$$

(5)

- 9.2 In the diagram, ABCD is a parallelogram. The diagonals of ABCD intersect in M. F is a point on AD such that  $AF : FD = 4 : 3$ . E is a point on AM such that  $EF \parallel BD$ . FC and MD intersect in G.



Calculate, giving reasons, the ratio of:

9.2.1  $\frac{EM}{AM}$  (3)

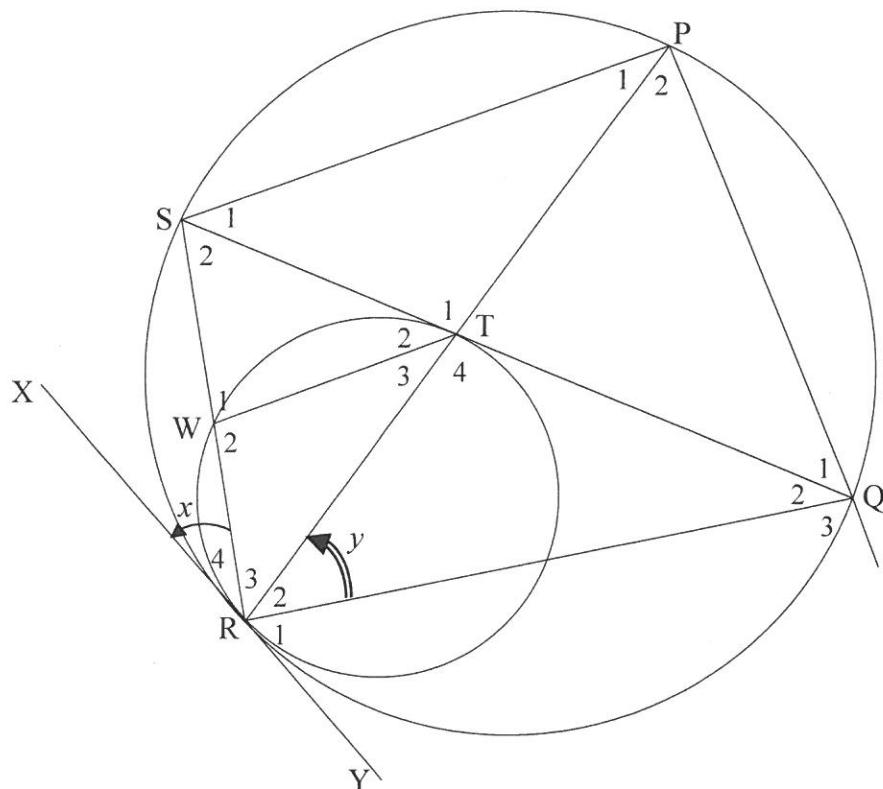
9.2.2  $\frac{CM}{ME}$  (3)

9.2.3  $\frac{\text{area } \triangle FDC}{\text{area } \triangle BDC}$  (4)  
[16]

**QUESTION 10**

The two circles in the diagram have a common tangent XRY at R. W is any point on the small circle. The straight line RWS meets the large circle at S. The chord STQ is a tangent to the small circle, where T is the point of contact. Chord RTP is drawn.

Let  $\hat{R}_4 = x$  and  $\hat{R}_2 = y$



10.1 Give reasons for the statements below.

**Complete the table on DIAGRAM SHEET 6.**

Let $\hat{R}_4 = x$ and $\hat{R}_2 = y$		
	Statement	Reason
10.1.1	$\hat{T}_3 = x$	
10.1.2	$\hat{P}_1 = x$	
10.1.3	$WT \parallel SP$	
10.1.4	$\hat{S}_1 = y$	
10.1.5	$\hat{T}_2 = y$	

(5)

- 10.2 Prove that  $RT = \frac{WR \cdot RP}{RS}$  (2)
- 10.3 Identify, with reasons, another TWO angles equal to  $y$ . (4)
- 10.4 Prove that  $\hat{Q}_3 = \hat{W}_2$ . (3)
- 10.5 Prove that  $\Delta RTS \parallel \Delta RQP$ . (3)
- 10.6 Hence, prove that  $\frac{WR}{RQ} = \frac{RS^2}{RP^2}$ . (3)  
**[20]**

**TOTAL:** **150**

**CENTRE NUMBER:**

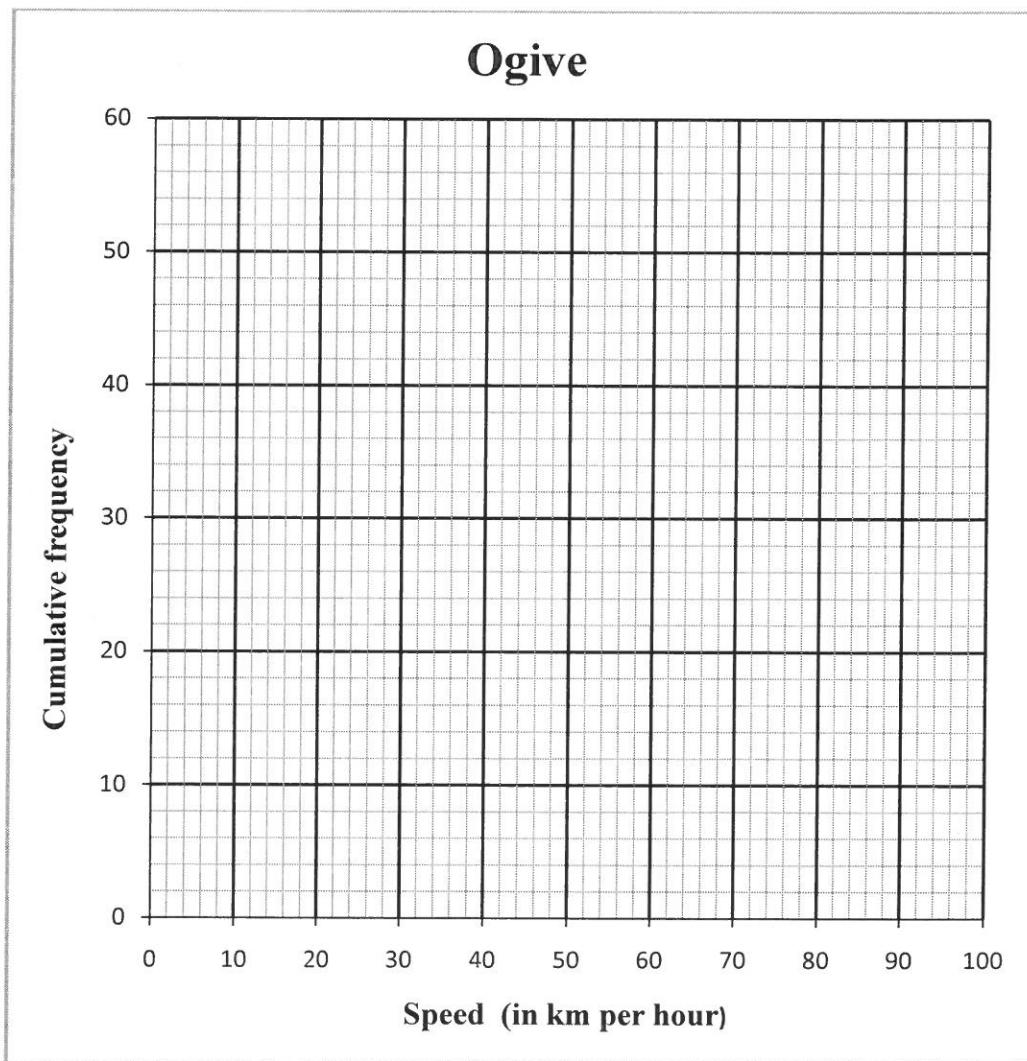
--	--	--	--	--	--	--	--

**EXAMINATION NUMBER:**

--	--	--	--	--	--	--	--	--	--	--	--

**DIAGRAM SHEET 1****QUESTION 2.2.1**

Class	Frequency	Cumulative frequency
$20 < x \leq 30$	1	
$30 < x \leq 40$	7	
$40 < x \leq 50$	13	
$50 < x \leq 60$	17	
$60 < x \leq 70$	9	
$70 < x \leq 80$	5	
$80 < x \leq 90$	2	
$90 < x \leq 100$	1	

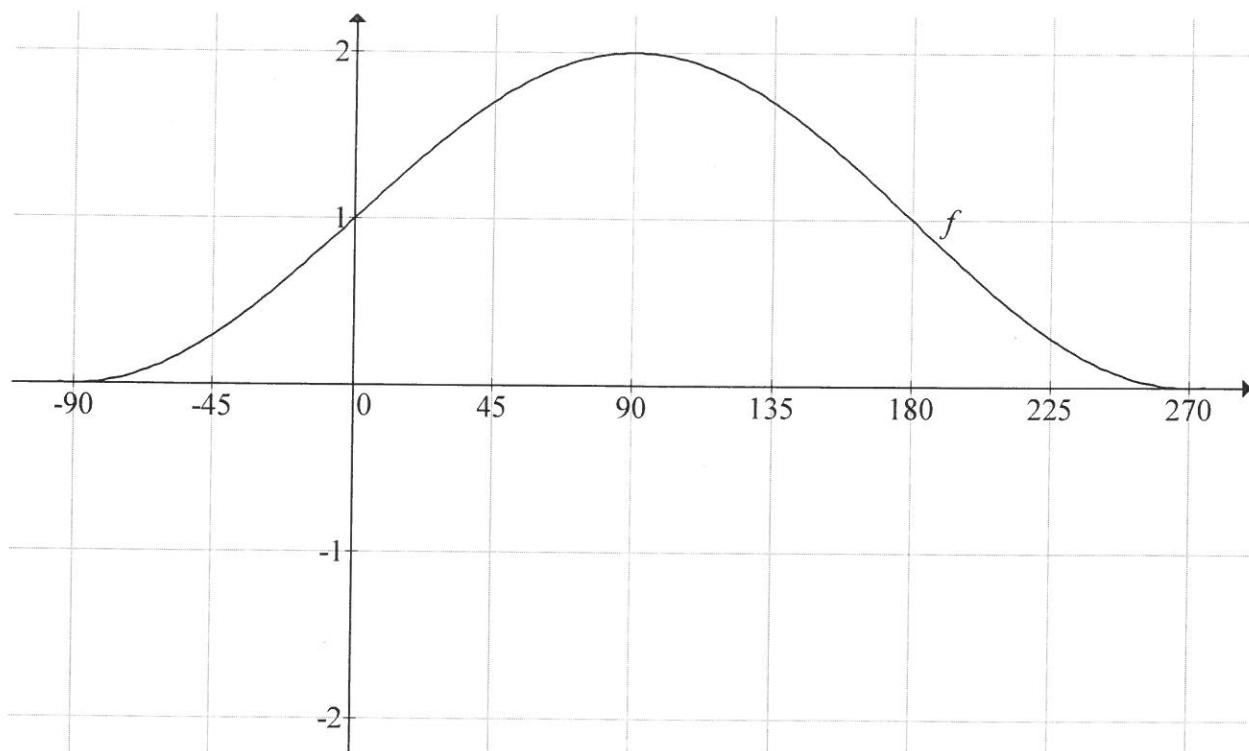
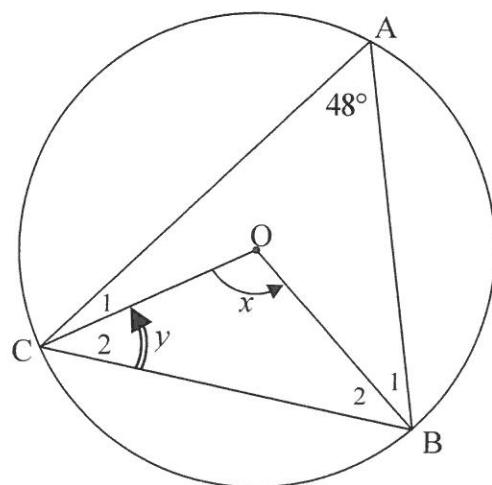
**QUESTION 2.2.2**

**CENTRE NUMBER:**

<input type="text"/>						
----------------------	----------------------	----------------------	----------------------	----------------------	----------------------	----------------------

**EXAMINATION NUMBER:**

<input type="text"/>											
----------------------	----------------------	----------------------	----------------------	----------------------	----------------------	----------------------	----------------------	----------------------	----------------------	----------------------	----------------------

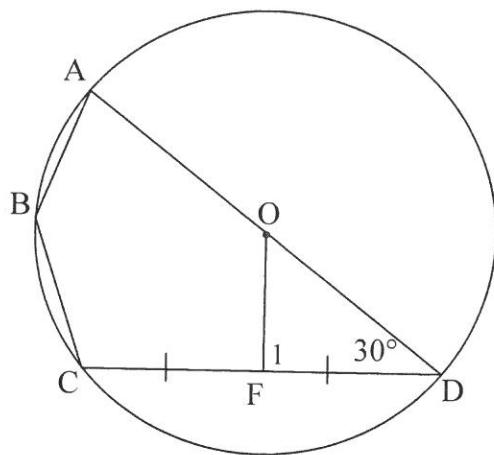
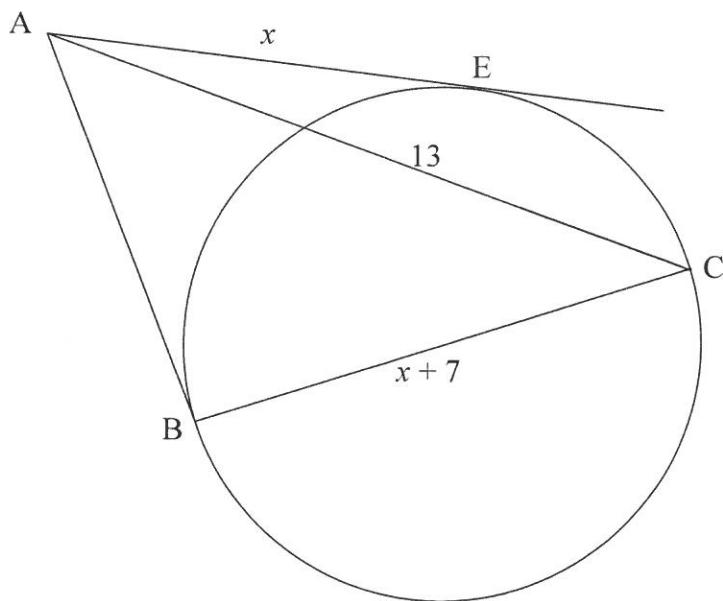
**DIAGRAM SHEET 2****QUESTION 7.4****QUESTION 8.1**

CENTRE NUMBER:

--	--	--	--	--	--	--	--

EXAMINATION NUMBER:

--	--	--	--	--	--	--	--	--	--

**DIAGRAM SHEET 3****QUESTION 8.2****QUESTION 8.3**

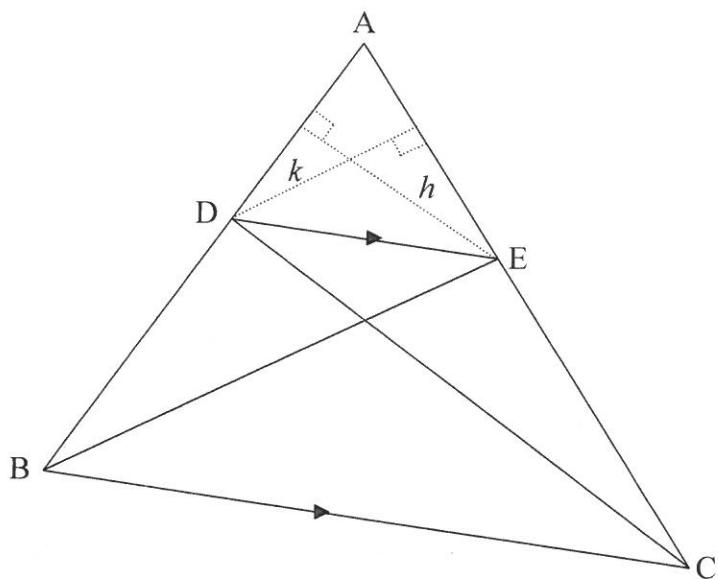
8.3.1	Statement	Reason
(a)	$\hat{A}BC = 90^\circ$	
(b)	$AB = x$	

**CENTRE NUMBER:**

<input type="text"/>						
----------------------	----------------------	----------------------	----------------------	----------------------	----------------------	----------------------

**EXAMINATION NUMBER:**

<input type="text"/>											
----------------------	----------------------	----------------------	----------------------	----------------------	----------------------	----------------------	----------------------	----------------------	----------------------	----------------------	----------------------

**DIAGRAM SHEET 4****QUESTION 9.1**

9.1.2 Construction: Construct the altitudes (heights)  $h$  and  $k$  in  $\triangle ADE$ .

$$\frac{\text{area } \triangle ADE}{\text{area } \triangle DEB} = \frac{\frac{1}{2}(AD)(h)}{\frac{1}{2}(BD)(h)} = \dots\dots$$

$$\frac{\text{area } \triangle ADE}{\text{area } \triangle DEC} = \dots\dots = \frac{AE}{EC}$$

But area  $\triangle DEB = \dots\dots$

(reason: .....)

$$\therefore \frac{\text{area } \triangle ADE}{\text{area } \triangle DEB} = \dots\dots$$

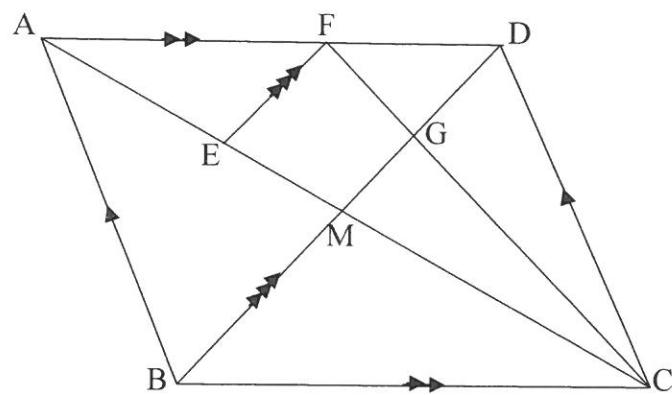
$$\therefore \frac{AD}{DB} = \frac{AE}{EC}$$

**CENTRE NUMBER:**

--	--	--	--	--	--	--	--

**EXAMINATION NUMBER:**

--	--	--	--	--	--	--	--	--	--	--	--

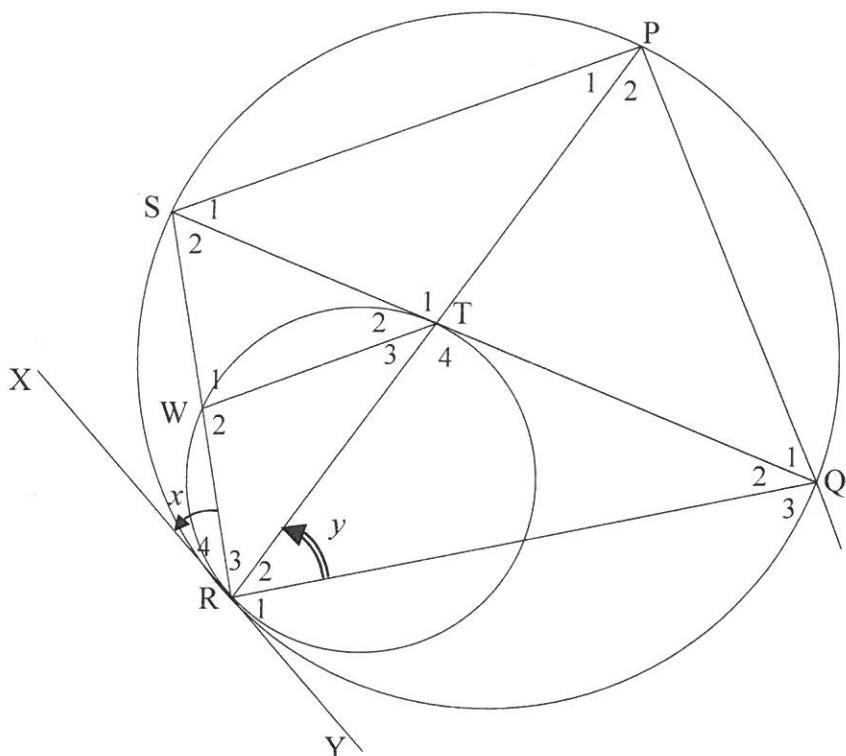
**DIAGRAM SHEET 5****QUESTION 9.2**

**CENTRE NUMBER:**

--	--	--	--	--	--	--	--

**EXAMINATION NUMBER:**

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

**DIAGRAM SHEET 6****QUESTION 10**

Let  $\hat{R}_4 = x$  and  $\hat{R}_2 = y$

	<b>Statement</b>	<b>Reason</b>
10.1.1	$\hat{T}_3 = x$	
10.1.2	$\hat{P}_1 = x$	
10.1.3	$WT \parallel SP$	
10.1.4	$\hat{S}_1 = y$	
10.1.5	$\hat{T}_2 = y$	

### INFORMATION SHEET

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$y = mx + c$$

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

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

$$m = \tan \theta$$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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



# basic education

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

## NATIONAL SENIOR CERTIFICATE

**GRADE/GRAAD 12**

**MATHEMATICS P2/WISKUNDE V2**

**NOVEMBER 2014**

**MEMORANDUM**

**MARKS/PUNTE: 150**

**This memorandum consists of 23 pages.  
*Hierdie memorandum bestaan uit 23 bladsye.***

**NOTE:**

- If a candidate answers a question TWICE, only mark the FIRST attempt.
- If a candidate has crossed out an attempt of a question and not redone the question, mark the crossed out version.
- Consistent accuracy applies in ALL aspects of the marking memorandum.
- Assuming answers/values in order to solve a problem is NOT acceptable.

**NOTA:**

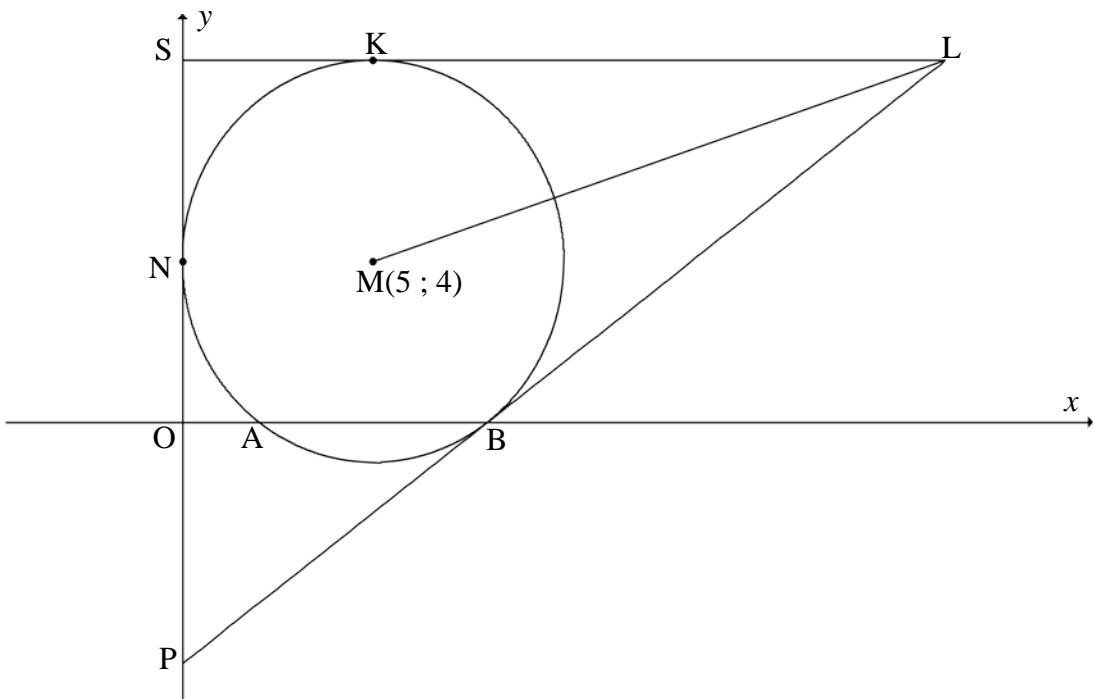
- As 'n kandidaat 'n vraag TWEEKEER beantwoord, merk slegs die EERSTE poging.
- As 'n kandidaat 'n poging om die vraag te beantwoord, doodgetrek het en nie dit oorgedoen het nie, merk die doodgetrekte poging.
- Volgehoue akkuraatheid word in ALLE aspekte van die nasienmemorandum toegepas.
- Aanvaarding van antwoorde/waardes om 'n probleem op te los, is ONaanvaarbaar.

**QUESTION/VRAAG 1**

1.1	$\bar{x} = \frac{816}{12} = 68$	✓ $\frac{816}{12}$ ✓ 68 (2)
1.2	$\sigma = 18,42$	✓ answer/antw (1)
1.3	$(68 - 18,42 ; 68 + 18,42) = (49,58 ; 86,42)$ $\therefore$ 6 candidates had a mark within one standard deviation of the mean/6 kandidate het 'n punt binne een standaardafwyking vanaf die gemiddelde.	✓✓ interval ✓ answer/antw (3)
1.4	$a = 22,828\dots = 22,83$  $b = 0,66429\dots = 0,66$  $\therefore \hat{y} = 0,66x + 22,83$ <b>OR/OF</b> $\hat{y} = 22,83 + 0,66x$	✓ value of $a$ / waarde van $a$ ✓ value of $b$ / waarde van $b$ ✓ equation/vgl (3)
1.5	$\hat{y} = 0,66x + 22,83$ $y = 0,66(60) + 22,83$ $62,43\dots\% \approx 62\%$  <b>OR/OF</b>  $62,69\% \approx 63\%$	✓ subs of 60 into equation ✓ answer/antw (2)  ✓✓ answer/antw (2)
1.6	(82 ; 62)	✓ answer/antw (1) [12]

**QUESTION/VRAAG 2**

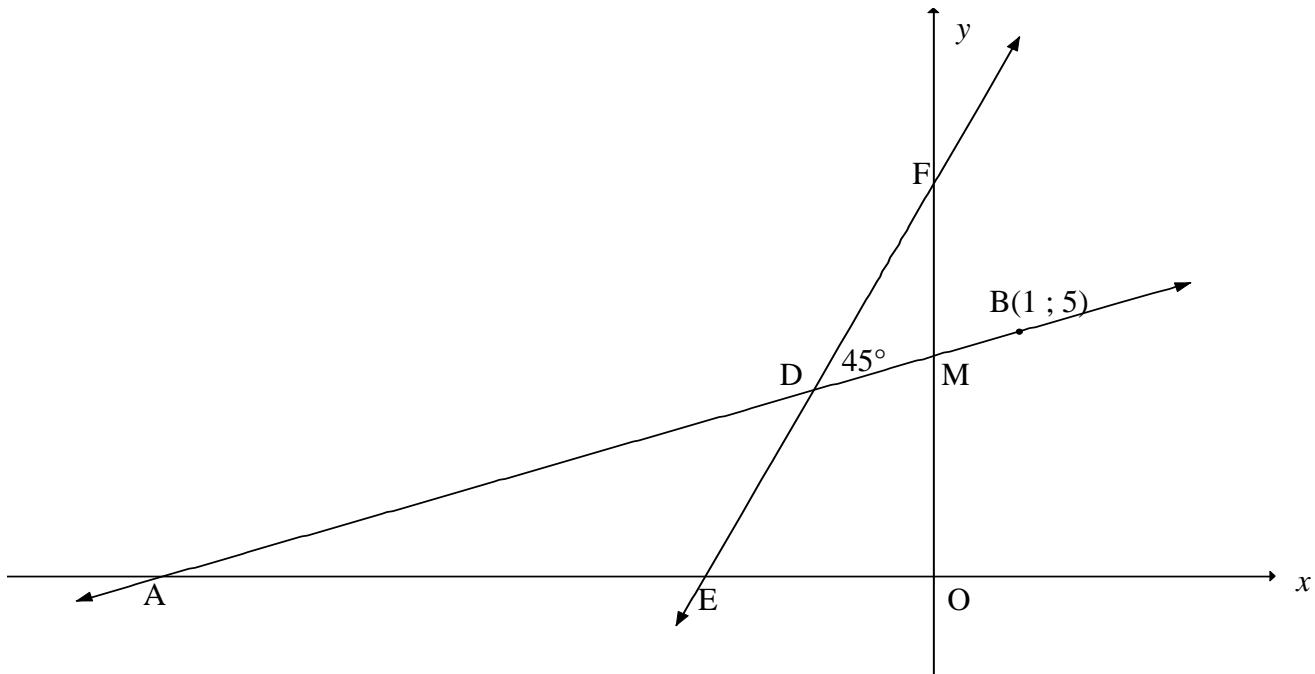
2.1	$50 < x \leq 60$ OR/OF $50 \leq x < 60$ OR/OF between 50 and 60/tussen 50 en 60	✓ answer/antw (1)																											
2.2.1	<table border="1"> <thead> <tr> <th>Class <i>Klas</i></th> <th>Frequency <i>Frekwensie</i></th> <th>Cumulative frequency <i>Kumulatiewe frekwensie</i></th> </tr> </thead> <tbody> <tr><td><math>20 &lt; x \leq 30</math></td><td>1</td><td>1</td></tr> <tr><td><math>30 &lt; x \leq 40</math></td><td>7</td><td>8</td></tr> <tr><td><math>40 &lt; x \leq 50</math></td><td>13</td><td>21</td></tr> <tr><td><math>50 &lt; x \leq 60</math></td><td>17</td><td>38</td></tr> <tr><td><math>60 &lt; x \leq 70</math></td><td>9</td><td>47</td></tr> <tr><td><math>70 &lt; x \leq 80</math></td><td>5</td><td>52</td></tr> <tr><td><math>80 &lt; x \leq 90</math></td><td>2</td><td>54</td></tr> <tr><td><math>90 &lt; x \leq 100</math></td><td>1</td><td>55</td></tr> </tbody> </table>	Class <i>Klas</i>	Frequency <i>Frekwensie</i>	Cumulative frequency <i>Kumulatiewe frekwensie</i>	$20 < x \leq 30$	1	1	$30 < x \leq 40$	7	8	$40 < x \leq 50$	13	21	$50 < x \leq 60$	17	38	$60 < x \leq 70$	9	47	$70 < x \leq 80$	5	52	$80 < x \leq 90$	2	54	$90 < x \leq 100$	1	55	✓ 8  ✓ 55 (2)
Class <i>Klas</i>	Frequency <i>Frekwensie</i>	Cumulative frequency <i>Kumulatiewe frekwensie</i>																											
$20 < x \leq 30$	1	1																											
$30 < x \leq 40$	7	8																											
$40 < x \leq 50$	13	21																											
$50 < x \leq 60$	17	38																											
$60 < x \leq 70$	9	47																											
$70 < x \leq 80$	5	52																											
$80 < x \leq 90$	2	54																											
$90 < x \leq 100$	1	55																											
2.2.2	<p>The graph shows a smooth curve representing the cumulative frequency of speeds. The x-axis is labeled "Speed in km per hour" and "Spoed in km per uur". The y-axis is labeled "Cumulative Frequency" and "Kumulatiewe frekwensie". The curve passes through points (20, 0), (30, 1), (40, 8), (50, 22), (60, 38), (70, 47), (80, 52), (90, 54), and (100, 55). A dashed horizontal line is drawn at y = 45, and a dashed vertical line is drawn at x = 65.</p>	✓ grounding at (20 ; 0)/ anker by (20 ; 0) ✓ plotting at upper limits/ plot by boonste limiete ✓ smooth shape of curve/gladde kurwe (3)																											
2.3	$55 - 44$ (accept/aanvaar 43 – 45) $\approx 11$ motorists/motoriste (accept/aanvaar 10 – 12 motorists/motoriste)	✓ 44 ✓ 11 (2) [8]																											

**QUESTION/VRAAG 3**

3.1	$r = MN = 5$	✓ answer/antw (1)	
3.2	$(x - 5)^2 + (y - 4)^2 = 25$	✓ equation/vgl (1)	
3.3	$A(x ; 0)$ $(x - 5)^2 + (0 - 4)^2 = 25$ $x^2 - 10x + 25 + 16 = 25$ $x^2 - 10x + 16 = 0$ $(x - 8)(x - 2) = 0$ $\therefore x = 8 \text{ or } x = 2$ $\therefore A(2 ; 0)$	$(x - 5)^2 + (0 - 4)^2 = 25$ $(x - 5)^2 + 16 = 25$ $(x - 5)^2 = 9$ $(x - 5) = \pm 3$ $\therefore x = 8 \text{ or } x = 2$ $\therefore A(2 ; 0)$	✓ substitute into eq/ vervang in vgl $y = 0$ ✓ standard form/ standaardvorm or perfect square form/kwadr vorm ✓ answer/antw (3)
3.4.1	$m_{MB} = \frac{4 - 0}{5 - 8}$ $= -\frac{4}{3}$	✓ subst M and B into form/vervang M and B in form ✓ $m_{MB} = -\frac{4}{3}$ (2)	

3.4.2	$m_{MB} \times m_{PB} = -1$ (tangent $\perp$ radius/ rkl $\perp$ radius) $m_{PB} = \frac{3}{4}$ $y = \frac{3}{4}x + c$ <b>OR/OF</b> $y - y_1 = \frac{3}{4}(x - x_1)$ $0 = \frac{3}{4}(8) + c$ $y - 0 = \frac{3}{4}(x - 8)$ $y = \frac{3}{4}x - 6$ $y = \frac{3}{4}x - 6$	✓ $m_{MB} \times m_{PB} = -1$ ✓ $m_{PB} = \frac{3}{4}$ ✓ equation/vgl (3)
3.5	$y_K = y_M + r = 4 + 5$ $y = 9$	✓ 9 ✓ equation/vgl (2)
3.6	At/By L: $\frac{3}{4}x - 6 = 9$ $3x - 24 = 36$ $3x = 60$ $x = 20$ $\therefore L(20 ; 9)$	✓ equating simultaneously ✓ simplification (2)
3.7	L(20 ; 9) $ML = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ <b>OR/OF</b> $ML = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ $= \sqrt{(20 - 5)^2 + (9 - 4)^2}$ $= \sqrt{(15)^2 + (5)^2}$ $= \sqrt{225 + 25}$ $= \sqrt{(5)^2(9 + 1)}$ $= \sqrt{250}$ or / of $5\sqrt{10}$ $= \sqrt{250}$ or / of $5\sqrt{10}$	✓ correct subst into distance formula/ korrekte subst in afstand-formule ✓ answer in surd form/antw in wortelvorm (2)
3.8	<b>MK <math>\perp</math> KL OR/OF <math>\hat{MKL} = 90^\circ</math></b> (radius $\perp$ tangent/radius $\perp$ rkl) $\therefore ML$ is a diameter as it subtends a right angle/ $ML$ is middellyn $r = \frac{ML}{2} = \frac{\sqrt{250}}{2} = \sqrt{\frac{125}{2}}$ or    7,91 Centre of circle = midpoint of $ML$ /Midpt van sirkel = midpt v $ML$ $x = \frac{5+20}{2} = \frac{25}{2} = 12,5$ $y = \frac{4+9}{2} = \frac{13}{2} = 6,5$ Centre/midpt: (12,5 ; 6,5) Equation of the circle KLM /Vgl van sirkel KLM: $\therefore (x - 12,5)^2 + (y - 6,5)^2 = \frac{250}{4} = \frac{125}{2} = 62,5$ <b>OR/OF</b>	✓ S ✓ value of/waarde van $r$ ✓ $x = 12,5$ ✓ $y = 6,5$ ✓ answer in correct form/ antw in korrekte vorm (5)

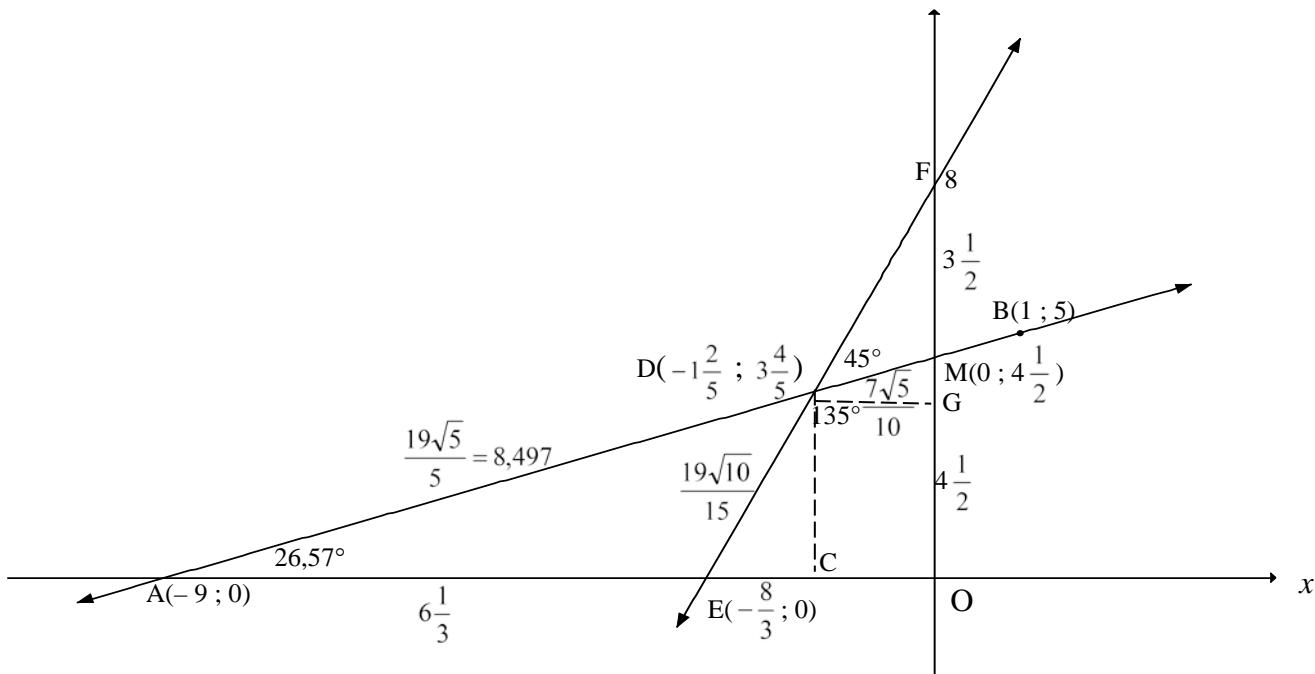
<p><b>MK ⊥ KL OR/OF <math>\hat{MKL} = 90^\circ</math></b> (radius <math>\perp</math> tangent/radius <math>\perp rkl</math>)  <math>\therefore ML</math> is a diameter as it subtends a right angle/<i>ML is middellyn</i>  Centre of circle = midpoint of <math>ML</math>/<i>Midpt van sirkel = midpt v ML</i></p> $x = \frac{5+20}{2} = \frac{25}{2} = 12,5 \quad y = \frac{4+9}{2} = \frac{13}{2} = 6,5$ <p>Centre/<i>midpt</i>: (12,5 ; 6,5)</p> <p>Equation of the circle KLM /<i>Vgl van sirkel KLM</i>:</p> $(x - 12,5)^2 + (y - 6,5)^2 = r^2$ <p>subst (5 ; 4): <math>(5 - 12,5)^2 + (4 - 6,5)^2 = r^2</math></p> $62,5 = r^2$ $\therefore (x - 12,5)^2 + (y - 6,5)^2 = \frac{250}{4} = \frac{125}{2} = 62,5$ <p><b>OR/OF</b></p> <p>By symmetry about LM/<i>deur simmetrie om LM</i>:</p> <p><b>MK ⊥ KL OR/OF <math>\hat{MKL} = 90^\circ</math></b> (radius <math>\perp</math> tangent/radius <math>\perp rkl</math>)  <math>\therefore ML</math> is a diameter as it subtends a right angle/<i>ML is middellyn</i>  <i>ML is a diameter /ML is 'n middellyn</i></p> $r = \frac{ML}{2} = \frac{\sqrt{250}}{2} = \sqrt{\frac{125}{2}} \quad \text{or /of } 7,91$ <p>Centre of circle = midpoint of <math>ML</math>/<i>Midpt van sirkel = midpt v ML</i></p> $x = \frac{5+20}{2} = \frac{25}{2} = 12,5 \quad y = \frac{4+9}{2} = \frac{13}{2} = 6,5$ <p>Centre/<i>midpt</i>: (12,5 ; 6,5)</p> <p>Equation of the circle KLM /<i>Vgl van sirkel KLM</i>:</p> $\therefore (x - 12,5)^2 + (y - 6,5)^2 = \frac{250}{4} = \frac{125}{2} = 62,5$	<p>✓ S</p> <p>✓ <math>x = 12,5</math> ✓ <math>y = 6,5</math></p> <p>✓ value of/waarde van <math>r^2</math></p> <p>✓ answer in correct form/antw in korrekte vorm (5)</p> <p>✓ S</p> <p>✓ value of/waarde van <math>r</math></p> <p>✓ <math>x = 12,5</math> ✓ <math>y = 6,5</math></p> <p>✓ answer in correct form/antw in korrekte vorm (5) [21]</p>
--	--

**QUESTION/VRAAG 4**

4.1	$y = 0: 3x + 8 = 0$ $x = -\frac{8}{3}$ $\therefore E\left(-2\frac{2}{3}; 0\right)$ <b>OR/OF</b> $E\left(-\frac{8}{3}; 0\right)$	✓ y-value/waarde ✓ x-value/waarde (2)
4.2	$\tan D\hat{E}O = m_{DE} = 3$ $\therefore D\hat{E}O = 71,565\dots = 71,57^\circ$ $D\hat{A}E = 71,565\dots^\circ - 45^\circ$ $= 26,57^\circ$	✓ $\tan D\hat{E}O = 3$ ✓ $71,565\dots^\circ$ ✓ $26,57^\circ$ (3)
4.3	$m_{AB} = \tan 26,57^\circ$ $= \frac{1}{2}$ $y = \frac{1}{2}x + c$ <b>OR/OF</b> $y - y_1 = \frac{1}{2}(x - x_1)$ $5 = \frac{1}{2}(1) + c$ $y - 5 = \frac{1}{2}(x - 1)$ $y = \frac{1}{2}x + 4\frac{1}{2}$ $y = \frac{1}{2}x + \frac{9}{2}$	✓ $m_{AB} = \tan 26,57^\circ$ ✓ $m_{AB} = \frac{1}{2}$ ✓ subst of $m$ and $(1; 5)$ into formula/ <b>subst <math>m</math> en <math>(1; 5)</math> in  formule</b> ✓ equation/vgl (4)

<p>4.4 Solve <math>x - 2y + 9 = 0</math> and <math>y = 3x + 8</math> simultaneously:</p> $x - 2(3x+8) + 9 = 0$ $x - 6x - 16 + 9 = 0$ $-5x = 7$ $x = -1\frac{2}{5}$ $\therefore y = 3(-1\frac{2}{5}) + 8 \quad \text{OR/OF} \quad -1\frac{2}{5} - 2y + 9 = 0$ $y = 3\frac{4}{5} \quad y = 3\frac{4}{5}$ $\therefore D(-1\frac{2}{5}; 3\frac{4}{5})$ <p><b>OR/OF</b></p> $x = 2y - 9$ $y = 3(2y - 9) + 8$ $y = 6y - 27 + 8$ $\therefore y = 3\frac{4}{5}$ $x = 2(3\frac{4}{5}) - 9 \quad \text{OR/OF} \quad 3\frac{4}{5} = 3x + 8$ $x = -1\frac{2}{5} \quad x = -1\frac{2}{5}$ $\therefore D(-1\frac{2}{5}; 3\frac{4}{5})$ <p><b>OR/OF</b></p> $3x + 8 = \frac{1}{2}x + 4\frac{1}{2}$ $6x + 16 = x + 9$ $5x = -7$ $\therefore x = -1\frac{2}{5}$ $\therefore y = 3(-1\frac{2}{5}) + 8 \quad \text{OR/OF} \quad y = \frac{1}{2}(-1\frac{2}{5}) + 4\frac{1}{2}$ $y = 3\frac{4}{5} \quad y = 3\frac{4}{5}$ $\therefore D(-1\frac{2}{5}; 3\frac{4}{5})$ <p><b>OR/OF</b></p>	<p>✓ subst/vervang</p> <p>✓ x-value/waarde</p> <p>✓ subst/vervang</p> <p>✓ y-value/waarde (4)</p> <p>✓ subst/vervang</p> <p>✓ y value/waarde</p> <p>✓ subst/vervang</p> <p>✓ x-value/waarde</p> <p>(4)</p> <p>✓ equating/gelyk stel</p> <p>✓ x value/waarde</p> <p>✓ subst/vervang</p> <p>✓ y-value/waarde (4)</p>
---	--

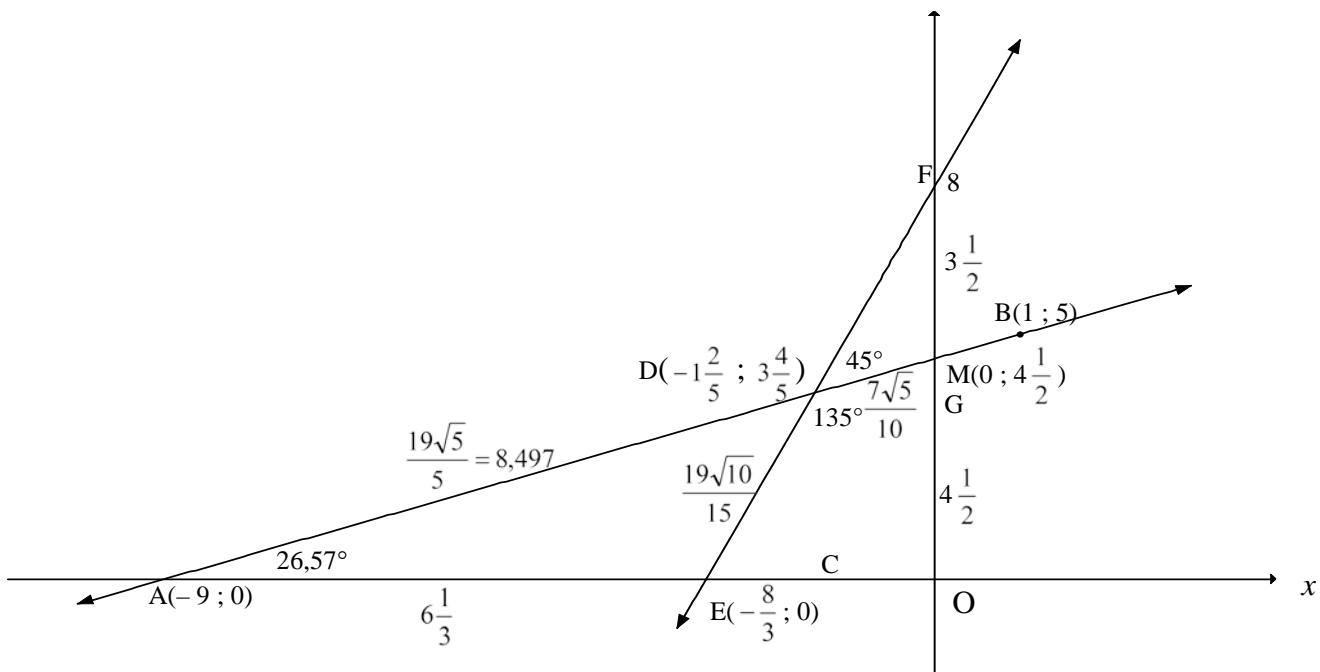
	$\begin{aligned}x - 2y &= -9 \dots\dots\dots(1) \\ -6x + 2y &= 16 \dots\dots\dots(2)\end{aligned}$ <p>(1) + (2):</p> $\begin{aligned}-5x &= 7 \\ \therefore x &= -1\frac{2}{5}\end{aligned}$ $\therefore -1\frac{2}{5} - 2y = -9 \quad \text{OR/OF} \quad y = 3(-1\frac{2}{5}) + 8$ $\begin{aligned}y &= 3\frac{4}{5} \\ y &= 3\frac{4}{5}\end{aligned}$ $\therefore D(-1\frac{2}{5}; 3\frac{4}{5})$ <p><b>OR/OF</b></p> $\begin{aligned}y &= 3x + 8 \dots\dots\dots(1) \\ 6y &= 3x + 27 \dots\dots\dots(2)\end{aligned}$ <p>(1) – (2):</p> $\begin{aligned}-5y &= -19 \\ \therefore y &= 3\frac{4}{5}\end{aligned}$ $\begin{aligned}3\frac{4}{5} &= 3x + 8 \quad \text{OR/OF} \quad x = 2(3\frac{4}{5}) - 9 \\ x &= -1\frac{2}{5} \quad x = -1\frac{2}{5}\end{aligned}$ $\therefore D(-1\frac{2}{5}; 3\frac{4}{5})$	<ul style="list-style-type: none"> <li>✓ adding/<i>optelling</i></li> <li>✓ <i>x</i>-value/<i>waarde</i></li> <li>✓ subst/<i>vervang</i></li> <li>✓ <i>y</i>-value/<i>waarde</i></li> </ul>
		(4)

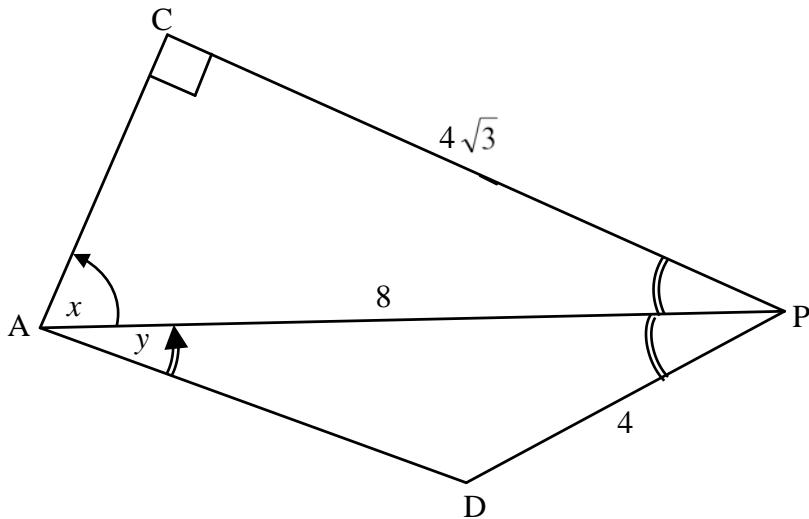


4.5	<p>area DMOE = area <math>\Delta</math>AMO – area <math>\Delta</math>ADE</p> $x_A = 2(0) - 9 \quad \therefore A(-9; 0)$ <p>area <math>\Delta</math>AMO                                  area <math>\Delta</math>ADE</p> $= \frac{1}{2} \cdot AO \cdot OM$ $= \frac{1}{2} \cdot (9) \cdot (4 \frac{1}{2})$ $= 20,25$ $= \frac{1}{2} \cdot AE \cdot y_D$ $= \frac{1}{2} \cdot (AO - EO) \cdot y_D$ $= \frac{1}{2} \left( 9 - 2 \frac{2}{3} \right) \left( 3 \frac{4}{5} \right)$ $= 12,03$ <p><b>OR/OF</b></p> <p>area <math>\Delta</math>ADE</p> $= \frac{1}{2} AD \cdot AE \cdot \sin DAE$ $= \frac{1}{2} \left( \frac{19\sqrt{5}}{5} \right) \cdot 6 \frac{1}{3} \cdot \sin 26,57^\circ$ $= 12,03$ <p><math>\therefore</math> area DMOE = 8,22 square units/vk eenh</p> <p><b>OR/OF</b></p>	<p>✓ correct method/ korrekte metode</p> <p>✓ <math>x_A = -9</math></p> <p>✓ <math>\frac{1}{2}(9)(4 \frac{1}{2})</math></p> <p>✓ <math>AE = 9 - 2 \frac{2}{3} = 6 \frac{1}{3}</math></p> <p>✓ <math>y_D = 3 \frac{4}{5}</math></p> <p><b>OR/OF</b></p> <p>✓ <math>AD = \frac{19\sqrt{5}}{5}</math></p> <p>✓ <math>AE = 6 \frac{1}{3}</math></p> <p>✓ answer/antw</p>
-----	--	--

	<p>area DMOE = area rectangle DCOG + area <math>\Delta</math>DMG + area <math>\Delta</math>DEC</p> $= \left(1\frac{2}{5} \times 3\frac{4}{5}\right) + \frac{1}{2}\left(1\frac{2}{5}\right)\left(\frac{7}{10}\right) + \frac{1}{2}\left(3\frac{4}{5}\right)\left(\frac{19}{15}\right)$ $= 8,22 \text{ square units/vk eenh}$	<ul style="list-style-type: none"> <li>✓ correct method/ korrekte metode</li> <li>✓ <math>3\frac{4}{5}</math></li> <li>✓ <math>1\frac{2}{5}</math> ✓ 0,7</li> <li>✓ <math>\frac{19}{15}</math></li> <li>✓ answer</li> </ul>
	<b>OR/OF</b>	(6)
	<p>area DMOE = area <math>\Delta</math>EZO + area <math>\Delta</math>ODM</p> $= \frac{1}{2}(EO \times y_D) + \frac{1}{2}(OM \times -x_D)$ $= \frac{1}{2}\left[\left(\frac{8}{3} \times \frac{19}{5}\right) + \left(\frac{9}{2} \times \frac{7}{5}\right)\right]$ $= \frac{1}{2}\left(\frac{304 + 189}{30}\right)$ $= \frac{493}{60} \text{ or/of } 8\frac{13}{60} \text{ or/of } 8,22 \text{ square units/vk eenh}$	<ul style="list-style-type: none"> <li>✓ correct method/ korrekte metode</li> <li>✓ <math>y_D = \frac{19}{5}</math> or <math>3\frac{4}{5}</math></li> <li>✓ <math>EO = \frac{8}{3}</math></li> <li>✓ <math>-x_D = \frac{7}{5}</math></li> <li>✓ <math>OM = \frac{9}{2}</math> or <math>4\frac{1}{2}</math></li> <li>✓ answer/antw</li> </ul>
	<b>OR/OF</b>	(6)
	<p>area DMOE = area <math>\Delta</math>EOF – area <math>\Delta</math>DMF</p> $= \frac{1}{2}(EO \times OF) - \frac{1}{2}(OF - OM)(-x_D)$ $= \frac{1}{2}\left[\left(\frac{8}{3} \times 8\right) + \left(\frac{7}{2} \times \frac{7}{5}\right)\right]$ $= \frac{1}{2}\left(\frac{640 - 147}{30}\right)$ $= \frac{493}{60} \text{ or } 8\frac{13}{60} \text{ or } 8,22 \text{ square units/vk eenh}$	<ul style="list-style-type: none"> <li>✓ correct method/ korrekte metode</li> <li>✓ <math>y_F = 8</math></li> <li>✓ <math>EO = \frac{8}{3}</math></li> <li>✓ <math>-x_D = \frac{7}{5}</math></li> <li>✓ <math>FM = 3\frac{1}{2}</math></li> <li>✓ answer/antw</li> </ul>
	<b>OR/OF</b>	(6)

$\begin{aligned} \text{area } \Delta EOM &= \frac{1}{2}(EO \times OM) \\ &= \frac{1}{2}\left(\frac{8}{3} \times \frac{9}{2}\right) \\ &= 6 \text{ sq units/vk eenh} \end{aligned}$ $\begin{aligned} ED &= \sqrt{\left(-\frac{7}{5} + \frac{8}{3}\right)^2 + \left(\frac{19}{5}\right)^2} \quad \text{and } DM = \sqrt{\left(\frac{7}{5}\right)^2 + \left(\frac{9}{2} - \frac{19}{5}\right)^2} \\ &= \frac{19\sqrt{10}}{15} \text{ or } 4,005\dots \quad = \frac{7\sqrt{5}}{10} \text{ or } 1,565\dots \end{aligned}$ $\begin{aligned} \text{area } \Delta EDM &= \frac{1}{2}(ED \times DM \times \sin E\hat{D}M) \\ &= \frac{1}{2}\left(\frac{19\sqrt{10}}{15}\right)\left(\frac{7\sqrt{5}}{10}\right)\sin 135^\circ \\ &= \frac{133}{60} \text{ or } 2,216\dots \end{aligned}$ <p><math>\therefore \text{area DMOE} = \text{area } \Delta EOM + \text{area } \Delta EDM</math></p> $\begin{aligned} &= 6 + 2,216\dots \\ &= \frac{493}{60} \text{ or/of } 8\frac{13}{60} \text{ or/of } 8,22 \text{ square units/eenh}^2 \end{aligned}$	✓ area $\Delta EOM$ ✓ $ED = \frac{19\sqrt{10}}{15}$ ✓ $DM = \frac{7\sqrt{5}}{10}$ ✓ area $\Delta EDM$ ✓ correct method/ <i>korrekte metode</i> ✓ answer/ <i>antw</i>
--	--

(6)  
[19]

**QUESTION/VRAAG 5**

5.1	$\sin C\hat{A}P = \frac{CP}{AP}$ $\sin x = \frac{4\sqrt{3}}{8} = \frac{\sqrt{3}}{2}$ $x = 60^\circ$  OR/OF $\frac{\sin 90^\circ}{8} = \frac{\sin x}{4\sqrt{3}}$ $\sin x = \frac{4\sqrt{3}}{8} = \frac{\sqrt{3}}{2}$ $x = 60^\circ$	<ul style="list-style-type: none"> <li>✓ correct sine ratio/ korrekte sin-verh</li> <li>✓ <math>\frac{\sqrt{3}}{2}</math></li> </ul> <p>(2)</p> <ul style="list-style-type: none"> <li>✓ correct sine ratio/ korrekte sin-verh</li> <li>✓ <math>\frac{\sqrt{3}}{2}</math></li> </ul> <p>(2)</p>
5.2	$C\hat{P}A = D\hat{P}A = 30^\circ$ ( APbisects DPC) $AD^2 = AP^2 + DP^2 - 2(AP)(DP)\cos A\hat{P}D$ $= 8^2 + 4^2 - 2(8)(4)\cos 30^\circ$ $= 8^2 + 4^2 - 2(8)(4)\left(\frac{\sqrt{3}}{2}\right)$ $= 24,57\dots$ $AD = 4,96$	<ul style="list-style-type: none"> <li>✓ <math>D\hat{P}A = 30^\circ</math></li> <li>✓ correct subst into cosine rule/ korrekte subst in cos-reël</li> <li>✓ 24,57\dots</li> <li>✓ 4,96</li> </ul> <p>(4)</p>

<p>5.3</p> $\frac{\sin D\hat{A}P}{DP} = \frac{\sin A\hat{P}D}{AD}$ $\frac{\sin y}{4} = \frac{\sin 30^\circ}{4,96}$ $\sin y = \frac{4 \sin 30^\circ}{4,96}$ $= 0,403\dots$ $y = 23,78^\circ$ <p><b>OR/OF</b></p> $AD^2 = AP^2 + DP^2 - 2 \cdot AP \cdot DP \cdot \cos D\hat{A}P$ $4^2 = 8^2 + (4,96)^2 - 2(8)(4,96) \cdot \cos y$ $\cos y = \frac{8^2 + (4,96)^2 - 4^2}{2(8)(4,96)}$ $\cos y = 0,9148\dots$ $y = 23,82^\circ$	<ul style="list-style-type: none"> <li>✓ correct subst into sine rule/ <i>korrekte subst in sin-reël</i></li> <li>✓ <math>\sin y</math> subject</li> <li>✓ <math>23,78^\circ</math></li> </ul> <p>(3)</p>
--	---

**QUESTION/VRAAG 6**

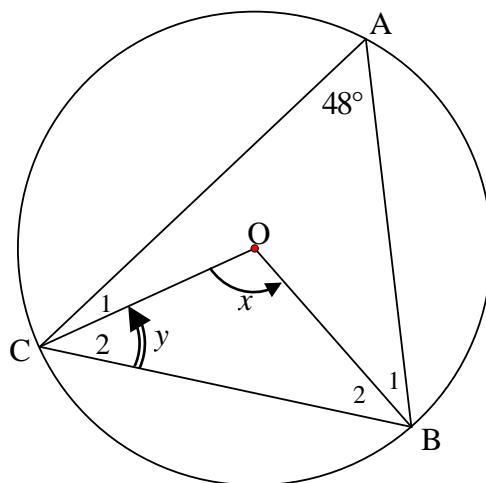
6.1	$\begin{aligned} & \cos^2(180^\circ + x) + \tan(x - 180^\circ) \sin(720^\circ - x) \cos x \\ &= (-\cos x)^2 + [-(-\tan x)](-\sin x)(\cos x) \\ &= \cos^2 x + \left(\frac{\sin x}{\cos x}\right)(-\sin x)(\cos x) \\ &= \cos^2 x - \sin^2 x \\ &= \cos 2x \end{aligned}$	<ul style="list-style-type: none"> <li>✓ <math>(-\cos x)^2</math> or <math>\cos^2 x</math></li> <li>✓ <math>\tan x</math> or <math>-(-\tan x)</math></li> <li>✓ <math>-\sin x</math></li> <li>✓ <math>\tan x = \frac{\sin x}{\cos x}</math></li> <li>✓ <math>\cos^2 x - \sin^2 x</math></li> </ul> <p style="text-align: right;">(5)</p>
6.2	$\begin{aligned} & \sin(\alpha - \beta) \\ &= \cos[90^\circ - (\alpha - \beta)] \\ &= \cos[(90^\circ - \alpha) + \beta] \\ &= \cos(90^\circ - \alpha) \cos \beta - \sin(90^\circ - \alpha) \sin \beta \\ &= \sin \alpha \cos \beta - \cos \alpha \sin \beta \end{aligned}$ <p style="text-align: center;"><b>OR/OF</b></p> $\begin{aligned} & \sin(\alpha - \beta) \\ &= \cos[90^\circ - (\alpha - \beta)] \\ &= \cos[(90^\circ + \beta) + (-\alpha)] \\ &= \cos(90^\circ + \beta) \cos(-\alpha) - \sin(90^\circ + \beta) \sin(-\alpha) \\ &= (-\sin \beta) \cos \alpha - \cos \beta (-\sin \alpha) \\ &= \sin \alpha \cos \beta - \cos \alpha \sin \beta \end{aligned}$	<ul style="list-style-type: none"> <li>✓ rewrite as/herkryf <math>\cos[(90^\circ - \alpha) + \beta]</math></li> <li>✓ expansion/ <i>uitbreiding</i></li> <li>✓ simpl/vereenv</li> </ul> <p style="text-align: right;">(3)</p> <ul style="list-style-type: none"> <li>✓ rewrite as/herkryf <math>\cos[(90^\circ + \beta) + (-\alpha)]</math></li> <li>✓ expansion/ <i>uitbreiding</i></li> <li>✓ simpl/vereenv</li> </ul> <p style="text-align: right;">(3)</p>
6.3	$\begin{aligned} & x^2 - y^2 \\ &= \sin^2 76^\circ - \cos^2 76^\circ \\ &= -(\cos^2 76^\circ - \sin^2 76^\circ) \\ &= -\cos 2(76^\circ) \\ &= -\cos 152^\circ \\ &= -(-\cos 28^\circ) \quad \textbf{OR/OF} \quad = -\cos(90^\circ + 62^\circ) \\ &= \cos 28^\circ \quad = -(-\sin 62^\circ) \\ &= \cos(90^\circ - 62^\circ) \quad = \sin 62^\circ \\ &= \sin 62^\circ \end{aligned}$ <p style="text-align: center;"><b>OR/OF</b></p> $\begin{aligned} & x^2 - y^2 \\ &= \sin^2 76^\circ - \cos^2 76^\circ \\ &= \sin 76^\circ \sin 76^\circ - \cos 76^\circ \cos 76^\circ \\ &= \sin 76^\circ \cos 14^\circ - \cos 76^\circ \sin 14^\circ \\ &= \sin(76^\circ - 14^\circ) \\ &= \sin 62^\circ \end{aligned}$ <p style="text-align: center;"><b>OR/OF</b></p> $\begin{aligned} & x^2 - y^2 \\ &= \sin^2 76^\circ - \cos^2 76^\circ \\ &= \cos^2 14^\circ - \sin^2 14^\circ \\ &= \cos 2(14^\circ) \\ &= \cos 28^\circ \\ &= \sin 62^\circ \end{aligned}$	<ul style="list-style-type: none"> <li>✓ <math>-(\cos^2 76^\circ - \sin^2 76^\circ)</math></li> <li>✓ recognition of cos double angle</li> <li>✓ <math>-\cos 152^\circ</math></li> <li>✓ <math>\cos 28^\circ</math></li> </ul> <p style="text-align: right;">(4)</p> <ul style="list-style-type: none"> <li>✓ <math>\cos 14^\circ</math></li> <li>✓ <math>\sin 14^\circ</math></li> <li>✓ recognition of sine compound angle</li> <li>✓ <math>\sin(76^\circ - 14^\circ)</math></li> </ul> <p style="text-align: right;">(4)</p> <ul style="list-style-type: none"> <li>✓ <math>\cos^2 14^\circ</math></li> <li>✓ <math>\sin^2 14^\circ</math></li> <li>✓ recognition of cos double angle</li> <li>✓ <math>\cos 28^\circ</math></li> </ul> <p style="text-align: right;">(4) [12]</p>

**QUESTION/VRAAG 7**

7.1	$0 \leq y \leq 2$ or $y \in [0 ; 2]$	✓ critical values/ kritieke waardes ✓ notation/notasie (2)
7.2	$\sin x + 1 = \cos 2x$ $\sin x + 1 = 1 - 2\sin^2 x$ $2\sin^2 x + \sin x = 0$ $\sin x(2\sin x + 1) = 0$	✓ $1 - 2\sin^2 x$ ✓ st form/st vorm (2)
7.3	$\sin x(2\sin x + 1) = 0$ $\sin x = 0$ or $\sin x = -\frac{1}{2}$ $x = 0^\circ + k \cdot 360^\circ$ or $x = 210^\circ + k \cdot 360^\circ$ or $x = 180^\circ + k \cdot 360^\circ$ or $x = 330^\circ + k \cdot 360^\circ, k \in \mathbb{Z}$ <b>OR/OF</b> $x = k \cdot 180^\circ, k \in \mathbb{Z}$	✓ $\sin x = 0$ or $\sin x = -\frac{1}{2}$ ✓ $0^\circ ; 180^\circ$ <b>OR/OF</b> $x = k \cdot 180^\circ$ ✓ $210^\circ ; 330^\circ$ ✓ $k \cdot 360^\circ, k \in \mathbb{Z}$ (4)
7.4		✓ y-intercept/afsnit ✓ x-intercepts/afsnitte ✓ min/max points/min/maks punte (3)
7.5	$f(x) = g(x)$ at/by: $x = -30^\circ ; 0^\circ ; 180^\circ ; 210^\circ$ $\therefore f(x + 30^\circ) = g(x + 30^\circ)$ at/by: $x = -60^\circ ; -30^\circ ; 150^\circ ; 180^\circ$	✓ $-30^\circ ; 0^\circ ; 180^\circ ; 210^\circ$ ✓✓ $-60^\circ ; -30^\circ ; 150^\circ ; 180^\circ$ (3)
7.6	Series will converge if/Reeks sal konvergeer as: $-1 < r < 1$ $-1 < 2\cos 2x < 1$ $-\frac{1}{2} < \cos 2x < \frac{1}{2}$ $\therefore 30^\circ < x < 60^\circ$ or $x \in (30^\circ ; 60^\circ)$	✓ $-1 < r < 1$ ✓ $r = 2\cos 2x$ ✓ $-\frac{1}{2} < \cos 2x < \frac{1}{2}$ ✓✓ $30^\circ < x < 60^\circ$ (5) [19]

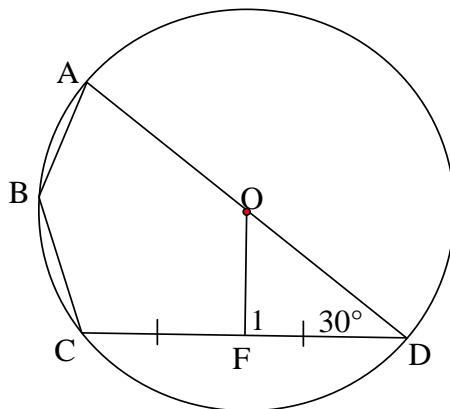
**QUESTION/VRAAG 8**

8.1



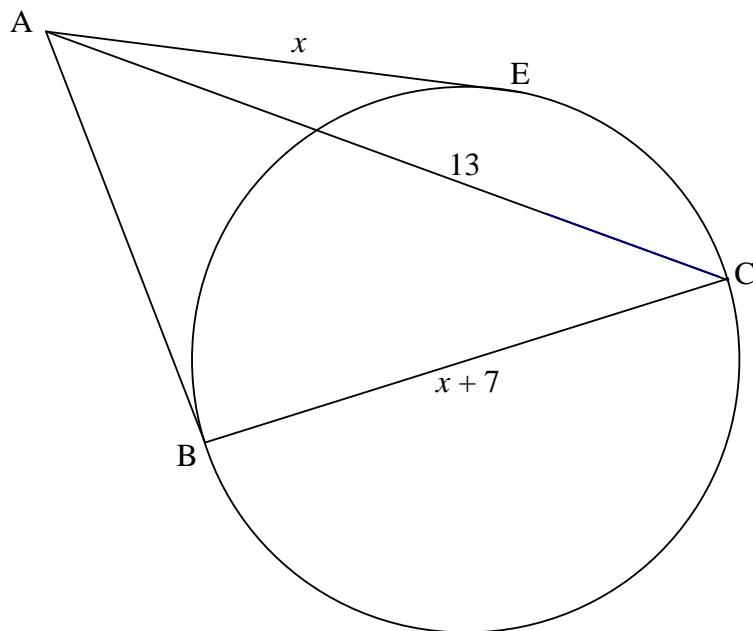
8.1.1	$x = 96^\circ$ ( $\angle$ at centre = $2 \angle$ at circumference/ $\angle$ by midpt = $2 \angle$ by omtrek)	✓ S ✓ R (2)
8.1.2	$\hat{C}_2 + \hat{B}_2 = 180^\circ - 96^\circ = 84^\circ$ (sum of $\angle$ s in $\Delta$ / som v $\angle$ e in $\Delta$ ) $y = \hat{B}_2 = 42^\circ$ ( $\angle$ s opp = sides/ $\angle$ e teenoor = sye)	✓ S ✓ S (2)

8.2



8.2.1	$\hat{F}_1 = 90^\circ$ (line from centre to midpt chord/ lyn vanaf midpt na midpt kd)	✓ S ✓ R (2)
8.2.2	$\hat{ABC} = 150^\circ$ (opposite $\angle$ s of cyclic quad/ tos $\angle$ e v koordevh )	✓ S ✓ R (2)

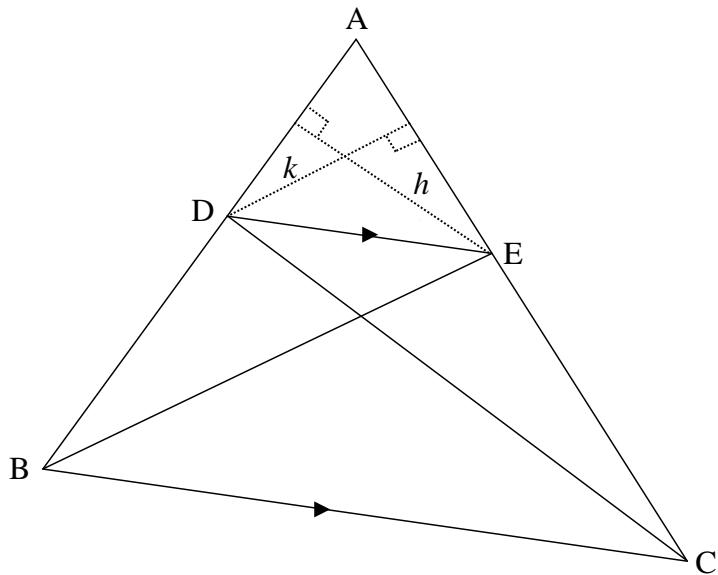
8.3



8.3.1 (a)	tangent $\perp$ radius/diameter / raaklyn $\perp$ radius/middellyn	$\checkmark$ R (1)
8.3.1 (b)	tangents from common pt OR tangents from same pt / raaklyne v gemeensk pt OF raaklyne vanaf dies pt	$\checkmark$ R (1)
8.3.2	$\begin{aligned} AB^2 + BC^2 &= AC^2 \\ x^2 + (x + 7)^2 &= 13^2 \quad (\text{Theorem of/Stelling van Pythagoras}) \\ x^2 + x^2 + 14x + 49 &= 169 \\ 2x^2 + 14x - 120 &= 0 \\ x^2 + 7x - 60 &= 0 \\ (x - 5)(x + 12) &= 0 \\ x = 5 \quad (x \neq -12) \end{aligned}$	$\checkmark$ $AB^2 + BC^2 = AC^2$ $\checkmark$ $x^2 + (x + 7)^2 = 13^2$ $\checkmark$ standard form  $\checkmark$ answer (4) <b>[14]</b>

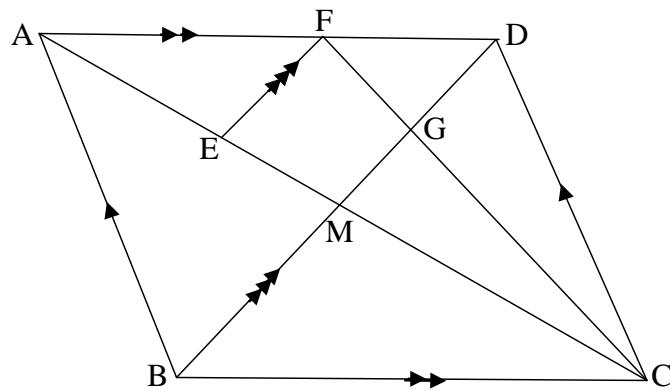
**QUESTION/VRAAG 9**

9.1

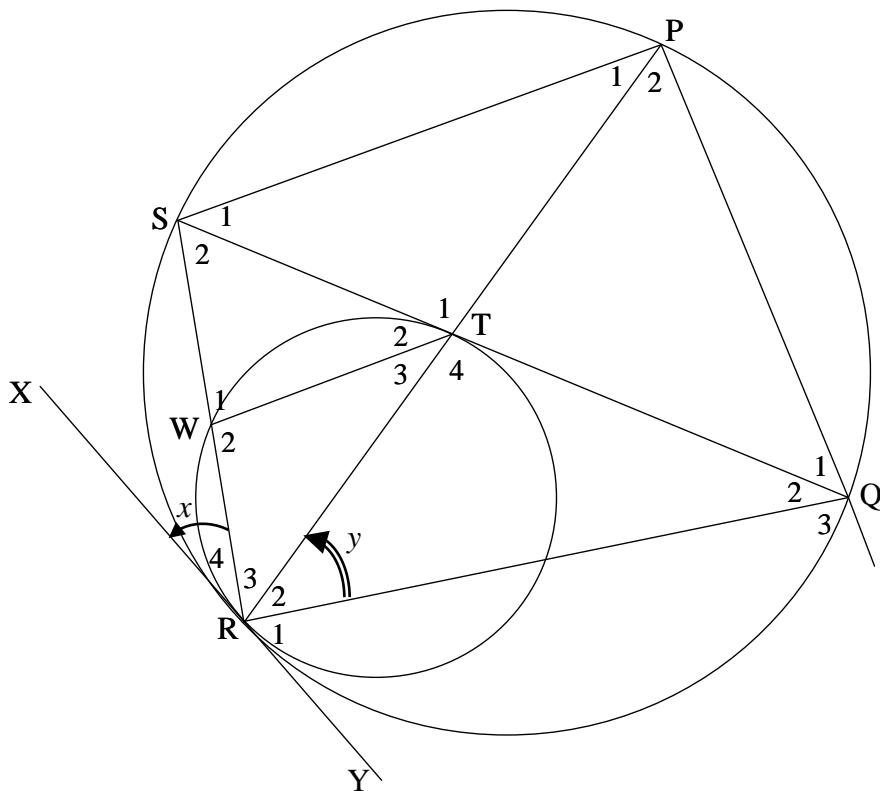


9.1.1	Same base (DE) and same height (between parallel lines) <i>Dieselde basis (DE) en dieselde hoogte (tussen ewewydige lyne)</i>	✓ same base/dies basis between    lines/ <i>tussen / / lyne</i> (1)
9.1.2	$\frac{AD}{DB}$ $\frac{1}{2} AE \times k$ $\frac{1}{2} EC \times k$ But/Maar area $\Delta DEB =$ area $\Delta DEC$ (Same base and same height/dieselde basis en dieselde hoogte) $\therefore \frac{\text{area } \Delta ADE}{\text{area } \Delta DEB} = \frac{\text{area } \Delta ADE}{\text{area } \Delta DEC}$ $\therefore \frac{AD}{DB} = \frac{AE}{EC}$	✓ S ✓ S ✓ S ✓ R ✓ S (5)

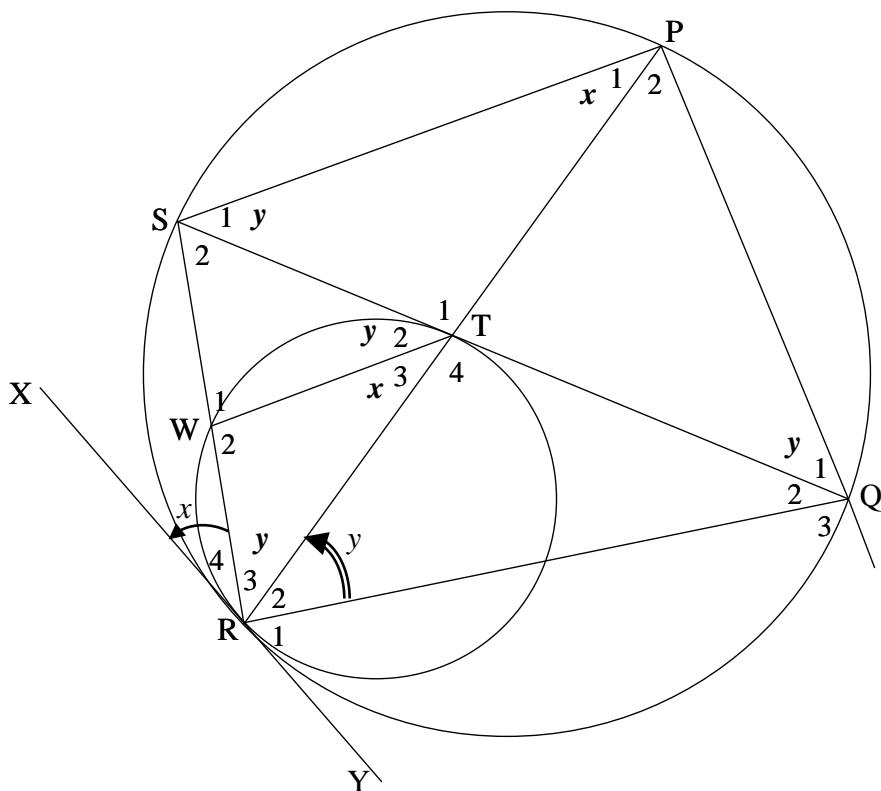
9.2



9.2.1	$\frac{EM}{AM} = \frac{FD}{AD}$ <p style="text-align: center;">(Line parallel one side of <math>\triangle</math> <b>OR</b> prop th; <math>EF \parallel BD</math>) (Lyn ewewydig aan sy v <math>\triangle</math> <b>OF</b> eweredigst; <math>EF \parallel BD</math>)</p> $\frac{EM}{AM} = \frac{3}{7}$	✓ S ✓R  ✓ answer/antw (3)
9.2.2	$CM = AM$ $\frac{CM}{ME} = \frac{AM}{ME} = \frac{7}{3}$ <p style="text-align: center;">(diags of parm bisect/hoekl parm halv) (from 9.2.1/vanaf 9.2.1)</p>	✓ S ✓R  ✓ answer/antw (3)
9.2.3	$h \text{ of } \triangle FDC = h \text{ of } \triangle BDC \quad (\text{AD} \parallel \text{BC})$ $\frac{\text{area } \triangle FDC}{\text{area } \triangle BDC} = \frac{\frac{1}{2} FD.h}{\frac{1}{2} BC.h}$ $= \frac{FD}{AD} \quad (\text{opp sides of parm} =)$ $= \frac{3}{7} \quad (\text{tos sye v parm} =)$ <p><b>OR/OF</b></p> $\frac{\text{area } \triangle FDC}{\text{area } \triangle ADC} = \frac{FD}{AD} = \frac{3}{7} \quad (\text{same heights})$ $\text{But Area } \triangle ADC = \text{Area } \triangle BDC \text{ (diags of parm bisect area)}$ $\text{area } \triangle FDC = \frac{3}{7}$	✓ AD    BC  ✓ subst into area form/ subst in opp formule  ✓ S  ✓ answer/antw (4)

**QUESTION/VRAAG 10**

10.1.1	Tangent chord theorem/Raaklyn-koordstelling	✓ R (1)
10.1.2	Tangent chord theorem/Raaklyn-koordstelling	✓ R (1)
10.1.3	Corresponding angles equal/Ooreenkomsige $\angle$ e gelyk	✓ R (1)
10.1.4	$\angle$ s subtended by chord PQ <b>OR</b> $\angle$ s in same segment $\angle$ e onderspan deur dieselfde koord <b>OF</b> $\angle$ e in dieselfde segment	✓ R (1)
10.1.5	alternate $\angle$ s/verwisselende $\angle$ e ; WT    SP	✓ R (1)
10.2	$\frac{RW}{RS} = \frac{RT}{RP}$ (Line parallel one side of $\Delta$ <b>OR</b> prop th; WT    SP) $\therefore RT = \frac{WR \cdot RP}{RS}$ ( <i>Lyn ewewydig aan sy v <math>\Delta</math> OF eweredighst: WT // SP)</i>  <b>OR/OF</b>  $\Delta RTW \parallel\parallel \Delta RPS$ ( $\angle$ ; $\angle$ ; $\angle$ ) $\therefore \frac{RW}{RS} = \frac{RT}{RP}$ ( $\Delta RTW \parallel\parallel \Delta RPS$ ) $\therefore RT = \frac{RW \cdot RP}{RS}$	✓ S ✓ R (2)
10.3	$y = \hat{T}_2 = \hat{R}_3$ (tan chord theorem/Rkl-koordst) $y = \hat{R}_3 = \hat{Q}_1$ ( $\angle$ s in same segment/ $\angle$ e in dieselfde segment)	✓ S ✓ R ✓ S ✓ R (4)



10.4	$\hat{Q}_3 = \hat{P}\hat{S}\hat{R}$ (ext $\angle$ of cyc quad/buite $\angle$ v kdvh) $\hat{P}\hat{S}\hat{R} = \hat{W}_2$ (corresp $\angle$ s/ooreenk $\angle$ e ; WT    SP) $\therefore \hat{Q}_3 = \hat{W}_2$ <b>OR/OF</b> $\hat{Q}_2 = x$ ( $\angle$ s in same segment/ $\angle$ e in dies segment) $\hat{Q}_3 = 180^\circ - (x + y)$ ( $\angle$ s on straight line/ $\angle$ e op reguitlyn) $\hat{W}_2 = 180^\circ - (x + y)$ ( $\angle$ s of $\Delta WRT/\angle$ e v $\Delta WRT$ ) $\therefore \hat{Q}_3 = \hat{W}_2$	✓ S ✓ R ✓ S ✓ R ✓ S ✓ S ✓ S
10.5	In $\Delta RTS$ and $\Delta RQP$ : $\hat{R}_3 = \hat{R}_2 = y$ (proven above/hierbo bewys) $\hat{S}_2 = \hat{P}_2$ ( $\angle$ s in same segment/ $\angle$ e in dies segment) $R\hat{T}\hat{S} = R\hat{Q}\hat{P}$ (3 <sup>rd</sup> angle of $\Delta$ ) $\therefore \Delta RTS \parallel\mid\mid \Delta RQP$ ( $\angle$ ; $\angle$ ; $\angle$ )	✓ S ✓ S/R ✓ S <b>OR/OF</b> ( $\angle$ ; $\angle$ ; $\angle$ )

<p>10.6</p> $\frac{RT}{RQ} = \frac{RS}{RP} \quad (\Delta RTS     \Delta RQP)$ $\frac{RS}{RP} \times \frac{RS}{RP} = \frac{RT}{RQ} \times \frac{RS}{RP}$ $\left(\frac{RS}{RP}\right)^2 = \left(\frac{RT}{RP}\right) \left(\frac{RS}{RQ}\right)$ $= \left(\frac{RW}{RS}\right) \left(\frac{RS}{RQ}\right) \quad (\text{proven in 10.2/bewys in 10.2})$ $= \frac{RW}{RQ}$ <p><b>OR/OF</b></p> $\frac{RT}{RQ} = \frac{RS}{RP} \quad (\Delta RTS     \Delta RQP)$ <p>But <math>RT = \frac{WR.RP}{RS}</math> <span style="float: right;">(proven in 10.2/bewys in 10.2)</span></p> $\therefore \frac{RT}{RQ} = \frac{WR.RP}{RQ.RS} = \frac{RS}{RP}$ $WR.RP^2 = RQ.RS^2$ $\therefore \frac{WR}{RQ} = \frac{RS^2}{RP^2}$ <p><b>OR/OF</b></p> $\frac{RT}{RS} = \frac{RQ}{RP} \quad (\Delta RTS     \Delta RQP)$ $RQ = \frac{RT.RP}{RS}$ <p>and <math>WR = \frac{RT.RS}{RP}</math> <span style="float: right;">(proven in 10.2/bewys in 10.2)</span></p> $\frac{WR}{RQ} = \frac{\frac{RT.RS}{RP}}{\frac{RT.RP}{RS}}$ $= \frac{RT.RS}{RP} \times \frac{RS}{RT.RP}$ $= \frac{RS^2}{RP^2}$	<p>✓ S</p> <p>✓ <math>\times \frac{RS}{RP}</math> on both sides</p> <p>✓ <math>\left(\frac{RT}{RP}\right) \left(\frac{RS}{RQ}\right)</math> (3)</p> <p>✓ S</p> <p>✓ <math>RT = \frac{WR.RP}{RS}</math></p> <p>✓ multiplication/ vermenigvuldig</p> <p>✓ WR = <math>\frac{RT.RS}{RP}</math></p> <p>✓ simplification/ vereenvoudiging</p>
<p>[20]</p>	<p>TOTAL/TOTAAL: 150</p>