education

Department:
Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

MATHEMATICS P3

NOVEMBER 2008

MEMORANDUM

MARKS: 100

This memorandum consists of 14 pages.

NOTE: Continued Accuracy applies as a rule throughout the memorandum

QUESTION 1	
1.1 $T_1 = 2$; $T_n = T_{n-1} + 4$ $T_{n+1} = T_n + 4$ Not recursive formula: max 2/3 Answer Only Full Marks	✓Identify $T_1 = 2$ ✓+4 ✓recursion used (3)
1.2 $T_n = 2 + (n - 1)4 = 4n - 2$	✓✓ formula in terms of n (2) **[5]**
QUESTION 2	
Answer Only Full Marks	
2.1 Approximately 2 %	✓✓answer (2)
2.2 Approximately 16 %	✓✓answer (2)
2.3 No, since there are some employees (less than 2%) earn below R3 000,00. These employees will not live an acceptable lifestyle economically. **OR** Yes, there is a fair distribution of salaries since the majority of the employees i.e. 68% earn a salary between R5 900 and R11 800 per month. Some employees will have more responsibilities or work longer hours and thus must be compensated accordingly. Less than 2% earn below R3 000,00. Union side Not a proper living Company side Have to differentiate between workers Check the avenue of argument provided that the candidate uses their everyday knowledge to justify their statements. One supporting statement is sufficient to justify the argument **with reference to the average salary and standard deviation** It is possible to get 3 marks from the argument if the candidate has not written YES / NO If candidate just writes YES / NO 1 out of 3	✓ Yes / No depending on the argument ✓✓ any reasonable explanation with justification based on the given data (3) **[7]**

<table>
<tr><td>

QUESTION 3

3.1 65% of 7 800 = 5 070

Answer Only
Full Marks

</td><td>

✓65%
✓5070
(2)

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3.2 No.
This is just the opinion of a small sample of the South African population. The view of the vast majority has not been heard. It is also not known whether the sample is representative of the population.

The results of the survey are not valid for the following reasons:
Only those who were watching this particular programme were able to respond. People who were not watching this programme were not even aware that such a survey had taken place.
Respondents needed a cellphone to make response. The viewers who did not have a cellphone were unable to respond. Also, viewers who had cellphones but no airtime could not respond.

</td><td>

✓ No

✓explanation - representative

✓ explanation – not watching programme ; no cellphone

(3)
[5]

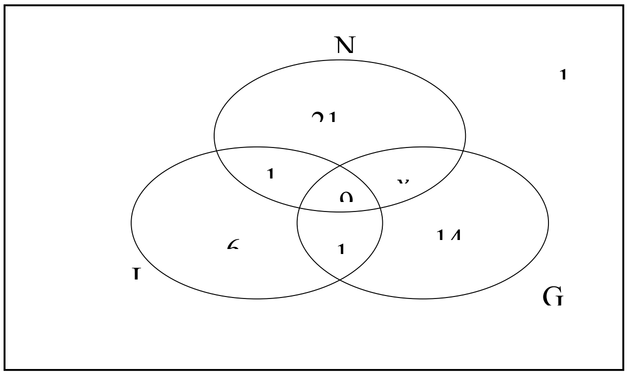
</td></tr>
</table>

QUESTION 4

4.1.1 11 students

✓answer (1)

4.1.2 Let N represent students reading the *National Geographic* magazine, G represent students reading the *Getaway* magazine and L represent students reading the *Leadership* magazine.



✓ 6
✓ 9
✓ $21 - x$
✓ $14 - x$
✓ all other values in Venn Diagram correct
(5)

Continuous Accuracy applies here

4.1.3 $21 - x + x + 14 - x + 9 + 14 + 10 + 6 + 11 = 80$

$85 - x = 80$

$x = 5$

No mark for $x = 5$ as it is already given

✓ $21 - x + x + 14 - x + 9 + 14 + 10 + 6 + 11$
✓ $= 80$
✓simplification
(3)

4.1.4 P(student reads at least two magazines) = $\frac{5+14+10+9}{80} = 0{,}475$

If candidate given in fraction form or rounding incorrect 2 out of 3

✓ numerator
✓divide by 80
✓answer (3)

4.2.1

P(smoke detected by device A or device B)
= P(smoke detected by A) + P(smoke detected by B) – P(smoke detected by both)
= 0,95 + 0,98 – 0,94
= 0,99

✓formula
✓substitution of probabilities
✓answer (3)

4.2.2 P(smoke not detected) = 1 – 0,99 = 0,01

✓answer (1)
[16]

QUESTION 5	
5.1.1 The number of different meal combinations = $3 \times 4 \times 2 = 24$.	✓multiplication rule ✓answer (2)
5.1.2 The number of different meal combinations that have chicken as main course = $3 \times 2 \times 2 = 12$	✓multiplication rule using 2 in the main course ✓answer (2)
5.2.1 Any learner seated in any position in: $6! = 6 \times 5 \times 4 \times 3 \times 2 \times 1$ $= 720$ different ways.	✓6! / multiplication rule ✓answer (2) If just write 6!, full marks
5.2.2 $2 \times 5! = 240$ **OR** These 2 particular learners could be seated in 2 different ways. Now consider them to be a single group. This group and the four remaining learners will yield 5 objects which results in $5! = 120$ different seating arrangements. Therefore the group of learners with these two particular learners seated together could be seated in $2 \times 120 = 240$ different ways.	✓multiplication rule – 2 learners ✓multiplication rule – 5 objects ✓answer (3) If just write $2 \times 5!$, full marks NOTE: Answer only in 5.1.1, 5.1.2 and 5.2.1 is full marks **[9]**

QUESTION 6

6.1 & 6.3

[redacted]

✓✓✓plotting points (3)

1 – 3 wrong 2 / 3
4 – 6 wrong 1 / 3
7 – 9 wrong 0 / 3

✓✓line of least squares (6.3) (2)

6.2 By using a calculator : a = 29,22 (29.21542…)
b = 0,89 (0,886530…)
$\therefore$ equation of line of least squares is $y = 29{,}22 + 0{,}89x$

✓✓ first value (a or b)
✓ second value (a or b)
✓ equation (4)

No penalty for incorrect decimal places

NOTE: According to the National Curriculum Statement the solutions to data-handling problems should be done with the use of a calculator. The alternative to the calculator is to use the pen and paper method as indicated below.

ALTERNATIVE

	x	y	$(x-\bar{x})$	$(y-\bar{y})$	$(x-\bar{x})(y-\bar{y})$	$(x-\bar{x})^2$	$(y-\bar{y})^2$
	16	45	–14,1	–10,9	153,69	198,81	118,81
	36	70	5,9	14,1	83,19	34,81	198,81
	20	44	–10,1	–11,9	120,19	102,01	141,61
	38	56	7,9	0,1	0,79	62,41	0,01
	40	60	9,9	4,1	40,59	98,01	16,81
	30	48	–0,1	– 7,9	0,79	0,01	62,41
	35	75	4,9	19,1	93,59	24,01	364,81
	22	60	– 8,1	4,1	–33,21	65,61	16,81
	40	63	9,9	7,1	70,29	98,01	50,41
	24	38	– 6,1	– 17,9	109,19	37,21	320,41
Sum	301	559	0	0	639,1	720,9	1290,9
Mean	30,1	55,9					

✓using the table
✓calculating the value of b

If incorrect table but correct substitution into formula 1 / 2

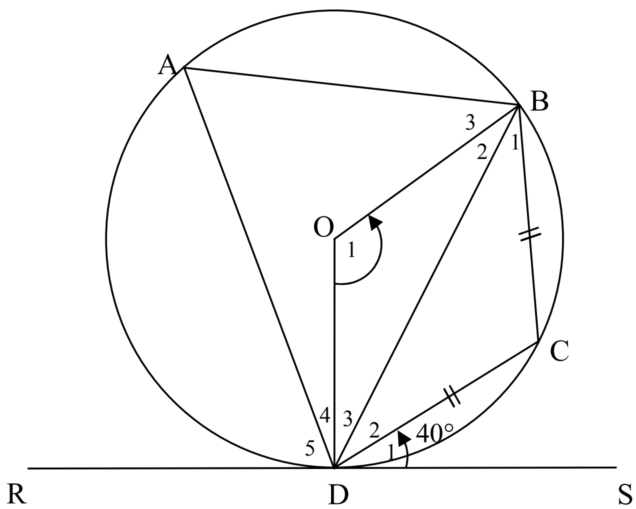
✓value of a (4)

No penalty for incorrect decimal places

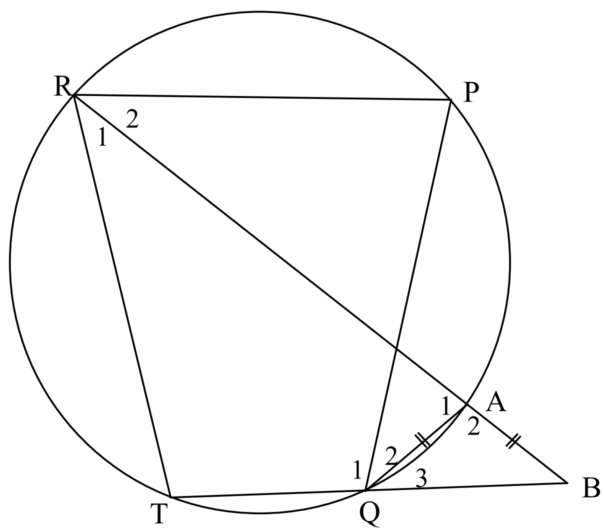
Consider the equation of the least squares line to be $\hat{y} = a + bx$

$$b = \frac{\sum(x-\bar{x})(y-\bar{y})}{\sum(x-\bar{x})^2} = \frac{639{,}1}{720{,}9} = 0{,}89 \qquad (0{,}88653)$$

Using $\hat{y} = a + bx$ and $\bar{x}$ and $\bar{y}$, 55,9 = a + (0,88653)(30,1) a = 29,22 (29,21542516)	If the equation is y = 0,89 + 29,22x 3 out of 4
Therefore equation of line of least squares is $y = 29{,}22 + 0{,}89x$ Also accept $y = 29 + x$	✓ equation
6.4 $y = 29{,}22 + (0{,}89)(22)$ $= 48{,}8$ Therefore the employee who undergoes 22 hours of training should produce about 49 units.	✓substituting 22 ✓answer (2)
6.5 r = 0,66	✓✓✓ answer (3)
OR $s_y = \sqrt{\dfrac{\sum(y-\bar{y})^2}{n}} = \sqrt{\dfrac{1290{,}9}{10}} = 11{,}36$ $s_x = \sqrt{\dfrac{\sum(x-\bar{x})^2}{n}} = \sqrt{\dfrac{720{,}9}{10}} = 8{,}49$ Using $b = r\dfrac{s_y}{s_x}$, we have $0{,}89 = r\dfrac{11{,}36}{8{,}49}$ r = 0,66	✓ s_y ✓ s_x ✓ answer (3)
6.6 Not a strong relationship because r is much less than 1 Positive correlation I would suggest that the manager look at the training programme and possibly revise it to meet the demands of the job. There is a positive correlation between the hours of training and productivity levels. However, the value of r does not indicate a very strong relationship between hours of training and productivity levels. I would suggest that the manager look at the training programme and possibly revise it to meet the demands of the job.	✓not very strong or NO ✓advice to manager (2) **[16]**

QUESTION 7	
7.1.1 equal to twice the angle subtended by the same chord at the circle.	✓ answer (1)
7.1.2 equal to the angle subtended by the same chord in the alternate segment.	✓ answer (1)
7.1.3 supplementary.	✓ answer (1)
	
7.2.1 $\hat{D}_1 = \hat{B}_1 = 40°$ …(angle between tangent and chord) $\therefore\ \hat{D}_2 = \hat{B}_1 = 40°$ …(CD = CB)	✓ statement & reason ✓ statement (2)
7.2.2 $\therefore\ \hat{C} = 180° - (40° + 40°)$ $= 100°$….(angle sum of triangle)	✓ statement $\hat{C} = 100°$ (1)
7.2.3 $\hat{A} = 180° - 100°$ $= 80°$ ……… (Opposite angles of a cyclic quad are supp.)	✓ statement $\hat{A} = 80°$ (1)
7.2.4 $\hat{O}_1 = 2\hat{A} = 160°$ …. (angle at the centre is twice…)	✓ statement $\hat{O}_1 = 160°$ ✓ reason (2)
ALTERNATIVE From 7.2.1 $\hat{D}_2 = \hat{B}_1 = 40°$ Now $\hat{D}_3 = 90° - (40° + 40°) = 10°$ … (tan ⊥ radius) $\therefore \hat{O}_1 = 180° - (10° + 10°) = 160°$ …(sum of angles in triangles)	✓ $\hat{D}_3 = 10°$ ✓ $\hat{O}_1 = 160°$ (2) **[9]**

QUESTION 8



8.1 $\hat{Q}_3 = \hat{R}_1 = \hat{R}_2 = x$ …(ext angle of cyclic quad…) and

(RA bisects $\hat{R}$)

$\hat{R}_2 = \hat{Q}_2 = x$ … (angles in the same segment)

Now $\hat{Q}_2 = \hat{Q}_3$

OR

$\hat{Q}_2 + \hat{Q}_3 = \hat{R}_1 + \hat{R}_2$ (ext angle of cyclic quad.)

but $\hat{Q}_2 = \hat{R}_2 = \hat{R}_1$ (angles in same segment, RA bisect...)

$\therefore \hat{Q}_3 = \hat{Q}_2$

OR

$\hat{Q}_2 + \hat{Q}_2 = \hat{R}_1 + \hat{R}_2$ (ext angle cyclic quad.)

but $\hat{Q}_2 = \hat{R}_2$ (angles in same segment)

$\Rightarrow \hat{Q}_3 = \hat{R}_1$

but $\hat{R}_1 = \hat{R}_2 = \hat{Q}_1$ (given)

$\Rightarrow \hat{Q}_3 = \hat{Q}_2$

$\therefore$ AQ bisects $P\hat{Q}B$

✓ $\hat{R}_1 = \hat{R}_2$
✓ reason
✓ $\hat{R}_2 = \hat{Q}_2 = x$
If no valid conclusion 2/3

(3)

Follow candidates' argument.

To get full marks candidate must reach a valid conclusion

8.2 $\hat{Q}_3 = \hat{B} = x$ … (angles opp equal sides, AQ = AB)

$\hat{R}_1 = \hat{B} = x$ … (from 8.1)

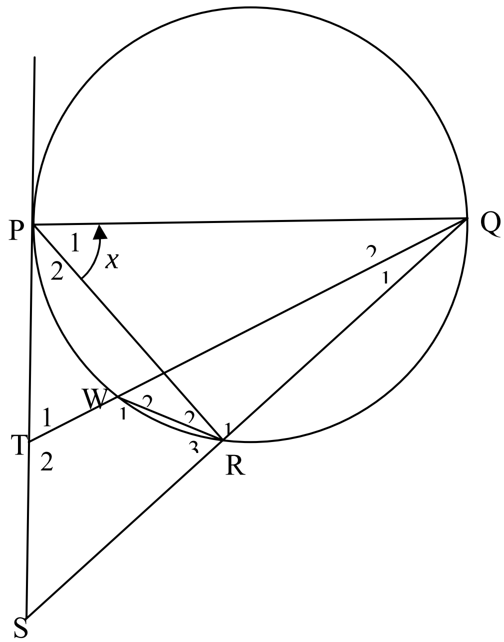
$\therefore$ TR = TB …….(sides opp equal angles)

✓ $\hat{Q}_3 = \hat{B} = x$
✓ $\hat{R}_1 = \hat{B} = x$

(2)

8.3 $\hat{P} = \hat{A}_1$ ($\angle$ in same segment) $\hat{A}_1 = \hat{Q}_3 + \hat{B}$ (ext $\angle$ of ΔABC = sum into opp $\angle$'s) $\hat{Q}_3 + \hat{B} = 2\hat{Q}_3$ ($\hat{Q}_3 = \hat{B}$ $\angle$'s opp equal sides) $2\hat{Q}_3 = 2\hat{R}_1$ (from 8.1) $2\hat{R}_1 = P\hat{R}T$ (given) **OR** $T\hat{R}P = 2x$ ……..(from above) $\hat{A}_1 = \hat{Q}_3 + \hat{B} = 2x$ ……(exterior angle of triangle) And $\hat{P} = \hat{A}_1 = 2x$ ….(angles in the same segment) $= T\hat{R}P$	✓ $\hat{P} = \hat{A}_1 = 2x$ ✓ $\hat{A}_1 = \hat{Q}_3 + \hat{B} = 2x$ ✓ $2\hat{Q}_3 = 2\hat{R}_1$ ✓ $\hat{R}_1 + \hat{R}_2 = 2x$ ✓ $\hat{A}_1 = \hat{Q}_3 + \hat{B} = 2x$ ✓ $\hat{P} = \hat{A}_1 = 2x$ (3) **[8]**

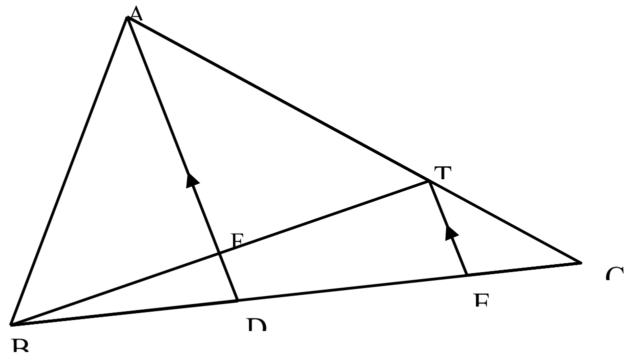
QUESTION 9



9.1 $\hat{R}_1 = 90°$ …(angle in a semi-circle)	✓ angle in a semi-circle (1)
9.2 $\hat{P}_2 = 90° - x$ …(angle between radius and tangent) $\hat{S} = 90° - \hat{P}_2$ …(ext. angle of Triangle)(sum of angles of triangle) $= 90° - (90° - x) = x$ $\therefore \hat{P}_1 = \hat{S} = x$	✓ $\hat{P}_2 = 90° - x$ ✓ $\hat{S} = 90° - \hat{P}_2$ ✓ $90° - (90° - x) = x$ (3)
9.3 $\hat{W}_2 = \hat{P}_1 = x$ …(angles in the same segment) Also $\hat{S} = x$ …(proved 9.2) $\hat{W}_2 = \hat{S}$ $\therefore$ SRWT is a cyclic quad…(ext angle = int. opposite angle)	✓ $Q\hat{W}R = \hat{P}_1 = x$ ✓ $Q\hat{W}R = \hat{S}$ ✓ reason (3)
9.4 In Δ QWR ; Δ QST $\hat{W}_2 = \hat{S}$ ….(proved 9.3) $\hat{Q}_1$ is common $W\hat{R}Q = \hat{T}_2$ ….(remaining angles) Δ QWR ||| Δ QST (AAA) or (∠∠∠) or equiangular	✓ $Q\hat{W}R = Q\hat{S}T$ ✓ $R\hat{Q}W$ is common ✓ AAA or ∠∠∠ or equiangular or 3rd angle equal (3)

9.5.1 $\frac{\text{TS}}{\text{RW}} = \frac{\text{QT}}{\text{QR}}$ ….. Δ QWR ||| Δ QST $\therefore \frac{\text{TS}}{2} = \frac{8}{4}$ $4\text{TS} = 16$ $\therefore \text{TS} = 4\,cm$	✓ $\frac{\text{TS}}{\text{RW}} = \frac{\text{QT}}{\text{QR}}$ ✓ $\frac{\text{TS}}{2} = \frac{8}{4}$ ✓ TS = 4 cm (3)
9.5.2 $\frac{\text{SQ}}{\text{WQ}} = \frac{\text{TS}}{\text{RW}}$ $\text{SQ} = \frac{4 \times 5}{2} = 10\,cm$ $\therefore \text{SR} = \text{SQ} - \text{RQ}$ $= 6\ cm$	✓ $\frac{\text{SQ}}{\text{WQ}} = \frac{\text{TS}}{\text{RW}}$ ✓10 cm ✓ 6 cm (3) **[16]**

QUESTION 10



10.1

$$\frac{CE}{ED} = \frac{CT}{TA} = \frac{1}{2}$$

✓ answer (1)

10.2 From 10.1 $\frac{CE}{ED} = \frac{1}{2}$

✓ use of ratio

But DC = 9 *cm*
$\therefore$ DE = 6 *cm*
= BD.
$\therefore$ D is the midpoint of BE.

✓ DE = *6 cm* (2)

10.3

$$\frac{FD}{TE} = \frac{BD}{BE}$$

✓proportion

$$\frac{2}{TE} = \frac{6}{12}$$

✓ answer (2)

$$6 \times TE = 24$$

$$TE = 4\,cm$$

ALTERNATIVE

✓proportion

D is the midpoint of BE. (from 10.2)
Then F is the midpoint of BT. … (sides in proportion)

✓ answer (2)

$\therefore$ TE = 2FD (midpoint theorem)
= 4 *cm*

10.4.1 $\dfrac{\Delta ADC}{\Delta ABD}=\dfrac{3}{2}$	✓ answer (1)
10.4.2 $\dfrac{\Delta TEC}{\Delta ABC}=\dfrac{\Delta TEC}{\Delta TBC}\times\dfrac{\Delta TBC}{\Delta ABC}$	✓ ratios
$=\left(\dfrac{1}{5}\right)\left(\dfrac{1}{3}\right)$	✓substitution
$=\dfrac{1}{15}$	✓ answer (3)
OR	
$\dfrac{\text{area }\Delta TEC}{\text{area }\Delta ABC}=\dfrac{\frac{1}{2}.TC.EC.\sin\hat{C}}{\frac{1}{2}.AC.BC.\sin\hat{C}}$	✓ ratios
$=\dfrac{TC.EC}{AC.BC}$	✓substitution
$=\left(\dfrac{1}{5}\right)\left(\dfrac{1}{3}\right)$	✓ answer (3)
$=\dfrac{1}{15}$	Answer Only : 3/3 **[9]**

TOTAL: 100