education

Department:
Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

MATHEMATICS P3

NOVEMBER 2008

MEMORANDUM

MARKS: 100

This memorandum consists of 11 pages.

QUESTION 1	
1.1 $T_1 = 2$; $T_n = T_{n-1} + 4$	✓ $T_1 = 2$ ✓+4 ✓recursion used (3)
1.2 $T_n = 2 + (n - 1)4 = 4n - 2$	✓✓ formula in terms of n (2) **[5]**
QUESTION 2	
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.	✓✓✓answer (3) **[7]**

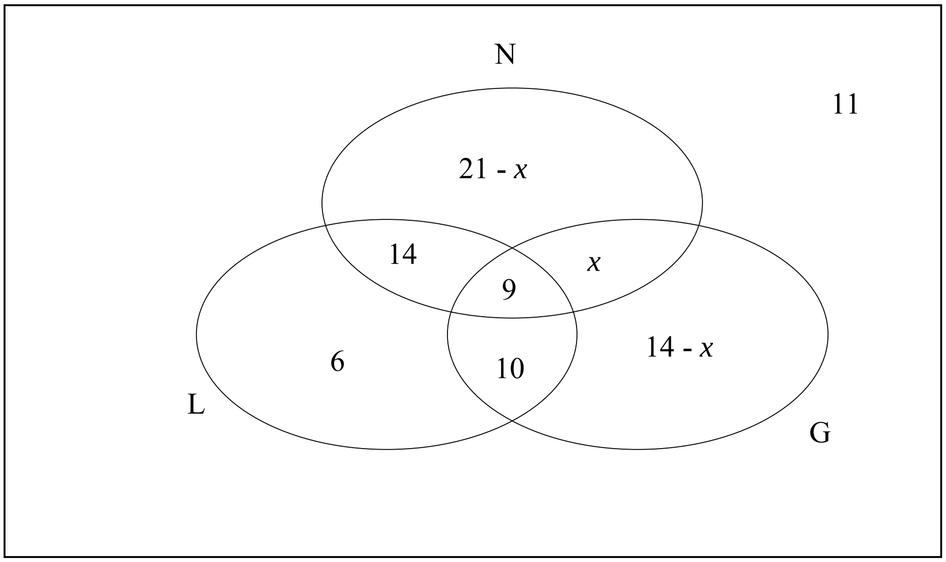
QUESTION 3	
3.1 65% of 7 800 = 5 070	✓ ✓answer (2)
3.2 No. This is just the opinion of a small sample of the South African population. The view of the vast majority has not been heard. It is also not known whether the sample is representative of the population. The results of the survey are not valid 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.	✓ no ✓explanation - representative ✓ explanation – not watching programme ; no cellphone (3) **[5]**

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
✓ 11
✓ 21 - x
✓ 14 - x
✓ other values (5)

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

$$85 - x = 80$$
$$x = 5$$

✓ ✓ setting up equation
✓simplification (3)

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

✓ 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)

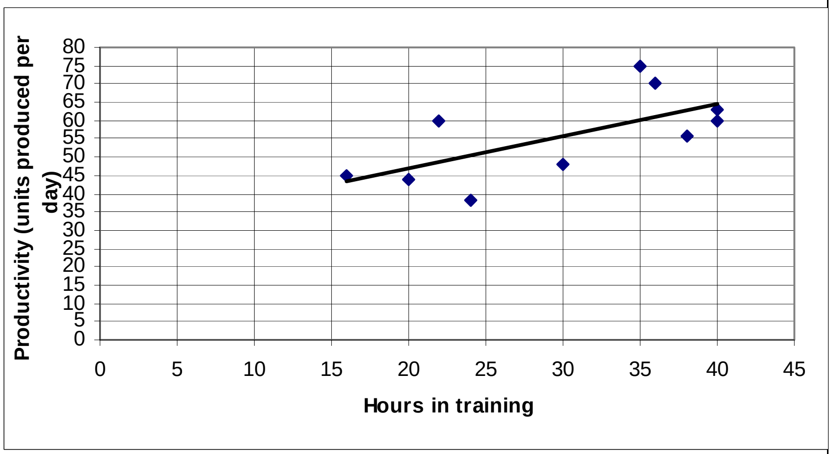
[16]

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 ✓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.	✓multiplication rule ✓answer (2)
5.2.2 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 these 2 particular learners could be seated together in $2 \times 120 = 240$ different ways.	✓multiplication rule – 2 learners ✓multiplication rule – 5 objects ✓answer (3) **[9]**

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.

QUESTION 6

6.1 & 6.3



✓✓plotting points
✓labels
(3)

✓✓line of least squares
(5.3)
(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 $y = 29{,}22 + 0{,}89x$

✓✓calculating the value of a
✓✓calculating the value of b
(4)

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					

✓✓calculating the value of b

✓✓calculating the value of a
(4)

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) Therefore equation of line of least squares is $y = 29{,}22 + 0{,}89x$	
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 $s_y = \sqrt{\dfrac{\sum (y - \bar{y})^2}{n}} = \sqrt{\dfrac{1290{,}9}{10}} = 11{,}36$ $s_x = \sqrt{\dfrac{\sum (x - \bar{x})^2}{n}} = \sqrt{\dfrac{720{,}9}{10}} = 8{,}49$ Using $b = r\dfrac{s_y}{s_x}$, we have $0{,}89 = r\dfrac{11{,}36}{8{,}49}$ r = 0,66	✓✓✓calculating the value of r (3) (or if read from the calculator – full marks)
6.6 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.	✓positive ✓advise to manager (2) **[16]**

QUESTION 7	
7.1.1 equal to twice the angle subtended by the same chord at the circumference.	✓ answer (1)
7.1.2 equal to the angle subtended 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)	✓ reason ✓ answer (2)
7.2.2 $\therefore\ \hat{C} = 180° - (40° + 40°)$ $= 100°$….(angle sum of triangle)	✓ answer (1)
7.2.3 $\hat{A} = 180° - 100°$ $= 80°$ ……… (Opposite angles of a cyclic quad are supp.)	✓ answer (1)
7.2.4 $\hat{O}_1 = 2\hat{A} = 160°$ ….(angle at the centre is twice…)	✓ answer ✓ 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 Let $\hat{Q}_3 = \hat{B} = x$ … (angles opp equal sides, AQ = AB) $\hat{Q}_3 = \hat{R}_1 = \hat{R}_2 = x$ …(ext angle of cyclic quad…) and (RA bisects $\hat{R}$) $\hat{R}_2 = \hat{Q}_2 = x$ … (angles in the same segment) Now $\hat{Q}_2 = \hat{Q}_3 = x$ **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 $P\hat{Q}B$	✓ $\hat{Q}_3 = \hat{B} = x$ ✓ $\hat{R}_1 = \hat{R}_2 = x$ ✓ $\hat{R}_2 = \hat{Q}_2 = x$ (3)
8.2 $\hat{R}_1 = \hat{B} = x$ ………(from 8.1) $\therefore$ TR = TB …….(sides opp equal angles)	✓ $\hat{R}_1 = \hat{B} = x$ ✓ isosceles triangle (2)
8.3 $T\hat{R}P = 2x$ ……..(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) $= T\hat{R}P$	✓ $\hat{R}_1 + \hat{R}_2 = 2x$ ✓ $\hat{A}_1 = \hat{Q}_3 + \hat{B} = 2x$ ✓ $\hat{P} = \hat{A}_1 = 2x$ (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)	✓ $Q\hat{W}R = Q\hat{S}T$ ✓ $R\hat{Q}W$ is common ✓ angles equal (3)
9.5.1 $\frac{TS}{RW} = \frac{QT}{QR}$ ….. Δ QWR ||| Δ QST $\therefore \frac{TS}{2} = \frac{8}{4}$ $4TS = 16$ $\therefore TS = 4\ cm$	✓ $\frac{TS}{RW} = \frac{QT}{QR}$ ✓ $\frac{TS}{2} = \frac{8}{4}$ ✓ $TS = 4\ cm$ (3)
9.5.2 $\frac{SQ}{WQ} = \frac{TS}{RW}$ $SQ = \frac{4 \times 5}{2} = 10\ cm$ $\therefore SR = SQ - RQ$ $= 6\ cm$	✓ $\frac{SQ}{WQ} = \frac{TS}{RW}$ ✓ $10\ cm$ ✓ $6\ cm$ (3) **[16]**

QUESTION 10	
10.1 $\frac{CE}{ED}=\frac{CT}{TA}=\frac{1}{2}$	✓ answer (1)
10.2.1 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)
10.2.2 D is the midpoint of BE. (from 10.2.1) Then F is the midpoint of BT. … (sides in proportion)	✓proportion
$\therefore$ TE = 2FD (midpoint theorem) = 4 *cm*	✓ answer (2)
ALTERNATIVE $\frac{FD}{TE}=\frac{BD}{BE}$	✓proportion
$\frac{2}{TE}=\frac{6}{12}$ $6\times TE=24$ $TE=4\,cm$	✓ answer (2)
10.3.1 $\frac{\Delta ADC}{\Delta ABD}=\frac{3}{2}$	✓ answer (1)
10.3.2 $\frac{\Delta TEC}{\Delta ABC}=\frac{\Delta TEC}{\Delta TBC}\times\frac{\Delta TBC}{\Delta ABC}$	✓ ratios
$=\left(\frac{1}{5}\right)\left(\frac{1}{3}\right)$	✓substitution
$=\frac{1}{15}$	✓ answer (3) **[9]**

TOTAL: 100