education

Department:
Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

MATHEMATICS P3

EXEMPLAR 2008

MEMORANDUM

This memorandum consists of 9 pages.

MEMORANDUM : GRADE 12, Exemplar PAPER 3,

QUESTION ONE 1.1 $T_1 = 5$, $T_2 = 8$, $T_3 = 11$, $T_4 = 14$, $T_5 = 17$. 1.2 $Tn = 3n + 2$	✓✓✓calculating terms from formula (3) ✓calculating the coefficient of n ✓ calculating the value of the constant. (2) **[5]**
QUESTION TWO 2.1 Average $= \frac{61}{3}$ $= 20,33$ 2.2 Since it is not an every day occurrence that 20 people will die in a train collision, the average is skewed from $\frac{41}{3} = 13,67$ to $\frac{61}{3} = 20,33$. 2.3 No. The reporter stood at one spot for TWO hours. The sample that the report was based on was far too small to make any valid conclusions. The conclusion does not take into account the situation at other level crossings. OR Yes From his experience only 1 car stopped, hence his claim could be valid.	✓answer (1) ✓✓explanation (2) ✓no ✓explanation (2) **[5]**

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 THREE

3.1

Hourly earnings	Midpoint of interval (x)	Frequency (f)	Total ($f \times x$)
9,70 – < 9,90	9,80	5	49
9,90 – <10,10	10,00	16	160
10,10 – <10,30	10,20	25	255
10,30 – <10,50	10,40	30	312
10,50 – <10,70	10,60	24	254,4
Sum			1030,4

✓midpoints of intervals
✓totals

✓sum

$$\text{Mean} = \frac{1030,4}{100} = R10,30$$

✓calculating the mean

(4)

3.2

Percentages	Midpoint of interval (x)	Frequency (f)	$(x-\bar{x})$	$(x-\bar{x})^2$	$f\times(x-\bar{x})^2$
9,70 – <9,90	9,80	5	-0,5	0,25	1,25
9,90 – <10,10	10,00	16	-0,3	0,09	1,44
10,10 – <10,30	10,20	25	-0,1	0,01	0,25
10,30 – <10,50	10,40	30	0,1	0,01	0,3
10,50 – <10,70	10,60	24	0,3	0,09	2,16
				Sum	5,4

✓calculating the difference between midpoints and mean

✓calculating the squares of the difference between midpoints and mean

✓calculating the totals

$$\text{Standard deviation} = \sqrt{\frac{5,4}{100}} = 0,23$$

✓✓calculating the standard deviation

(5)

3.3 Yes, she is correct. The difference in the mean between men and women is only 5 cents and the difference between the standard deviation is 2 cents.

✓answer
✓explanation
(2)

3.4

Hourly earnings	Frequency (f)	Cumulative frequency
9,70 – <9,90	5	5
9,90 – <10,10	16	21
10,10 – <10,30	25	46
10,30 – <10,50	30	76
10,50 – <10,70	24	100

✓✓cumulative frequency

✓✓ogive

(4)

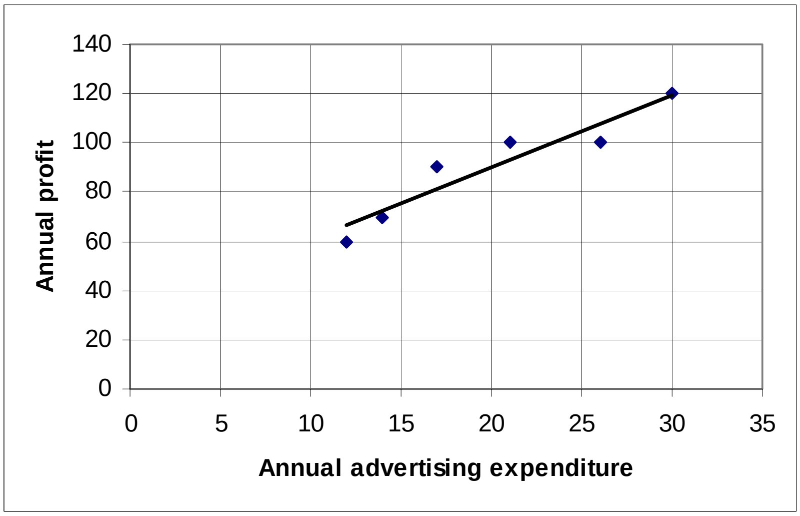
[15]

QUESTION FOUR 4.1 P(pass Maths or Acc) = P(pass Maths) + P(pass Acc) - P(pass Maths and Acc) = 0,4 + 0,6 – 0,3 = 0,7	✓formula ✓substitution of probabilities ✓answer (3)
4.2.1 P(first one not defective) = $\frac{35}{40} = \frac{7}{8}$	✓✓answer (2)
4.2.2 P(one defective and one not defective) = P(defective, not defective) + P(not defective, defective) $= \left(\frac{5}{40} \times \frac{35}{39}\right) + \left(\frac{35}{40} \times \frac{5}{39}\right)$ $= \frac{35}{156} = 0{,}22$ (0,2243589…)	✓sum of probabilities ✓✓substitution of probabilities ✓answer (4)
4.2.3 P(defective and defective) = $\frac{5}{40} \times \frac{4}{39} = \frac{1}{78} = 0.01$ (0.012820..)	✓✓substitution of probabilities and product ✓answer (3)
4.3.1 Any book in any position in $7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1 = 7! =$ 5040 different ways.	✓multiplication rule ✓answer (2)
4.3.2 The two books can be arranged in $2 \times 1 = 2$ different ways. Consider these two books as a single entity. Now we need to arrange six objects. This can be done in $6 \times 5 \times 4 \times 3 \times 2 \times 1 =$ 6! = 720 different ways. Therefore the total arrangement of these books can take place in $2 \times 720 = 1440$ different ways.	✓multiplication rule – two books ✓multiplication rule – six objects ✓answer (3)
4.3.3 The Mathematics books can be arranged in $4 \times 3 \times 2 \times 1 = 4! =$ 24 different ways. The Science books can be arranged in $3 \times 2 \times 1 = 3! = 6$ different ways. The Mathematics books and the Science books can be arranged in $2 \times 1 = 2$ different ways. Therefore the total arrangement of these books can take place in $24 \times 6 \times 2 = 288$ different ways.	✓multiplication rule – 24 and 6 ✓multiplication rule – two different subjects ✓answer (3) **[20]**

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 FIVE

5.1 & 5.3



✓✓plotting points
✓labels
(3)

✓line of least squares
(1)

5.2

	x	y	$(x-\bar{x})$	$(y-\bar{y})$	$(x-\bar{x})(y-\bar{y})$	$(x-\bar{x})^2$	$(y-\bar{y})^2$
	12	60	-8	-30	240	64	900
	14	70	-6	-20	120	36	400
	17	90	-3	0	0	9	0
	21	100	1	10	10	1	100
	26	100	6	10	60	36	100
	30	120	10	30	300	100	900
Sum	120	540	0	0	730	246	2400
Mean	20	90					

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

$$b = \frac{\sum(x-\bar{x})(y-\bar{y})}{\sum(x-\bar{x})^2} = \frac{730}{246} = 2{,}97 \qquad (2{,}9674)$$

✓✓calculating the value of b

Using $\hat{y} = a + bx$ and $\bar{x}$ and $\bar{y}$,
$90 = a + (2{,}97)(20)$
$a = 30{,}6$.

Therefore equation of line of least squares is $y = 30{,}65 + 2{,}97x$

✓✓calculating the value of a
(4)

5.4 $y = 30{,}6 + (2{,}97)(25000)$ $= 104\,850$ $\therefore$ Profit = R104 850.	✓substituting 25 ✓profit in rands (2)
5.5 $s_y = \sqrt{\dfrac{\sum (y-\bar{y})^2}{n-1}} = \sqrt{\dfrac{2400}{5}} = 21{,}908$ $s_x = \sqrt{\dfrac{\sum (x-\bar{x})^2}{n-1}} = \sqrt{\dfrac{246}{5}} = 7{,}0142$ Using $b = r\dfrac{s_y}{s_x}$, we have $2{,}9674 = r\dfrac{21{,}908}{7{,}0142}$ $r = 0{,}95$	✓✓✓calculating the value of r (3)
5.6 There is strong positive correlation between the annual advertising expenditure and the annual profit of the company.	✓strong ✓positive (2) **[15]**

QUESTION SIX	
6.1.1 $3x + x + 2x = 180°$ (angles on a straight line) $6x = 180°$ $x = 30°$	✓ $3x + x + 2x = 180°$ ✓ reason ✓ answer (3)
6.1.2 $\hat{B}_1 = 2x = 60°$ $\hat{E} = 60°$ Now $\hat{E} = \hat{B}_1$ $\therefore$ AC is a tangent (angle between line and chord = angle in alternate segment)	✓ $\hat{B}_1 = 2x = 60°$ ✓ reason (2)

6.2.1 A clock has 12 sectors (each say α) Now $12\alpha = 360°$ $\therefore\ \alpha = 30°$ at centre $\therefore\ A\hat{O}D = 60°$ (angle at the centre …)	✓$12\alpha = 360°$ ✓ $A\hat{O}D = 60°$ (2)
6.2.2 From 6.1 $C\hat{O}B = 3\alpha$ $C\hat{O}B = 3(30°) = 90°$	✓ $C\hat{O}B = 3x$ ✓ $C\hat{O}B = 3(30°) = 90°$ (2)
6.2.3 $C\hat{A}B = ½ (90°)$ ……(angle at the centre ….) $= 45°$ $A\hat{C}D = \frac{1}{2}(60°)$ ……(angle at the centre ….) $= 30°$ Now $\hat{E}_1 = C\hat{A}B + A\hat{C}D$ ……(exterior angle of triangle ….) $= 75°$	✓ 45° ✓ $A\hat{C}D = ½ (60°)$ ✓ 75° (3) **[12]**
<u>QUESTION SEVEN</u> 7.1 $4t > 3t$ $4t + 1 > 3t - 1$ and $3t - 1 < 3t$ $\therefore\ 4t + 1 > 3t > 3t - 1$ $\therefore$ DF is the longest side	✓$4t + 1 > 3t > 3t - 1$ ✓ DF is the longest side (2)
7.2 $DF^2 = (4t + 1)^2 = 16t^2 + 8t + 1$ $EF^2 = (3t - 1) = 9t^2 - 6t + 1$ $DE^2 = (3t)^2 = 9t^2$ For ΔDEF to be right angled We must have : $16t^2 + 8t + 1 = 18t^2 - 6t + 1$(Converse Pythagoras) $-2t^2 + 14t = 0$ $-2t(t - 7) = 0$ $t = 0$ (N /A) ; <u>$t = 7$</u>	✓$(4t + 1)^2 = 16t^2 + 8t + 1$ ✓ Converse Pythagoras ✓ $-2t(t - 7) = 0$ ✓ $t = 7$ (4) **[6]**

QUESTION EIGHT	
8.1 $B_1 = x$……(angle between tan-chord theorem) $A_2 = x$ …..(FA = FB) $B_2 = x$ …..(DAB = DBA = $2x$ / tan-chord theorem) $D_1 = B_2 = x$ …..(alternate angles, DC//FB) $C = B_1 = x$ …..(corresponding angles, DC//FB / ext $\angle$ theorem)	✓ one mark for each angle ✓ ✓ ✓ ✓ (5)
8.2 $A_2 = D_1 = x$ …..(from 8.1 above.) but these are angles subtended by BE $\therefore$ ABED is cyclic	✓ $A_2 = D_1 = x$ ✓ reason (2)
8.3 $B_3 = A_1 = x$ ……..(angles in the same segment) Now ABE = $B_1 + B_2 + B_3$ $= 3x$ = 3DAE.	✓$B_3 = A_1 = x$ ✓ABE = $B_1 + B_2 + B_3$ ✓ $3x$ (3)
8.4 $D_1 = C = x$ $\therefore$ BD = CB ……..(Isosceles Triangle) but BD = AD ……..(tangents from a common point) $\therefore$ AD = BC	✓ $D_1 = C = x$ ✓ BD = CB ✓ BD = AD (3) **[12]**
QUESTION NINE	
9.1 $R_2 = R_3 = x$ ……..(LRN bisected) $R_2 = P_1 = x$………(corresponding angles, RM//PN) $R_3 = N_1 = x$ ……....(alternate angles; RM//PN) Now RN = RP In Δ LNP ; $\frac{LR}{RP} = \frac{LM}{MN}$ …..(RM//PN; lines drawn parallel to..) But RN=RP $\frac{LR}{RN} = \frac{LM}{MN}$	✓ $R_2 = P_1 = x$ ✓ $R_3 = N_1 = x$ ✓ RN = RP ✓ $\frac{LR}{RP} = \frac{LM}{MN}$ (4)
9.2 $R_2 = L_1 = x$ ……..(alternate angles, KL//PN) Now $L_1 = N_1 = x$ $\therefore$ KLNP is cyclic ….(angles subtended by the same arc..)	✓ $R_2 = L_1 = x$ ✓ $L_1 = N_1 = x$ (2)
9.3 In Δ's KLP, MRN $L_1 = R_3 = x$ ….(from 9.1) $N_2 = P_2$ ……….(KLNP is cyclic) LKP = RMN ….(Remaining angles) $\therefore \Delta$ KLP ||| Δ MRN	✓ $L_1 = R_3 = x$ ✓ $N_2 = P_2$ ✓ LKP = RMN (3) **[9]**

TOTAL : 100 marks