



education

Department:
Education
REPUBLIC OF SOUTH AFRICA

**NATIONAL
SENIOR CERTIFICATE**

GRADE 12

MATHEMATICS P3

FEBRUARY/MARCH 2009

MEMORANDUM

MARKS: 100

This memorandum consists of 11 pages.

QUESTION 1 1.1 33 1.2 $T_{n+1} = T_n + 5$ and $T_1 = 3$	✓ 33 (1) ✓✓ formula in terms of n ✓ $T_1 = 3$ (3) [4]								
QUESTION 2 2.1 Yes. According to the bar chart, the total amount spent on workers salaries is R800 000 and the total amount spent on managers salaries is R400 000, hence twice the amount. 2.2. No. The total amount paid to workers is the highest of the three categories. This is expected taking into account the high number of workers in this company. The bar chart does not show the salary of individual workers and individual managers. If individual salaries are taken into account, a low percentage increase for workers will not reduce the gap in salaries. To the contrary, it will widen the gap. 2.3 Mean = $\frac{\text{R } 800\,000}{200} = \text{R } 4\,000$ 2.4 Mean monthly salary paid to different category of employee <table border="1"> <caption>Data from Bar Chart</caption> <thead> <tr> <th>Category of employee</th> <th>Mean monthly salary (in Rands)</th> </tr> </thead> <tbody> <tr> <td>Director</td> <td>150 000</td> </tr> <tr> <td>Manager</td> <td>25 000</td> </tr> <tr> <td>Worker</td> <td>5 000</td> </tr> </tbody> </table>	Category of employee	Mean monthly salary (in Rands)	Director	150 000	Manager	25 000	Worker	5 000	✓ yes ✓ reason (2) ✓ no ✓ reason (2) ✓ R800 000 ✓ answer (2) ✓ labels and heading ✓✓✓ height of bars (4) [10]
Category of employee	Mean monthly salary (in Rands)								
Director	150 000								
Manager	25 000								
Worker	5 000								

QUESTION 3

3.1 $176 - 30 = 146$ and $176 + 30 = 206$. Therefore the interval between 146 seconds and 206 seconds lies between one standard deviation of the mean. For the normal distribution, approximately 68% of the data lies between one standard deviation of the mean.	✓ calculation ✓ one standard deviation ✓ 68% (3)
3.2 The middle 96% of the data for a normal distribution lies between 2 standard deviations on either side of the mean. The lower limit will be $176 - 2(30) = 116$ seconds. The upper limit will be $176 + 2(30) = 236$ seconds. The middle 96% of the calls will be between 116 and 236 seconds.	✓ 2 standard deviations ✓ lower limit ✓ upper limit (3)
3.3 Approximately 34% of the calls are between 146 and 176 seconds. Another 50% of the calls are in excess of 176 seconds. Therefore, in total, approximately 84% of the calls are in excess of 146 seconds.	✓ 34% & 50% ✓ 84% (2) [8]

4.3 Since the teams work on the problem independently, the probabilities that both teams will solve the problem

$$= \frac{1}{2} \times \frac{1}{3} = \frac{1}{6} = 0,17.$$

$$\text{Now } P(\text{problem will be solved}) = \frac{1}{2} + \frac{1}{3} - \frac{1}{6} = \frac{2}{3} = 0,67$$

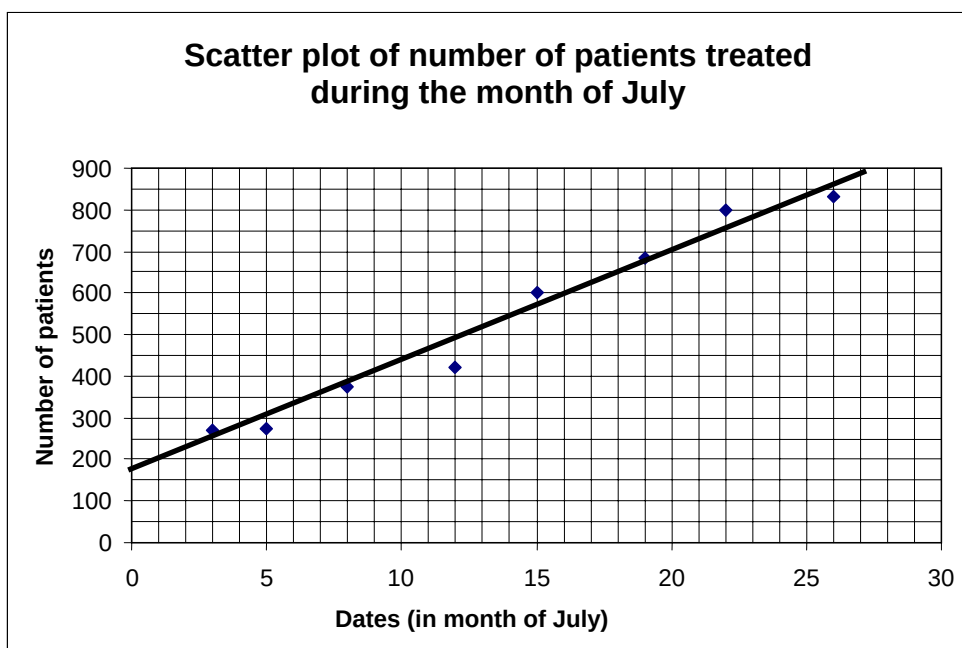
- ✓ independent events.
- ✓ probability both teams solve the problem

- ✓ probability rule
- ✓ answer

(4)

[22]**QUESTION 5**

5.1 & 5.3



- ✓✓ plotting points
- ✓ labels

(3)

- ✓✓ line of least squares (5.3)

(2)

5.2 By using a calculator : $a = 161,24$ (161,2371188...)
 $b = 26,88$ (26,88275499...)
 $\therefore$ equation of line of least squares is $y = 161,24 + 26,88x$

- ✓✓ calculating the value of a
- ✓✓ calculating the value of b

(4)

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. All answers have been rounded to two decimal places for ease of calculations.

ALTERNATIVE

	x	y	$(x - \bar{x})$	$(y - \bar{y})$	$(x - \bar{x})(y - \bar{y})$	$(x - \bar{x})^2$	$(y - \bar{y})^2$
	3	270	-10,75	-260,88	2804,46	115,56	68058,37
	5	275	-8,75	-255,88	2238,95	76,56	65474,57
	8	376	-5,75	-154,88	890,56	33,06	23987,81
	12	420	-1,75	-110,88	194,04	3,06	12294,37
	15	602	1,25	71,13	88,91	1,56	5059,48
	19	684	5,25	153,13	803,93	27,56	23448,80
	22	800	8,25	269,13	2220,32	68,06	72430,96
	26	820	12,25	289,13	3541,84	150,06	83596,16
Sum	110	4247	0	0	12783,01	475,48	354350,52
Mean	13,75	530,875					

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

$$b = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sum (x - \bar{x})^2} = \frac{12783,01}{475,48} = 26,88$$

(26,88443257)

Using $\hat{y} = a + bx$ and $\bar{x}$ and $\bar{y}$,

$$530,875 = a + (26,88443257)(13,75)$$

$$a = 161,21 \quad (161,2140522)$$

Therefore equation of line of least squares is $y = 161,21 + 26,88x$

✓✓ calculating the value of b

✓✓ calculating the value of a

- 5.4 On 30 June, $x = 0$.
Therefore approximately 161 patients were treated on 30 June.

✓ substituting 0
✓ answer

ALTERNATIVE USING TABLE VALUES:

On 30 June, $x = 0$.

Therefore approximately 161 patients were treated on 30 June.

(2)

- 5.5 On 24 July, $x = 24$.
 $\hat{y} = 161,21 + 26,88(24) = 806,36$
Approximately 806 patients were treated as at 24 July.

✓ substituting 24
✓ answer

ALTERNATIVE USING TABLE VALUES:

$$y = 161,21 + (26,88)(24)$$

$$= 806,33$$

Approximately 806 patients were treated as at 24 July.

(2)

- 5.6 By using a calculator, $r = 0,98$ (0,9847864966...)
 There is a very strong positive correlation between the number of days elapsed in July and the number of patients that were treated. This would suggest that there was a rapid spread of the influenza virus in the community.

✓✓ calculating the value of r

✓ interpretation

ALTERNATIVE USING TABLE VALUES:

$$s_y = \sqrt{\frac{\sum (y - \bar{y})^2}{n}} = \sqrt{\frac{354350,52}{8}} = 210,46$$

$$s_x = \sqrt{\frac{\sum (x - \bar{x})^2}{n}} = \sqrt{\frac{475,48}{8}} = 7,71$$

Using $b = r \frac{s_y}{s_x}$, we have $26,88 = r \frac{210,46}{7,71}$

$$r = 0,98$$

There is a very strong positive correlation between the number of days elapsed in July and the number of patients that were treated. This would suggest that there was a rapid spread of the influenza virus in the community.

(3)
[16]

QUESTION 6

6.1 equal to twice the angle at the circumference.

✓ answer (1)

6.2.1

$$\hat{T} = \hat{R}_1 = y \quad \dots(\text{PR} = \text{PT})$$

$$\text{Now } \hat{P}_1 = 2y \quad \dots(\text{ext } \angle \text{ of triangle } \dots)$$

$$\text{and } \hat{O}_1 = 2\hat{P}_1 \quad \dots(\text{angle at centre } \dots)$$

$$\text{i.e. } x = 2(2y) = 4y$$

✓ PR = PT

$$\checkmark \hat{P}_1 = 2y$$

✓ answer (3)

6.2.2 (a)

From 6.2.1

$$x = 4y = 120^\circ$$

$$\therefore y = 30^\circ$$

✓ ✓ answer

(2)

6.2.2 (b) Join Q to R and let $\hat{QRO} = \hat{R}_3$

$$\hat{T} = y = 30^\circ$$

$$\text{but } \hat{TQR} = \hat{TRQ} \quad \dots(\text{TQ} = \text{TR, isosceles triangle})$$

$$\hat{TQR} = \hat{TRQ} = \frac{180^\circ - 30^\circ}{2} = 75^\circ$$

$$\text{Now } \hat{R}_1 + \hat{R}_2 + \hat{R}_3 = 75^\circ$$

$$\text{i.e. } 30^\circ + \hat{R}_2 + 30^\circ = 75^\circ$$

$$\therefore \hat{R}_2 = 15^\circ$$

✓ calculation

✓ substitution

✓ answer (3)

[9]

QUESTION 7

7.1

$\hat{P}_1 = \hat{Q}_1 = x$ (given)
 and $\hat{P}_1 = \hat{R} = x$ (tan - chord theorem)
 Now $\hat{Q}_1 = \hat{R} = x$
 $\therefore TQ \parallel SR$ (corresponding angles are equal)

✓ $\hat{P}_1 = \hat{Q}_1 = x$
 ✓ $\hat{P}_1 = \hat{R} = x$
 ✓ reason
 ✓ reason (4)

7.2

$\hat{P}_1 = \hat{S}_1 = x$ (TS = SP, tangents from a common point)
 $\therefore \hat{Q}_1 = \hat{S}_1$ (both = x)
 But these are angles subtended by the same line segment TP
 $\therefore QPTS$ is a cyclic quadrilateral

✓ $\hat{P}_1 = \hat{S}_1 = x$
 ✓ reason
 ✓ conclusion
 ✓ reason (4)

7.3

$\hat{P}_1 = \hat{Q}_1 = x$ (given)
 $\hat{P}_1 = \hat{Q}_2 = x$ (QPTS is a cyclic quad -
 angles subtended by same chord.)
 $\therefore \hat{Q}_1 = \hat{Q}_2$
 $\therefore TQ$ bisects $\hat{SQP}$.

✓ $\hat{P}_1 = \hat{Q}_2 = x$
 ✓ reason
 ✓ conclusion (3)
[11]

QUESTION 88.1 In ΔABQ ,

$$\frac{BR}{RA} = \frac{BT}{TQ}$$

..... (RT $\parallel$ AQ, proportional intercept theorem)

$$\frac{1}{2} = \frac{k}{TQ}$$

$$\therefore TQ = 2k$$

✓ statement & reason

$$\checkmark \frac{1}{2} = \frac{k}{TQ}$$

✓ answer

(3)

8.2.1 In ΔCRT ,

$$\frac{CP}{PR} = \frac{5k}{2k}$$

.... (RT $\parallel$ AQ, proportional intercept theorem)

$$\therefore \frac{CP}{PR} = \frac{5}{2}$$

✓ ratio

✓ reason

✓ answer

(3)

8.2.2

$$\begin{aligned} \frac{\text{Area } \Delta RCT}{\text{Area } \Delta ABC} &= \frac{\text{Area } \Delta RCT}{\text{Area } \Delta BRC} \times \frac{\text{Area } \Delta BRC}{\text{Area } \Delta ABC} \\ &= \frac{7}{8} \times \frac{1}{3} \\ &= \frac{7}{24} \end{aligned}$$

.. (the ratio of the areas of triangles having equal altitude)

✓ ratio of areas

$$\checkmark \frac{7}{8}$$

$$\checkmark \frac{1}{3}$$

$$\checkmark \frac{7}{24}$$

(4)

[10]

QUESTION 99.1 In $\triangle BPE$ and $\triangle BDA$ $\hat{B}_1$ is common $\hat{P}_2 = \hat{D} = 90^\circ$ (given perpendicular, $\angle$ in a semi - circle) $\hat{B A D} = \hat{E}_3$ (remaining angles) $\therefore \triangle BPE \sim \triangle BDA$ (equiangular)9.2 $\triangle BPE \sim \triangle BDA$ (from 9.1) $\therefore \frac{BP}{BD} = \frac{PE}{DA}$ (sides in proportion)9.3 $AB = \frac{BD \cdot BE}{BP}$

$$AB^2 = \frac{BD^2 \cdot BE^2}{BP^2}$$

In $\triangle PBE$; $BE^2 = BP^2 + PE^2$ (Theorem of Pythagoras)

$$AB^2 = \frac{BD^2 \cdot (BP^2 + PE^2)}{BP^2}$$

$$AB^2 = \frac{BD^2 \cdot BP^2}{BP^2} + \frac{BD^2 \cdot PE^2}{BP^2}$$

$$AB^2 = BD^2 + \frac{BD^2 \cdot PE^2}{BP^2}$$

✓ $\hat{B}_1$ is common✓ $\hat{P}_2 = \hat{D} = 90^\circ$ ✓ $\hat{B A D} = \hat{E}_3$

(3)

✓ similar triangles

✓ reason

(2)

✓ changing the subject of the formula

✓ squaring

✓ $PB^2 = BE^2 - PE^2$

✓ substitution

✓ simplification

(5)

[10]**TOTAL: 100**