education

Department:
Education
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE (VOCATIONAL)
NQF LEVEL 4

NOVEMBER 2009

MATHEMATICS
(First Paper)

This memorandum consists of 11 pages.

QUESTION 1

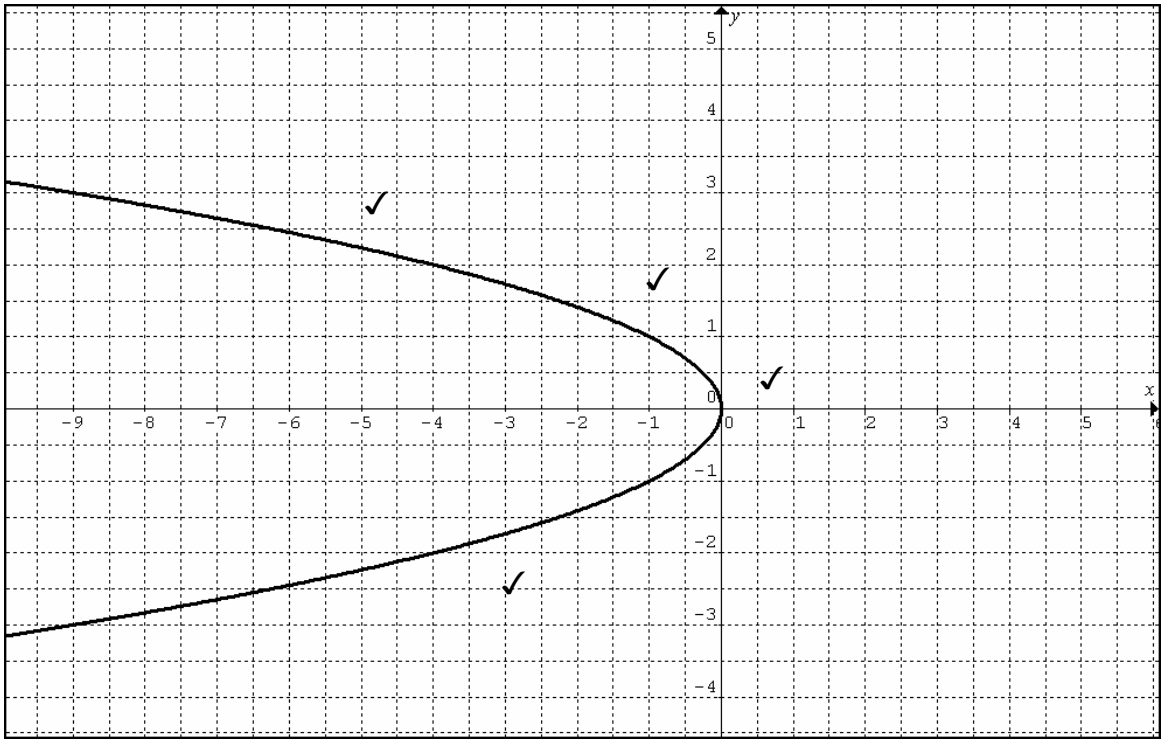
✓= 1 MARK √ $= \frac{1}{2}$ MARK

1.1.1 $y = 0$ or the y - axis ✓ (1)

1.1.2 Function ✓ √ Yes; many to one mapping √ (1)

1.1.3
$y = -x^2$
$x = -y^2$ ✓
$-y^2 = x$
$y^2 = -x$
$y = \sqrt{-x}, x < 0$ ✓ (2)

1.1.4



Mark graph in both directions.
Mark ③ correct points on the graph including the turning point. (3)

1.1.5 Continuous ✓ (1)

1.2 $f(x) = 2x^3 + x^2 - 5x - p$

$f(-3) = 2(-3)^3 + (-3)^2 - 5(-3) - p = 0$ ✓

$-54 + 9 + 15 - p = 0$ ✓

$p = -30$ ✓

(3)

1.3.1 $y \geq \frac{1}{2}x$ ✓

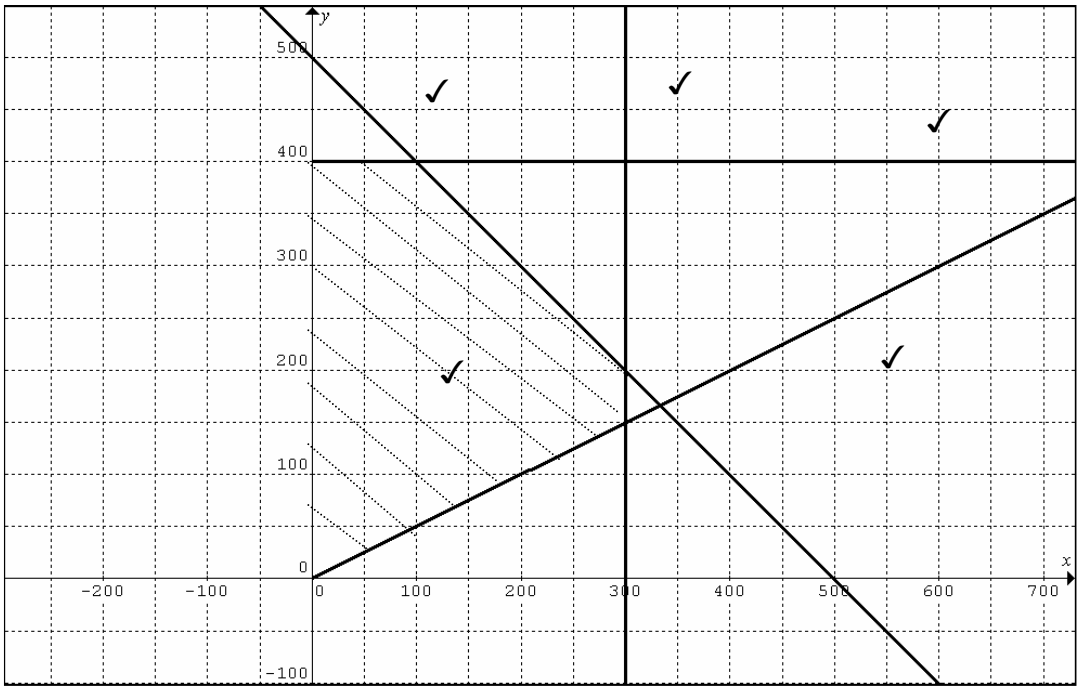
$x + y \leq 500$ ✓

$x \leq 300$ ✓

$y \leq 400$ ✓

(4)

1.3.2



(5)

1.3.3 $P = 4{,}5x + 3y$ ✓

$y = -\frac{3}{2}x + \frac{P}{3}$

(1)

1.3.4 The learner needs to show the search line. ✓

300 hamburgers and 200 chicken burgers should be sold ✓

$P = 4{,}5(300) + 3(200)$

$= R\ 1950$ ✓

(3)

[24]

QUESTION 2

2.1 $$f(x+h)=\frac{1}{x+h}$$

$$f'(x)=\lim_{h\to 0}\frac{\frac{1}{x+h}-\frac{1}{x}}{h}\ \checkmark$$

$$=\lim_{h\to 0}\frac{x-1(x+h)}{x(x+h}\times\frac{1}{h}\ \checkmark$$

$$=\lim_{h\to 0}\ \frac{x-x-h}{x(x+h)}\times\frac{1}{h}\ \checkmark$$

$$=\lim_{h\to 0}\frac{-1}{x^2+xh}\ \checkmark$$

$$=\ -\frac{1}{x^2}\ \checkmark$$

The learner could have used the Binomial theorem even though it is not in the syllabus.

$$f(x+h)=(x+h)^{-1}$$

$$=x^{-1}+-1x^{-1-1}h+\frac{-1(2)}{2}\ x^{-1-2}h^2+\ldots\checkmark$$

$$f'(x)\ =\lim_{h\to 0}\ \frac{x^{-1}-x^{-2}h+x^{-3}h^{2\cdots}-x^{-1}}{h}\checkmark$$

$$=\lim_{h\to 0}\frac{-x^{-2}h+x^{-3}h^2\checkmark\ldots}{h}$$

$$=\lim_{h\to 0}\frac{h(-x^{-2}+x^{-3}h)}{h}\checkmark\ldots)$$

$$=-x^{-2}$$

$$=-\frac{1}{x^2}\checkmark$$

(5)

2.2.1 $y = \frac{2}{\sqrt{x^3}} + 2x^{-1} - 2t$

$y = \frac{2}{x^{\frac{3}{2}}} + 2x^{-1} - 2t$

$y = 2x^{-\frac{3}{2}} + 2x^{-1} - 2t$ ✓

$\frac{dy}{dx} = -3x^{-\frac{5}{2}} - 2x^{-2} - 0$ ✓

$= \frac{-3}{x^{\frac{5}{2}}} - \frac{2}{x^2}$ ✓

$= \frac{-3}{\sqrt{x^5}} - \frac{2}{x^2}$ ✓

(4)

2.2.2 $u = x^2 + 1$ $v = \ln x$

$\frac{du}{dx} = 2x$ √ $\frac{dv}{dx} = \frac{1}{x}$ √

$\frac{dy}{dx} = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}$

$= \frac{\ln x \,.2x - (x^2+1).\frac{1}{x}}{(\ln x)^2}$ ✓

full marks for answer only

(2)

2.2.3 $y = e^{2x-1}$

$u = 2x - 1$ $y = e^u$

$\frac{du}{dx} = 2$ √ $\frac{dy}{du} = e^u$ √

$\frac{dy}{dx} = 2.e^u$ ✓

$= 2e^{2x-1}$ ✓

full marks for answer only

(3)

2.3 $y = (2x-3)(1-x)$

$y = 2x - 2x^2 - 3 + 3x$

$= -2x^2 + 5x - 3$ ✓

$\frac{dy}{dx} = -4x + 5$ ✓

$m = -4(2) + 5$

$= -3$ ✓

when $x = 2;\ y = -1$. Hence point is (2; -1)

$y = -3x + c$

$-1 = -3(2) + c$

$c = 5$

$y = -3x + 5$ ✓

(4)

2.4.1 $v = \frac{ds}{dt} = 108 + 27t - 3t^2$ ✓

$v = 108 + 27(5) - 3(5)^2$ ✓

$= 168\ ms^{-1}$ ✓

(3)

2.4.2 $a = \frac{dv}{dt} = 27 - 6t$ ✓

$= 27 - 6(5)$ ✓

$= -3ms^{-2}$ ✓

(3)

[24]

QUESTION 3

3.1.1 $\int (1-2x)^2\, dx$

$= \int (1 - 4x + 4x^2)\, dx$ √

$= \int 1dx - \int 4x\, dx + \int 4x^2\, dx$

$= x - \frac{4}{2}x^2 + \frac{4}{3}x^3 + c$ ✓

$= x - 2x^2 + \frac{4}{3}x^3 + c$ √

(2)

3.1.2 $\int\left(e^{3x}+\frac{1}{2}\cos 2x-3\sin 6x\right)dx$

$=\int e^{3x}\,dx+\frac{1}{2}\int\cos 2x\,dx-3\int\sin 6x\,dx$

$=\frac{e^{3x}}{3}+\frac{1}{2}\left(\frac{\sin 2x}{2}\right)-3\left(\frac{-\cos 6x}{6}\right)+c$ √ √ √

$=\frac{1}{3}e^{3x}+\frac{1}{4}\sin 2x+\frac{1}{2}\cos 6x+c$ √ √ √ (3)

3.2 $\int_3^5(-x^2+8x)\,dx$

$=\left[\frac{-x^3}{3}+4x^2\right]_3^5$ ✓

$=\left[\frac{-(5)^3}{3}+4(5)^2\right]-\left[\frac{-(3)^3}{3}+4(3)^2\right]$ √

$=58{,}33-27$

$=31{,}33$ √ (2)

3.3

$A=\int_1^2 y\,dx$ ✓

$=\int_1^2(\frac{4}{x})\,dx$ ✓

$=\left[4\ln x\right]_1^2$ ✓

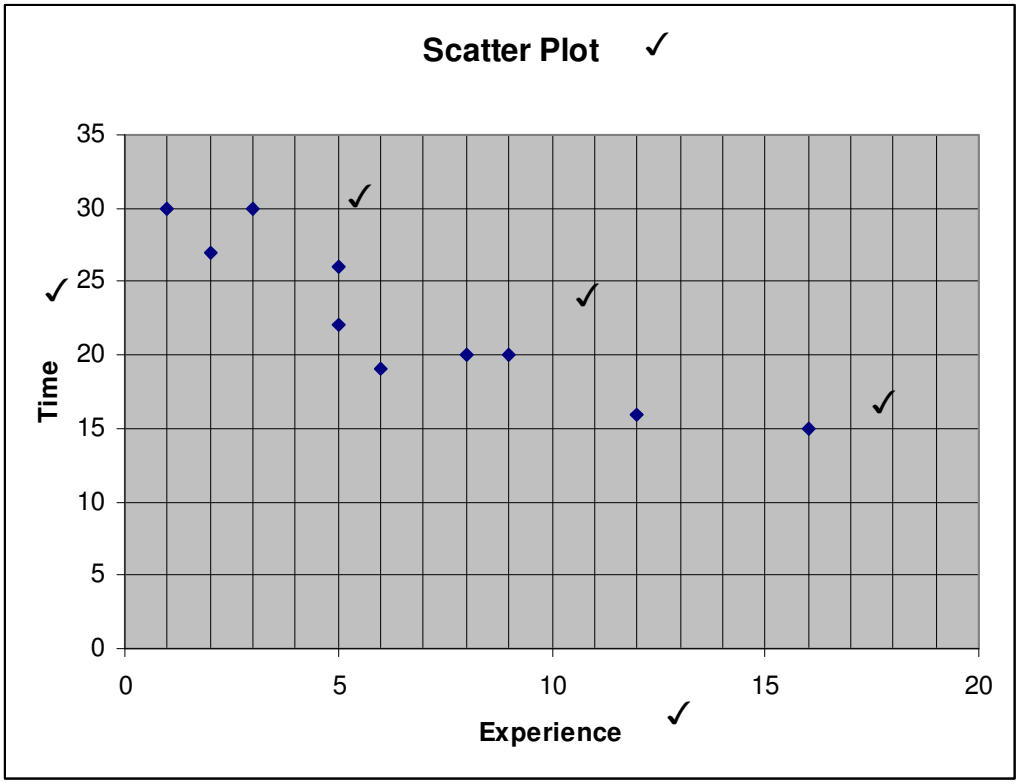
$=4\ln 2-4\ln 1$ ✓

$=2{,}77\ units^2$ ✓ (5)

[12]

QUESTION 4

4.1.1



3 marks for correctly plotting points. 2 marks for correctly labelling axes. (6)

4.1.2

Employee	**Experience** x **(in months)**	**Time** y **(minutes)**	xy	x^2	y^2
A	2	27	54	4	729
B	5	26	130	25	676
C	3	30	90	9	900
D	8	20	160	64	400
E	5	22	110	25	484
F	9	20	180	81	400
G	12	16	192	144	256
H	16	15	240	256	225
I	1	30	30	1	900
J	6	19	114	36	361
	67 √	**225** √	**1300** √	**645** √	**5331** √
	$\bar{x} = 6,7$ √	$\bar{y} = 22,5$ √			

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

$$= \frac{10(1300) - (67)(225)}{10(645) - (67)^2} \quad ✓$$
$$= -1{,}058 \quad ✓$$

$$a = \bar{y} - b\bar{x}$$
$$= 22{,}5 - (-1{,}058)(6{,}7) \quad √$$
$$= 29{,}589 \quad ✓$$

$$\hat{y} = 29{,}589 - 1{,}058\,x \quad ✓$$

(8)

4.1.3 $\hat{y} = 29{,}589 - 1{,}058\,(4)$ ✓
$= 25{,}357$ min ✓

(2)

4.2

x	$x - \bar{x}$	$(x - \bar{x})^2$
13	1	1
7	-5	25
10	-2	4
15	3 ✓	9
12	0	0
18	6	36
9	-3	9
		$\sum (x - \bar{x})^2 = 84$ ✓

✓

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$$
$$= \frac{84}{7} \quad ✓$$
$$= 12 \quad ✓$$

$$s = \sqrt{\frac{\sum (x_i - \bar{x})^2}{n}}$$
$$= \sqrt{\frac{84}{7}} \quad ✓$$
$$= 3{,}46 \quad ✓$$

Learner did not have to use the table. Could do substitution into the equation. (7)

4.3 P (yellow ball) $= \frac{2}{10}$ ✓

$= \frac{1}{5}$ ✓ (2)

4.4.1 P (throwing a double) $= \frac{6}{36}$ ✓

$= \frac{1}{6}$ ✓ (2)

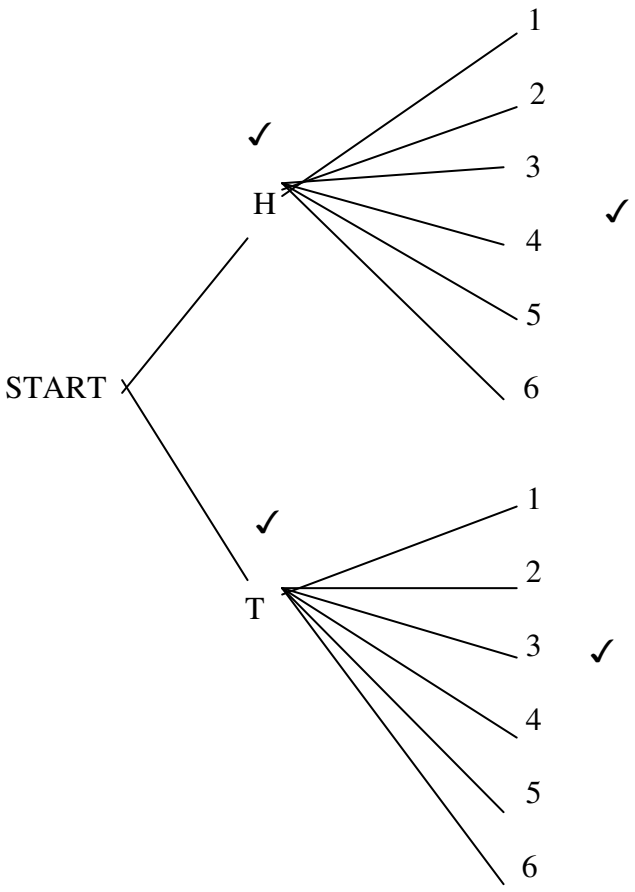
4.4.2 P (score of 7) $= \frac{6}{36}$ List possibilities: (1;6) , (2;5), (3;4), (4;3), (5;2), (6;1) ✓

$= \frac{1}{6}$ ✓ (2)

4.5 P (three heads) $= \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2}$ ✓

$= \frac{1}{8}$ ✓ (2)

4.6.1



✓ ✓ ✓ ✓ (4)

4.6.2 P (head and a 6) $= \frac{1}{12}$ ✓ ✓ (2)

4.6.3 P (tail and even number) $= \frac{3}{12}$ ✓✓

$= \frac{1}{4}$ ✓ (3)

[40]

TOTAL: 100