ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Advanced Level

MARKING SCHEME

JUNE 2012

MATHEMATICS 9164/1

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4.

$-b < a + x < b$

$-b - a = 4$ M1

$b - a = 2$ A1

$a = 1$ A1

$b = 3$

$h = \frac{0,2}{4}$

$x_1 = 0 \qquad y_1 = 1$

$x_2 = 0,05 \qquad y_2 = \frac{\cos(0,05)^2}{e^{0,05^2}}$

5.

$x_3 = 0,1 \qquad y_3 = \frac{\cos(0,1)^2}{e^{0,1^2}}$ M1

$x_4 = 0,15 \qquad y_4 = \frac{\cos(0,15)^2}{e^{0,15^2}}$

$x_5 = 0,2 \qquad y_5 = \frac{\cos(0,2)^2}{e^{0,2^2}}$ M1 6.

$A = \frac{0.05}{2}\left[1 + 0,9229 + 2(0,9975 + 0,9904 + 0,97775)\right]$ M1

$\approx 0,1963$ B1

3. $BD = h\sqrt{3}$ M1

$\tan\left(\frac{11}{4} + x\right) = \frac{1 + \tan x}{1 - \tan x}$

$\approx \frac{1 + x}{1 - x}$ M1

7. (i)

$DC = \frac{h(1-x)}{1+x}$

$(1+x)^{-1} = 1 - x + x^2$

$BC = BD + DC$

$= h\sqrt{3} + h(1-x)(1-x+x^2)$

$\approx h(1 + \sqrt{3} - 2x + 2x^2)$

$\approx h(1 + \sqrt{3} - 2x + 2x^2)$

(ii)

4. $3x^2y^2 + 2x^3y\frac{dy}{dx} = 0$ M1

$\frac{dy}{dx} = \frac{-3x^2y^2}{2x^3y}$ M1

$\frac{dy}{y} = \frac{-3}{2}\frac{dx}{dy}$ M1

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

$= \frac{-3(0,5y)}{2}$

$= -0,75$ A1

Z decreases by 0,75% A1

5. $\frac{x^4}{x^4-1} = 1 + \frac{1}{(x^2-1)(x^2+1)}$ M1

$= 1 + \frac{Ax+B}{x^2-1} + \frac{Cx+D}{x^2+1}$ M1

$= 1 + \frac{1}{2}\left[\frac{1}{x^2-1} + \frac{1}{x^2+1}\right]$ M1A1

6. $(1-x)^{1/5} = 1 + \frac{x}{5} - \frac{2}{25}x^2$

$(1+qx)^{-1} = 1 + qx + q^2x^2$ B1

$(1+px)(1+qx)^{-1} = 1 + (p-q)x + (q^2-pq)x^2$

$\frac{1}{5} = p - q$ B1

$-\frac{2}{25} = q^2 - pq$ B1

$p = \frac{3}{5}, q = \frac{3}{5}$ B1

7. (i) $a - d = ar \Rightarrow r = \frac{a+d}{a}$ M1

$a + 4d = ar^2$

$a + 4d + a\left(\frac{a+d}{a}\right)$

$d^2 - 2ad = 0$ M1

$d(d-2a) = 0$

$a = \frac{d}{2}$ A1

(ii) $l = a + ad$ M1

$a+ad-a=36$

$d=4$

M1

$S_{10}=\frac{10}{2}[2(2)+(9)(4)]$

$=200$

A1 [4]

3.(a) $w=\frac{4+3i(3+x)}{3-x}(3+x)$

M1 (a)

$=\frac{6}{13}+\frac{17}{13}i$

M2

(a) (i) $|w|=\sqrt{\left(\frac{6}{13}\right)^2+\left(\frac{17}{13}\right)^2}$

A1

$=\frac{5}{13}\sqrt{13}$

M1

(i) $\arg(w)=\tan^{-1}\left(\frac{17}{6}\right)$

A1

$=70,6^0$ [5]

9. Equation of the normal

M1

$\frac{y-1}{x-2}=-\frac{3}{4}$ A1 (b)

$4y-4=-3x+6$

$4y=-3x+10$

$\perp$ bisector of the line forming (0,0) and (2,1) M1

$\frac{y-1/2}{x-1}=-2$ (i)

$y-1/2=-2x+2$

$y=-2x+\frac{5}{2}$

$-10x+10=-3x+10$ A1

$x=0$

$y=\frac{5}{2}$

$Centre\left(0;\frac{5}{2}\right)$ A1

$$\overline{MD} = \begin{pmatrix} 0 \\ -4 \\ -4 \end{pmatrix} + \begin{pmatrix} 8 \\ 0 \\ 8 \end{pmatrix}$$ M1

$$= \begin{pmatrix} 8 \\ -4 \\ 4 \end{pmatrix}$$ A1

$$\cos \hat{M} = \frac{\begin{pmatrix} 4 \\ 4 \\ 4 \end{pmatrix}\begin{pmatrix} 8 \\ -4 \\ 4 \end{pmatrix}}{\sqrt{48}\sqrt{96}}$$ M1

$$D\hat{M}P = 61{,}9^0$$ A1

12. (i) $\dfrac{1}{\sin x} - \dfrac{\cos 2x}{\sin 2x}$

$$= \frac{1-(1-2\sin^2 x)}{2\sin x \cos x}$$ M1

$$= \frac{2\sin^2 x}{2\sin x \cos x}$$ M1

$$= \frac{\sin x}{\cos x}$$

$$= \tan x$$ A1

(ii) $\tan x + 5 = 3(1+\tan^2 x)$ M1

$3\tan^2 x - \tan x - 2 = 0$ M1

$\tan x = \dfrac{1 \pm 5}{6}$ M1

$\tan x = 1$ or $\tan x = -\dfrac{2}{3}$

$x = 45,\ 225,\ 326.3$ and $146,3$ M1

$x = 45^0,\ 146,3^0\ 225^0,\ 326,3^0$ A1

13. (i) $V = \dfrac{32}{x^2}.x.d = 128$ M1

$d = 4x$ A1

Total surface area

$2\left(\dfrac{32}{x^2}.4x\right) + 2(x.4x) + \dfrac{32}{x^2}$ M1

14. (a)

(b)

(c)

$8x^2 + \frac{288}{x^2}$ A1

$\frac{dy}{dx} = 16x - \frac{288}{x^2} = 0$ M1

$16x^3 = 288$ M1

$x^3 = 18$

$x = \sqrt[3]{18}$ A1

The surface area is minimum and $\frac{d^2s}{dx^2} > 0$ at $x = \sqrt[3]{18}$ M1

The dimensions are: length=4,659 depth= 10,483 width= 2,621 A1A1

[10

14. (a) $y = x^3 - 12x - 12$ M1

$\frac{dy}{dx} = 3x^2 - 12$ M1

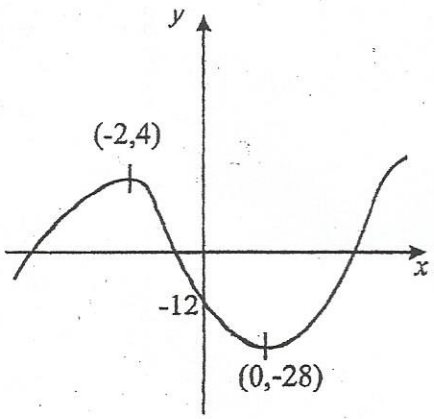
$3x^2 = 12$ A1

$x = \pm 2$

$(2;-28)$ min (for both) A1

$(-2;4)$ max

y-intercept (0,-12)



B2

(b) $-28 \le k \le 4$ B2

(c) $x_1 = 3,9$

$x_2 = 3,9 - \left[\frac{3,9^3 - 12(3,9) - 12}{3(3,9)^2 - 12}\right]$ M1

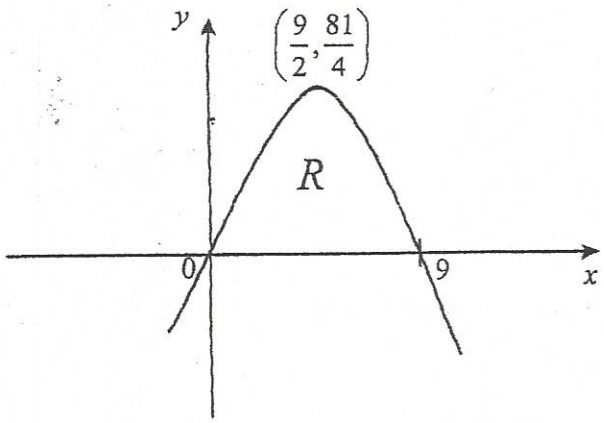
$= 3,885$ A1

$x_3 = 3,884$ A1

$x_4 = 3,884$ A1

[4] (b) (i)

5. (a) $9x - x^2 = \frac{81}{4} - \left(x - \frac{9}{2}\right)^2$ B2



[4] ii)

B2

(b) (i) $\int_0^9 9x - x^2 dx$ M1

$= \left[\frac{9}{2}x^2 - \frac{1}{3}x^3\right]_0^9$ M1

$= 121,5 units^2$ A1

(ii) $\pi \int_0^9 \left(9x - x^2\right)^2 dx$ M1

$= \pi \int_0^9 81x^2 - 18x^3 + x^4 dx$ M1

$= \pi \left[\frac{81x^3}{3} - \frac{18x^4}{4} - \frac{1}{5}x^5\right]_0^9$ M1

$= \pi \left[\frac{81(9)^3}{3} - \frac{18(9)^4}{4} - \frac{1}{5}(9)^5 - 0\right]$ M1

$= 1968,3\pi units^3$ A1

6. (a) $\int \frac{1}{y} dy = \int \frac{1}{4-x} dx$ M1

$\ln y = -\ln(4-x) + c$ M1

at $(1,4)$ A1

$\ln y = \frac{12}{4-x}$ M1

$y = \frac{12}{4-x}$ A1

(b) (i) $-\frac{d\theta}{dt} \alpha \theta$ M1

$\Rightarrow \frac{d\theta}{dt} = -k\theta$ A1 [2]

$\int \frac{1}{\theta} d\theta = \int k dt$ M1

$\ln\theta = -kt + c$ A1

$\ln 60 = c$ M1

$\ln 40 = -5k + \ln 60$ A1

$5k = \ln\frac{3}{2}$

$\ln\theta = \frac{1}{5} t \ln\frac{2}{3} + \ln 60$ M1

$\ln\theta = \ln\left(\left(\frac{2}{3}\right)^2 . \ln 60\right)\frac{2}{3} + \ln 60$

$\theta = \frac{4}{9}.60$ A1 [6]

$\theta = 26\frac{2}{3}$