CENTRAL EAST EDUCATION DIVISION

2024 MALAWI SCHOOL CERTIFICATE MOCK EXAMINATION

PROVISIONAL MARKING KEY

ADDITIONAL MATHEMATICS I

2024 CEED MOCK ADDITIONAL MATHEMATICS PAPER 1.

MARKING KEY

1. a)

$\frac{1}{2}[lk(t)]=\frac{1}{2}[2(3-\frac{t}{2})^2]$ (1

¿ $\frac{1}{2}[2\left(3-\frac{t}{2}\right)\left(3-\frac{t}{2}\right)]$ (1

¿ $\frac{1}{2}[2(9-\frac{3t}{2}-\frac{3t}{2}+\frac{t^2}{4})]$ (1

¿ $\frac{1}{2}[2(9-\frac{6t}{2}+\frac{t^2}{4})]$ (1

¿ $\frac{1}{2}(18-6t+\frac{t^2}{2})$ ¿ (1

¿ $(9-3t+\frac{t^2}{4})$ ¿ (1

b). Either

$x \geq 3-11$ (1

$x \geq 3-11$ (1

x ≥ -8 (1

or $-3 \geq x+11$ (1

$-3-11 \geq x$

$-14 \geq x$ (1

2. Let $u = 4x^2$ and $v = (2 + x^3)$ (1

Now $\frac{du}{dx} = 8x$ and $\frac{dv}{dx} = 3x^2$ (1

So $\frac{dy}{dx} = u.\frac{dv}{dx} + v.\frac{du}{dx}$

¿ $4x^2(3x^2)$ + $(2 + x^3)(8x)$ (1

¿ $12x^4 + 8x^4 + 16x$ (1

¿ $20x^4 + 16x$ or simply $4x(5x^3 + 4)$ (1

3. a) LHS: $(\tan^2 x + 1)(1 - \sin^2 x) - 1$

¿ $\left(\frac{\sin^2 x}{\cos^2 x} + 1\right)(\cos^2 x) - 1$ (1

$= \left(\frac{\sin^2 x + \cos^2 x}{\cos^2 x}\right)(\cos^2 x) - 1$ (1

¿ $\frac{1}{\cos^2 x}.\cos^2 x - 1$ (1

= 1 −¿ 1 (1

= 0

=RHS (proved)

(1

b) $\lim_{x \to 3} \frac{2x^2 - 6x + 5x - 15}{x - 3}(1)$

¿ $\lim_{x \to 3} \frac{(x-3)(2x+5)}{x-3}$ (1

¿ $\lim_{x \to 3} 2x + 5$ (1

¿ $2(3) + 5 = 11$ (1

4. a) Area of a circle, $T = \pi r^2$

(1

Differentiating yields: $\frac{dT}{dr} = 2\pi r$

(1

So $\delta T = \left(\frac{dT}{dr}\right)_{r=6.8} x\, \delta r$

$¿2\pi(6.8)(7-6.8)$

(1

$¿2.72\pi$

(1

Now the actual change

$\Delta T = New\,area - Old\,area$ (1

$¿\pi(7)^2 - \pi(6.8)^2$

(1

$¿2.76\pi\,cm^2$

(1

$b)$ $The\,constant\,term = 5C4(3x^2).\left(\frac{-1}{3x}\right)^2(3)$

$$¿5.3.x^2.\frac{1}{9x^2}(1$$

$$¿\frac{5}{3}(1)$$

5. $2(\tan 2x + \tan x) = 0(1)$

$$\tan 2x + \tan x = 0(1)$$

$$\frac{2\,tanx}{1-\tan^2 x} + \tan x = 0(1)$$

$$\frac{2\tan x + [\tan x(1-\tan^2 x)]}{1-\tan^2 x} = 0(1)$$

$$2\tan x + [\tan x(1-\tan^2 x)] = 0(1)$$

$$2 + (1-\tan^2 x) = 0$$

$$\tan^2 x = 3(1)$$

$$\tan x = \pm\sqrt{3}(1)$$

$$x = \tan^{-1}(\pm\sqrt{3})$$

$$¿-60 \vee 60$$

$$\therefore x = 60^o, 120^o, 240^o, 300^o(1)$$

Since 270°≤ x ≤360°, x = 300° (1)

6. a) The length of an arc is given by $s=\theta r$ (1

But $\theta=\frac{2\pi}{3}$ … since is equally divided. (1

So $s=\theta r=\frac{2\pi}{3}(3)=2\pi$ (2

b) Area of the circle is given by $A=\frac{1}{2}r^2\theta$ (1

¿ $\frac{1}{2}(3)^2\left(\frac{2\pi}{3}\right)$ (2

¿ $\frac{1(9)(2)\pi}{(2)(6)}$ (1

¿ $3\pi\,cm^2$ (1

7. $y=\frac{1}{x}+4x$

$\frac{dy}{dx}=\frac{-1}{x^2}+4(1)$

$\frac{-1}{x^2}+4=0$

$\Rightarrow 4x^2=1(1)$

$\therefore x=\frac{-1}{2}\vee\frac{1}{2}(1)$

When $x=\frac{1}{2}, y=\frac{1}{0.5}+4(0.5)=4$

When $x=\frac{-1}{2}, y=\frac{1}{-0.5}+4(-0.5)=-4$

The points are $\left(\frac{1}{2},4\right)$ and $\left(-\frac{1}{2},-4\right)$ (2)

Section B

8. a) $m=\frac{d}{dx}(3x^2-2)|x=3$ (1

$m=6x=6(3)=18$ (1

Using $y-y_1=m(x-x_1)$ (1

We have,

$y-0=-18(x-3)$ (1

Thus $y=¿-18x+54$ as equation of the tangent. (1

Now the equation of the normal, which is perpendicular to the tangent.

Hence $m_n=\frac{-1}{m}=\frac{-1}{18}$ (1

Using $y-y_1=m(x-x_1)$

$y-0=\frac{-1}{18}(x-3)$ (1

Then $y=\frac{3-x}{18}$ = equation of the normal. (1

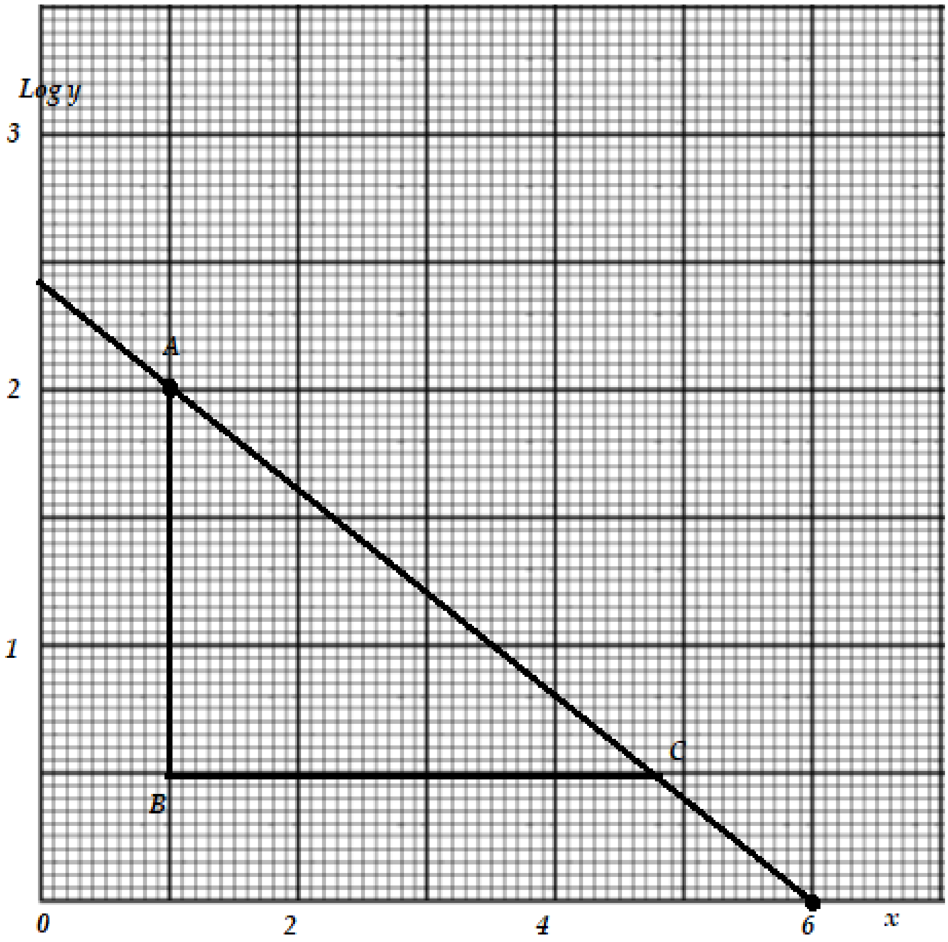
b) **(i)**

$\log y=\log kn^{-x}$ (1

$logy=logk-xlogn$ (1

Construct a table of values: (1. For any 3 correct y-values

x	1	2.5	3.2	4.5	5.1	6
y	1.98	1.43	1.18	0.70	0.48	0



1mark for plotting the points
1 mark for horizontal scale
1 mark for vertical scale
1 mark for correct graph

ii)

Using the triangle ABC,

$G=\frac{A-B}{C-B}=\frac{2-0.5}{5-1}=0.375$ (1

Thus $logn=0.375$ (1

So $n=10^{0.375}=2.37$

Now using the point, A where $(x,y)=(1,2)$

We have $logk=2+0.375(1)=2.375$ (1

So $k=10^{2.375}=237.1$

Therefore

$n=2.37$ (1

$k=237.1$ (1

9. a) $3x^2+9x+4<x^2+2x+1 (1)$

$3x^2-x^2+9x-2x+4-1<0 (1)$

$2x^2+7x+3<0 (1)$

$2x^2+6x+x+3<0(1)$

$(2x+1)(x+3)<0(1)$

The critical points are: $x=-0.5 \wedge x=-3 (1)$

x	←3	-3		-0.5	¿-0.5
$x+0.5$	$-$¿	$-$¿	$-$¿	0	$+$¿
$x+3$	$-$¿	0	$+$¿	$+$¿	$+$¿
$f(x)$	$+$¿	0	$-$¿	0	$+$¿

(3)

Hence the solution is $(-3,-0.5)(1)$

b) $$\int_{\frac{-\pi}{2}}^{\frac{\pi}{2}} (1+xsinx)\,dx$$

$$¿\int_{\frac{-\pi}{2}}^{\frac{\pi}{2}} 1\,dx+\int_{\frac{-\pi}{2}}^{\frac{\pi}{2}} xsin\,x^2\,dx \qquad (1)$$

For the second part we use substitution.

Let $x^2 = t$ (1)

$2x\ dx = dt$ (1)

i.e. $xdx = \frac{dt}{2}$ (1)

Hence $\int \sin(t)\frac{dt}{2}$

$= ½ (-¿\text{Cos t}) + c$

$= -¿½ \text{Cosx}^2 + c.$ (1)

Therefore, $\int_{\frac{-\pi}{2}}^{\frac{\pi}{2}} x\sin x^2 dx = \frac{-1}{2}\cos x^2 \Big|_{\frac{-\pi}{2}}^{\frac{\pi}{2}} (1)$

$$¿\left(\frac{-1}{2}\cos\left(\frac{\pi}{2}\right)^2\right) - \left(\frac{-1}{2}\cos\left(\frac{-\pi}{2}\right)^2\right)(1)$$

$= 0$ (1)

$$Now, \int_{\frac{-\pi}{2}}^{\frac{\pi}{2}} 1\,dx = ¿x¿¿$$

Hence $\int_{\frac{-\pi}{2}}^{\frac{\pi}{2}} 1\,dx + \int_{\frac{-\pi}{2}}^{\frac{\pi}{2}} x\sin x^2 dx = \pi + 0 = \pi(1)$

10. a. Let $u=2x$ and $v=(\frac{1}{2}x^2-x^3)$, (1

$So\ \frac{du}{dx}=2$ (1

And $\frac{dv}{dx}=x-3x^2$ (1

So $\frac{dy}{dx}=u.\frac{dv}{dx}+v.\frac{du}{dx}$ (1

$\frac{dy}{dx}=2x.(x-3x^2)+(\frac{1}{2}x^2-x^3)2$ (1

$\frac{dy}{dx}=x^2(3-7x)$ (1

But at T.P. the FOC¿0

Then $0=x^2(3-7x)$

So $x=0 \vee 3/7$ (1

Now substitute the values into the function $y=2x\left(\frac{1}{2}x^2-x^3\right)$, to get

$y-values$ (1

So $y=0 \vee 0$ (1

The T.P is (0,0). (1

10b. (i) Sketch

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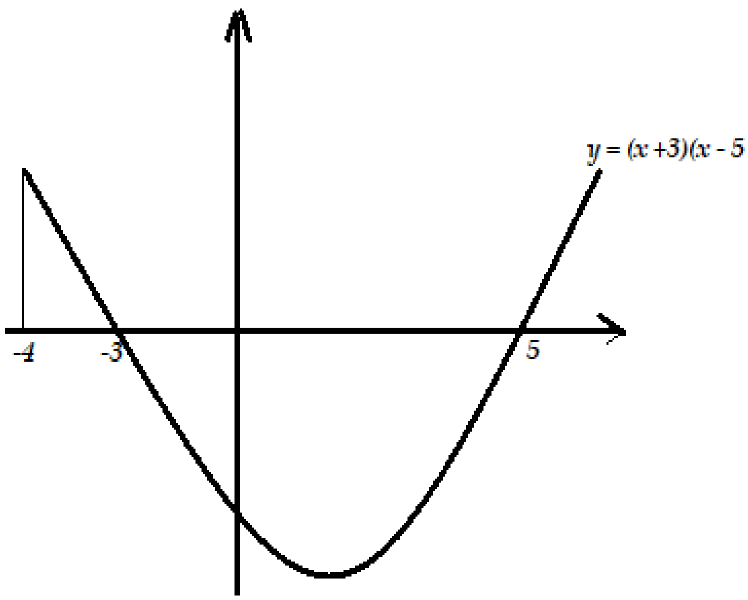

(1) for x – intercepts $-¿3$ and (1) for the correct sketch

Area = $\int_{-4}^{-3}(x+3)(x-5)\text{dx} +-¿\int_{-3}^{5}(x+3)(x-5)\text{dx}$ (1, 1

$= \int_{-4}^{-3}(x^2-2x-15)dx - ¿\int_{-3}^{5}(x^2-2x-15)dx$ (1

$= \left[\frac{x^3}{3}-\frac{2x^2}{2}-15x\right]_{-4}^{-3} - ¿\left[\frac{x^3}{3}+\frac{2x^2}{2}-15x\right]_{-3}^{5}$ (1

$$=\left\{\left[\frac{(-3)^3}{3}-\frac{2(-3)^2}{2}-15(-3)\right]-\text{¿}\left[\frac{(-4)^3}{3}-\frac{2(-4)^2}{2}-15(-4)\right]\right\}-\text{¿}$$

$$\left\{\left[\frac{(5)^3}{3}-\frac{2(5)^2}{2}-15(5)\right]-\text{¿}\left[\frac{(-3)^3}{3}-\frac{2(-)^2}{2}-15(-3)\right]\right\} \quad (1$$

$$=\left\{\left[\frac{-27}{3}-\frac{18}{2}+45\right]-\text{¿}\left[\frac{-64}{3}-\frac{32}{2}+60\right]\right\}-\text{¿}\left\{\left[\frac{125}{3}-\frac{50}{2}-75\right]-\text{¿}\left[\frac{-27}{3}-\frac{18}{2}+45\right]\right\}$$

(1

$$=\left\{27-22\frac{2}{3}\right\}-\text{¿}\left\{-58\frac{1}{3}-27\right\} \quad (1$$

$$= \quad 4\frac{1}{3}+\text{¿}\,85\frac{1}{3} \qquad (1$$

$$= 89\frac{2}{3}\text{ sq. units} \quad (1$$

END OF MARKING KEY