

TANZANIA HEADS OF ISLAMIC SCHOOL
COUNCIL

FORM SIX INTER ISLAMIC MOCK EXAMINATION

BASIC APPLIED MATHEMATICS

141

MARKING GUIDE -

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1. (a) (i) 1.507×10^{-2} - - - - 02

(ii) 0.219 - - - - 02

(b) $\bar{X} = 7.62$ - - - - 02

$\sigma_x = 1.2472$ - - - - 02

$\sum x^2 = 228701$ - - - - 02

2 (a) $f(x) = \frac{ax+b}{x+1}$ $f(2) = \frac{2a+b}{2+1} = 1$

$2a+b = 3$ - - - - (i) - - - - 01

also $f(1) = \frac{a+b}{1+1} = \frac{a+b}{2} = 2$

$a+b = 4$ - - - - (ii) - - - - 01

Solve (i) and (ii)

$$\begin{cases} 2a+b = 3 \\ a+b = 4 \end{cases}$$

$a = -1$ - - - - 01

$$a+b=4$$

$$-1+b=4$$

$$b=5$$

01

2 b) $g(x) = \frac{x}{x+2}$

x-intercept, $y=0$

$$x=0$$

(0,0)

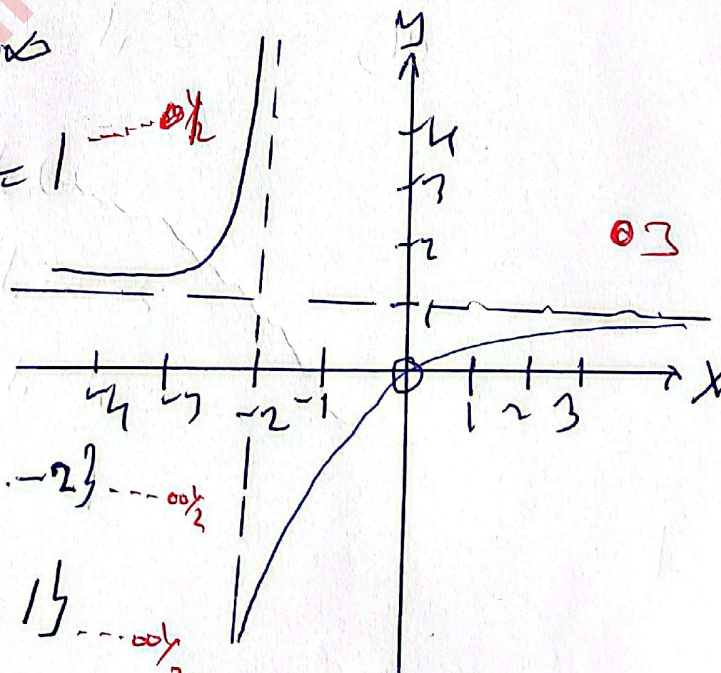
V.A: $x+2=0$

$$x=-2$$

H.A: $y = \frac{x}{x+2} = \frac{1}{1+\frac{2}{x}}$

as $x \rightarrow \infty$

$$y = \frac{1}{1} = 1$$



Domain = $\{x \in \mathbb{R}; x \neq -2\}$

Range = $\{y \in \mathbb{R}; y \neq 1\}$

3

$$Q_1 \quad S_n = \frac{n}{2} [2a + (n-1)d]$$

$$S_{10} = \frac{10}{2} [2a + (10-1)d] =$$

$$S_{10} = 5 [2a + 9d]$$

$$= 10a + 45d = 210 \quad \text{--- (1) ---}$$

$$S_{20} = \frac{20}{2} [2a + (20-1)d]$$

$$S_{20} = 10 [2a + 19d]$$

$$= 20a + 190d$$

$$20a + 190d - 210 = 410 \quad \text{--- (2) ---}$$

$$20a + 190d = 620 \quad \text{--- (1) ---}$$

Solve (1) & (2)

$$20a + 190d = 620$$

$$10a + 45d = 210$$

$$a = 12,$$

$$d = 2$$

$$d = 2, \quad a = 12 \quad \text{--- (1) ---}$$

3 b) $I \propto \frac{A}{d^2}$ $I = \text{Intensity, } A = \text{Amplitude}$
 $d = \text{distance}$

$$I = \frac{kA}{d^2}$$

$$50 = \frac{k(8)}{2^2} \quad \text{--- --- --- 01}$$

$$\frac{4 \times 50}{5} = k$$

$$5 \quad k = 40 \quad \text{--- --- --- 01}$$

$$I = \frac{40A}{d^2}$$

$$A = 8, d = 4$$

$$I = \frac{40 \times 8}{16} \quad \text{--- --- --- 01}$$

$$I = 20$$

The Intensity is 20 units --- --- 01

Ques

$$y = \frac{x^3 - 4}{2 - x^2}$$

$$\frac{dy}{dx} = \frac{(2 - x^2) \frac{d}{dx}(x^3 - 4) - (x^3 - 4) \frac{d}{dx}(2 - x^2)}{(2 - x^2)^2} \quad \text{--- only 2}$$

~~$$\frac{(2 - x^2)(3x^2) - (x^3 - 4)(-2x)}{(2 - x^2)^2}$$~~

$$= \frac{3x^2(2 - x^2) - (-2x)(x^3 - 4)}{(2 - x^2)^2} \quad \text{--- only 2}$$

$$= \frac{6x^2 - 3x^4 + 2x^4 + 8x}{(2 - x^2)^2}$$

$$\frac{dy}{dx} = \frac{6x^2 - x^4 + 8x}{(2 - x^2)^2} \quad \text{--- 01}$$

4 as $\Rightarrow x^2y - xy^2 = 2x$ at $(1, -1)$.

Differentiate both side w.r.t x .

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

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

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

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

at $(1, -1)$.

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

$$\frac{dy}{dx} = \frac{1 + 2 + 2}{1 - 2}$$

$$\frac{dy}{dx} = -5$$

$$\therefore \frac{dy}{dx} = -5$$

$$4 \quad b) \quad y = 1 + \cos^2 x$$

$$y = 1 + (\cos x)^2$$

$$\frac{dy}{dx} = -2 \sin x \cos x$$

$$= -2 \sin 2x \quad (03)$$

$$4 \quad c) \quad s(t) = t^3 - 2t^2 + 6t + 5$$

$$V = s'(t) = 3t^2 - 4t + 6$$

$$\text{at } t = 2 \text{ sec}$$

$$V = s'(2) = 3(2)^2 - 4(2) + 6$$

$$= 12 - 8 + 6$$

$$V = 10 \text{ m/s}$$

$$a = V'(t) = 6t - 4$$

$$\text{at } t = 2 \text{ sec}$$

$$V'(2) = 6(2) - 4$$

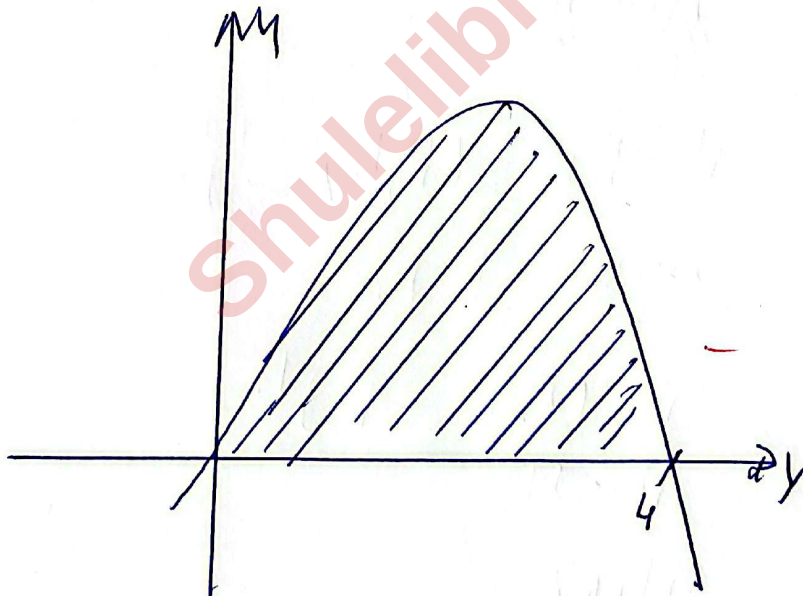
$$= 12 - 4$$

$$= 8 \text{ m/s}^2$$

At the end of 2 sec. the
velocity is 10 m/s . and acceleration
is 5 m/s^2

5) a) $\int (4x^3 + 1)x^2 - \frac{7}{2} \cos x) dx$
 $= x^4 + \frac{7x^3}{3} + \frac{3}{2} \sin x + C$ --- 02

b) $y = 4x - x^2$, $y \geq 0$, $4x - x^2 \geq 0$
 $x(4-x) \geq 0$, $x \geq 0$, in $x \leq 4$ --- 00 1/2



$$A_{\text{area}} = \int_0^4 (4x - x^2) dx$$

only 2

$$\left[2x^2 - \frac{x^3}{3} \right]_0^4$$

only 2

$$\left(2(4)^2 - \frac{4^3}{3} \right) - 0$$

01

$$32 - \frac{64}{3}$$

$$96 - \frac{64}{3}$$

$$A_{\text{area}} = \frac{32}{3} \text{ sq. units}$$

01

5 (c)

$$\frac{ds}{dt} = \text{km/s}$$

$$ds = 4 dt$$

$$\int ds = \int 4 dt$$

$$s = 4t + c$$

01

$$5 = 4(2) + c$$

$$C = 5 - 8$$

$$C = -3$$

$$S = 4t - 3$$

$$S = \int_1^3 (4t - 3) dt$$

$$S = [2t^2 - 3t]_1^3$$

$$S = (18 - 9) - (2 - 3)$$

$$9 + 1$$

$$S = 10 \text{ m.}$$

$$\text{Distance} = 10 \text{ m}$$

G

Mark %	f	x	d	d ²	fd	
20-24	26	24.5	-20	400	-520	10400
30-39	36	34.5	-10	100	-360	3600
40-49	44	44.5	0	0	0	0
50-59	42	54.5	10	100	420	4200
60-69	28	64.5	20	400	560	11200
70-79	24	74.5	30	900	720	21600
		$\sum f$	$\sum d$	$\sum d^2$	$\sum fd$	$\sum f \cdot x$
		204	0	1800	820	51000

$$\text{Mean} = A + \frac{\sum fd}{N} \quad \text{--- --- --- } 00\frac{1}{2}$$

$$= 44.5 + \frac{820}{200}$$

$$= 48.6 \quad \text{--- --- --- } 01$$

$$\text{Variance} = \frac{\sum fd^2}{N} - \left(\frac{\sum fd}{N} \right)^2 \quad \text{--- --- --- } 00\frac{1}{2}$$

$$\frac{51050}{200} - \left(\frac{820}{200} \right)^2 \quad \text{--- --- --- } 00\frac{1}{2}$$

$$38.19 \quad \text{--- --- --- } 01$$

$$b, \text{ Median} = L + \left(\frac{\frac{N}{2} - cf}{f_w} \right) \times c \quad \text{--- --- --- } 00\frac{1}{2}$$

$$\text{Median class } 40 - 49 \quad L = 39.5 \quad \text{--- --- --- } 00\frac{1}{2}$$

$$\text{Median} = 39.5 + \left(\frac{\frac{200}{2} - 62}{44} \right) \times 10$$

$$= 48.136364 \quad \text{--- --- --- } 01$$

c) total number of students who passed

$$= 42 + 28 + 24$$

$$= 94$$

$$\% \text{ students who passed} = \frac{94}{200} \times 100$$

$$= 47\%$$

7. a) $\frac{8!}{3!2!} = 3360 \text{ ways.}$

$$\text{Since } n(A) = {}^{10}C_3 = 120$$

$$n(E) = {}^6C_3 = 20$$

$$P(E) = \frac{n(E)}{n(A)} = \frac{20}{120} = \frac{1}{6}$$

$$\text{ii) } {}^6C_1 \times {}^4C_2 = 6 \times 6 = 36$$

$$n(E) = 36$$

$$P(E) = \frac{n(E)}{N(S)} = \frac{36}{120} = \frac{3}{10}$$

$$P(\text{one bag obtained}) = \frac{3}{10} \quad \text{--- 0.2}$$

7. c₁ i) T = people who like tea

C = people who like coffee

$$n(T) = 65, \quad n(C) = 55$$

$$n(T \cap C) = 30$$

$$n(S) = 100$$

$$P(T \cup C) = P(T) + P(C) - P(T \cap C)$$

$$= \frac{65}{100} + \frac{55}{100} - \frac{30}{100} \quad \text{--- 0.1}$$

$$\frac{90}{100}$$

$$P(T \cup C) = \frac{90}{100}$$

$$= \frac{9}{10} \quad \text{--- 0.9}$$

$$(ii) P(\text{like neither tea nor coffee}) = P(T \cup C)'$$

$$P(T \cup C)' = 1 - P(T \cup C) \quad \text{--- --- 01}$$

$$1 - \frac{9}{10}$$

$$P(T \cup C)' = \frac{1}{10} \quad \text{--- --- 01}$$

$$\text{Ex 9, } \sin x = 4 \cos x$$

$$\frac{\sin x}{\cos x} = 4$$

$$\tan x = 4 \quad \text{--- --- 01}$$

$$x = \tan^{-1}(4)$$

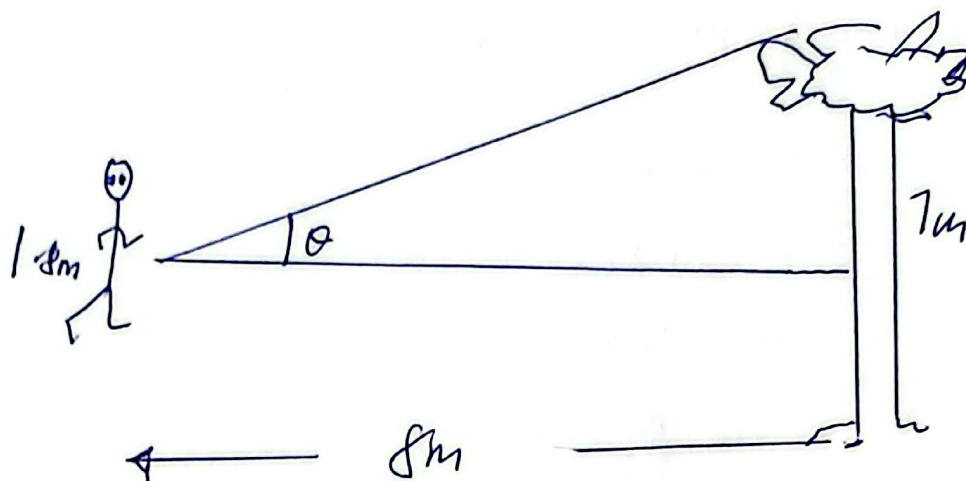
$$x = 75.96^\circ \quad \text{--- --- 01}$$

$$\angle = 180^\circ + 75.96$$

$$= 180 + 75.96$$

$$x = 255.96 \quad \text{--- --- 01}$$

$$\angle = 75.96^\circ \quad x = 255.96^\circ$$



$$\theta = \tan^{-1} \left(\frac{7m - 1.8m}{8m} \right)$$

$$= 33.02$$

$$\theta \approx 33^\circ$$

Angle of deviation = 33°

$$8. (i) \quad T = \frac{24}{g} \left(\sin \theta - \frac{\cos \theta}{\cot \alpha} \right)$$

$$T = \frac{24 \sin (\theta - \alpha)}{g \cos \alpha}$$

$$b) \frac{24 \sin(\theta - \alpha)}{g \cos \alpha}$$

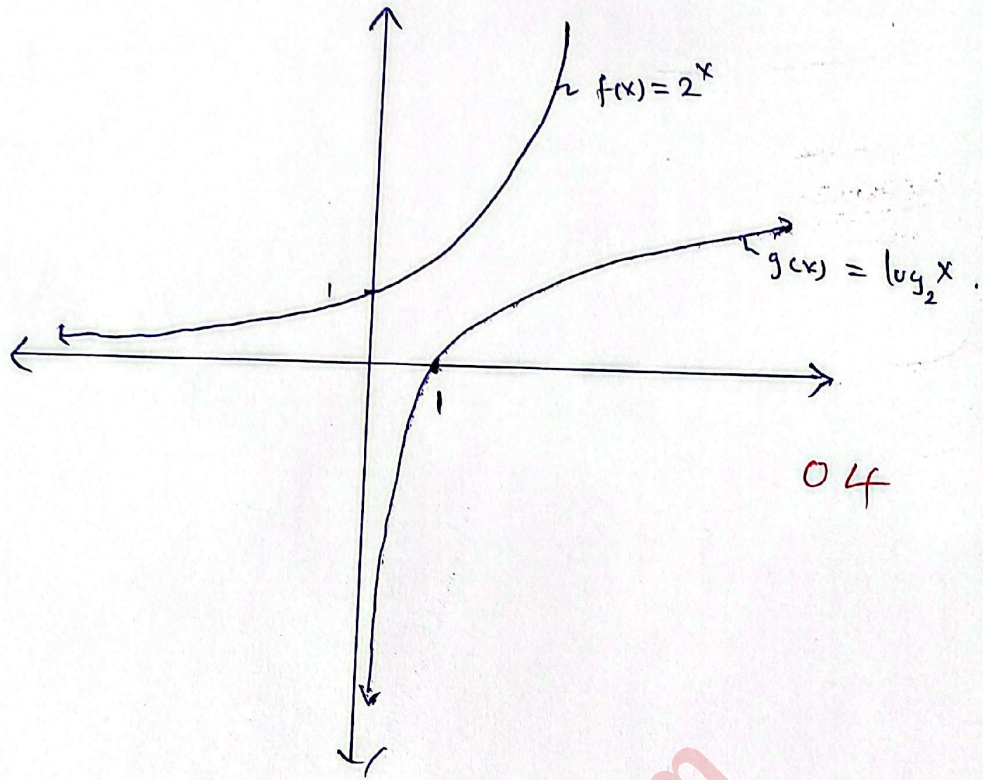
$$= \frac{24 \sin \theta \cos \alpha - \sin \alpha \cos \theta}{g \cos \alpha}$$

$$= \frac{24}{g} (\sin \theta - \cos \theta \tan \alpha)$$

$$= \frac{24}{g} \left(\sin \theta - \frac{\cos \theta}{\cot \alpha} \right) \quad \dots \dots \dots 03$$

$$\therefore \frac{24 \sin(\theta - \alpha)}{g \cos \alpha} = \frac{24}{g} \left(\sin \theta - \frac{\cos \theta}{\cot \alpha} \right)$$

9 a)



04

b) Given

i) $N = 50 + 30e^{\frac{t}{100}}$

At the start, $t = 0$

~~N~~ $N = 50 + 30e^{\frac{0}{100}} \dots \dots 01$

$N = 50 + 30 \dots \dots 01$

$N = 80$

$\therefore$ The size of population at the start of observation is 80 insects.

9 ii) Given $N = 120$

$$120 = 50 + 30 e^{t/100} \quad \text{--- 0/}$$

$$e^{t/100} = \frac{120 - 50}{30}$$

$$e^{t/100} = \frac{7}{3}$$

$$t/100 = \ln\left(\frac{7}{3}\right) \quad \text{--- 0/}$$

$$t = 100 \ln\left(\frac{7}{3}\right)$$

$$\approx 85 \quad \text{--- 0/}$$

$\therefore$ It will take 85 days to reach 120 infect

10 a) Given

$$A = \begin{bmatrix} 1 & k & 2 \\ 3 & 4 & 5 \\ 6 & 7 & 8 \end{bmatrix}$$

for singular matrix

$$\text{Determinant} = 0$$

$$|A| = 0$$

$$\begin{vmatrix} 1 & k & 2 \\ 3 & 4 & 5 \\ 6 & 7 & 8 \end{vmatrix} = 0$$

$$\begin{vmatrix} 4 & 5 \\ 7 & 8 \end{vmatrix} - k \begin{vmatrix} 3 & 5 \\ 6 & 8 \end{vmatrix} + 2 \begin{vmatrix} 3 & 4 \\ 6 & 7 \end{vmatrix} = 0$$

3x3

$$-3 - k(-6) + 2(-3) = 0$$

$$-9 + 6k = 0$$

$$6k = 9$$

$$k = \frac{9}{6} = \frac{3}{2}$$

$$\therefore k = \frac{3}{2}$$

10

b) let

 x be the number of table manufactured --- 00 1/2 y be the number of chairs manufactured --- 00 1/2

Maximize

$$f(x, y) = 90x + 25y \quad \text{--- 01}$$

Subject to:-

$$8x + 2y \leq 400 \Rightarrow 4x + y \leq 200 \quad \text{--- 01}$$

$$2x + y \leq 120 \quad \text{--- 02}$$

$$x \geq 0 \quad \text{--- 00 1/2}$$

$$y \geq 0 \quad \text{--- 00 1/2}$$

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