MATIGO EXAMINATION BOARD

PRE- Mock 2023

MATHEMATICS 456/2

MARKING GUIDE

SECTION A

① School fees = $\frac{1}{4}$, Remainder = $1 - \frac{1}{4}$

$= \frac{3}{4}$

Food = $\frac{2}{3} \times \frac{3}{4} = \frac{2}{4} = \frac{1}{2}$ m_1

Remainder = $\frac{3}{4} - \frac{1}{2} = \frac{1}{4}$

Transport = $\frac{1}{4} \times \frac{1}{5} = \frac{1}{20}$ m_1

Remainder = $\frac{1}{4} - \frac{1}{20} = \frac{5-1}{20} = \frac{1}{5}$

Saves = $\frac{1}{5}$

His salary = $3400 \div \frac{1}{5}$ m_1

$= 3400 \times 5$

$=$ shs 17000 A_1

A_0 if a learner gives answer as 17000

04

② $\varepsilon = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28\}$ M_1

$M = \{4, 8, 12, 16, 20, 24, 28\}$ B_1

$N = \{1, 4, 9, 16, 25\}$ B_1

$(M \cap N) = \{4, 16\}$ A_1

04

③ L.S.f = $\left(\frac{16}{8}\right) = 2$ m_1

V.S.f = $(2)^3 = 8$ m_1

$\therefore 8 = \frac{V}{160}$ m_1

$V = 8 \times 160$

$\therefore V = 1280\ cm^3$ A_1

A_0 if a learner gives answer as 1280

④ $= \frac{(\sqrt{3}-\sqrt{2})(\sqrt{3}-\sqrt{2})}{(\sqrt{3}+\sqrt{2})(\sqrt{3}-\sqrt{2})}$ M_1

$= \frac{3-\sqrt{6}-\sqrt{6}+2}{(\sqrt{3})^2-(\sqrt{2})^2}$ M_1

$= 5-2\sqrt{6}$ B_1

$= 5+(-2)\sqrt{6}$ A_1

04

⑤ $f(x) = 3x^2+bx-3$, $f(2)=15$

$\therefore 3(2)^2+2b-3 = 15$ M_1 M_1

$2b = 15+3-12$ M_1

$b = 3$ A_1

04

⑥ $m = 2$, $A(-1,-3)$

From $y = mx+c$

$\Rightarrow -3 = 2(-1)+c$ M_1

$c = -1$

y-intercept is $(0,-1)$ A_1

$\therefore y = 2x-1$

when $y=0$, $0 = 2x-1$ M_1

$x = 0.5$

x-intercept is $(0.5, 0)$ A_1 Accept $(\frac{1}{2}, 0)$

04

⑦

$A = 500,000\left(1+\frac{2}{100}\right)^3$ M_1 M_1

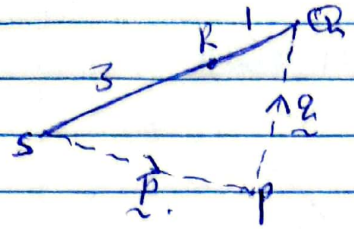
$= 500,000(1.02)^3$ M_1

$\therefore A =$ shs 530604 A_1 Rejected 530604

04

(8) $\underset{\sim}{RQ} = \frac{1}{4}\underset{\sim}{SQ}$

$\underset{\sim}{RQ} : \underset{\sim}{SQ} = 1:4$



$\underset{\sim}{PR} = \underset{\sim}{PS} + \underset{\sim}{SR}$ M_1

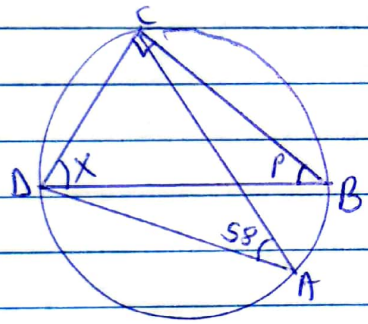
$= -\underset{\sim}{P} + \frac{3}{4}\underset{\sim}{SQ}$ m_1

$= \frac{-4\underset{\sim}{P} + 3(\underset{\sim}{P} + \underset{\sim}{Q})}{4}$ m_1

$\underset{\sim}{PR} = \frac{1}{4}(3\underset{\sim}{Q} - \underset{\sim}{P})$ A_1

04

(9)



$P = 58°$ B_1

let $\angle CDB = X$

$X + 90 + 58 \overset{M_1}{=} 180$

$X = 180 - 148$ m_1

$X = 32°$ A_1

04

(10)

No	s.f	$\log_{10}$
1828	1.828×10^3	3.2620
98.64	9.864×10^1	$\overset{m_1}{1.9941}$
		1.2679
		$1.2679 \overset{m_1}{\times} 1/3$
2.6461	2.6461×10^0 m_1	0.4226

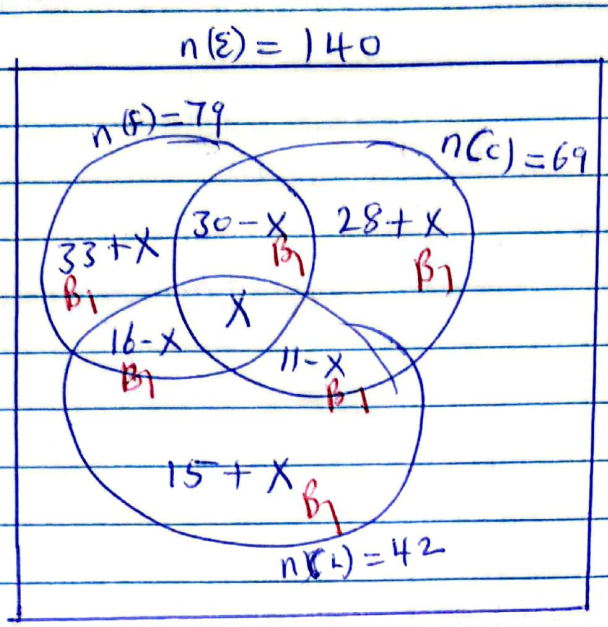
$\therefore \sqrt[3]{\left(\frac{1828}{98.64}\right)} = 2.6461$ A_1

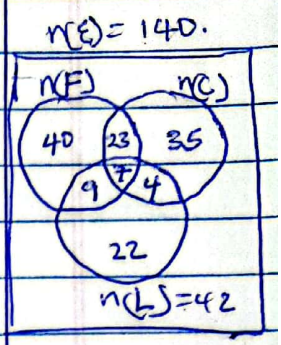
04

SECTION B

11 let the number of students

(i) exhibiting all the symptoms be x





(ii) $33 + X + 16 - X + 15 + X + 11 - X + 28 + X + X + 30 - X = 140$ m1

$133 + X = 140$ m1

$X = 7$ students A1

iii) $= 15 + X$

$= 15 + 7$

$= 22$ students B1

$n(E) = 22$

$n(S) = 140$

Prob(neither fever nor cough) $= \frac{22}{140}$ M1

$= \frac{11}{70}$ A1

Accept 0.157

12

(12) a) $= \dfrac{\left(\frac{5}{3} \times \frac{5}{4}\right) \times \frac{1}{4}}{\frac{7}{3} - \frac{13}{7}}$ m_1

$= \dfrac{25}{48} \div \dfrac{49-39}{21}$ m_1 m_1

$= \dfrac{25}{48} \times \dfrac{21}{10}$ m_1

$= \dfrac{3}{32}$ A_1

Accept $\frac{35}{32}$

b) $2\log x = \log 18 + \log(x-4)$

$\log x^2 = \log[18(x-4)]$ m_1

$x^2 = 18x - 72$

$x^2 - 18x + 72 = 0$ B_1

$\{-12, -6\}$

$\therefore x^2 - 12x - 6x + 72 = 0$ m_1 m_1

$x(x-12) - 6(x-12) = 0$

$(x-6)(x-12) = 0$ m_1

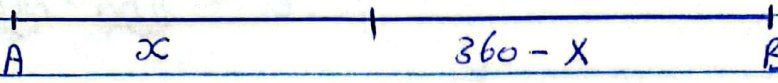
$\Rightarrow x - 6 = 0$ or $x - 12 = 0$

$x = 6$ A_1 or $x = 12$ A_1

12

13 a)

(i)



For minibus

$s = 90 km/hr$

$\Delta = x\ km$

$T = \left(\frac{7}{3} + t\right) hrs$

$x = 90\left(\frac{7}{3} + t\right)$

$x - 90t = 210$ — ① B_1

For drone

$s = 110 km/hr$

$T = t$

$\Delta = 360 - x$

$360 - x = 110(t)$

$x + 110t = 360$ — ② B_1

② − ①

$x + 110t = 360$

$-\ x - 90t = 210$ M_1

$200t = 150$

$\therefore t = \frac{3}{4} hrs$ B_1

Time taken by minibus to meet the drone $= \left(\frac{7}{3} + \frac{3}{4}\right) hrs$

$= \frac{37}{12} hrs = 3:05\ hrs$

The time when the minibus meets the drone = 8:15 Am + 3:05 hrs

= 11:20 Am. A_1

(ii) Using $x - 90t = 210$

$x = 210 + 90\left(\frac{3}{4}\right)$ $M_1 M_1$

$x = 277.5 km$ A_1 A_0 for $x = 277.5$

b) Time taken by minibus to reach B

$\Delta = s \times T$

$360 = 90 \times t$ M_1

$t = 4 hrs$ B_1

∴ For motorist,

$s = 100 km/hr$

$\Delta = 360 + P$

$T = 4 hrs$ B_1

$\therefore \Delta = s \times T$

$360 + P = 100(4)$ M_1

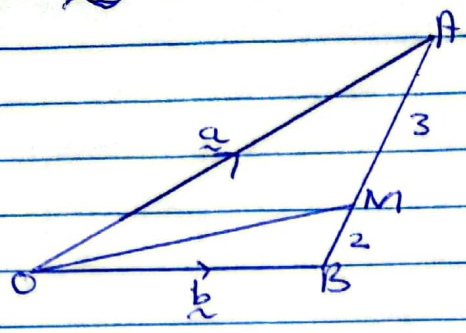
$P = 400 - 360$

$P = 40 km$ A_1 A_0 for $P = 40$

12

(14)

a) $AM : MB = 3 : 2$



$\underset{\sim}{AB} = \underset{\sim}{b} - \underset{\sim}{a}$. A_1

b $\underset{\sim}{AM} = \frac{3}{5}\underset{\sim}{AB}$. M_1

$= \frac{3}{5}(\underset{\sim}{b} - \underset{\sim}{a})$ M_1 A_1

c) $\underset{\sim}{OM} = \underset{\sim}{OA} + \underset{\sim}{AM}$. m_1

$= \underset{\sim}{a} + \frac{3}{5}(\underset{\sim}{b} - \underset{\sim}{a})_{M_1}$

$= \frac{1}{5}(2\underset{\sim}{a} + 3\underset{\sim}{b})_{A_1}$

d) $\underset{\sim}{OC} = \underset{\sim}{a} + k\underset{\sim}{b}$ —— ①

Also

$\underset{\sim}{OC} = \lambda \underset{M_1}{\underset{\sim}{OM}} = \frac{\lambda}{5}(2\underset{\sim}{a} + 3\underset{\sim}{b})$

$\underset{\sim}{OC} = \frac{2\lambda}{5}\underset{\sim}{a} + \frac{3\lambda}{5}\underset{\sim}{b}$ —— ②

② = ①

$\therefore \underset{\sim}{a} + k\underset{\sim}{b} = \frac{2\lambda}{5}\underset{\sim}{a} + \frac{3\lambda}{5}\underset{M_1}{\underset{\sim}{b}}$

By comparing coefficients of $\underset{\sim}{a}$ & $\underset{\sim}{b}$,

$1 = \frac{2\lambda}{5} \Rightarrow \lambda = 5/2$ B_1

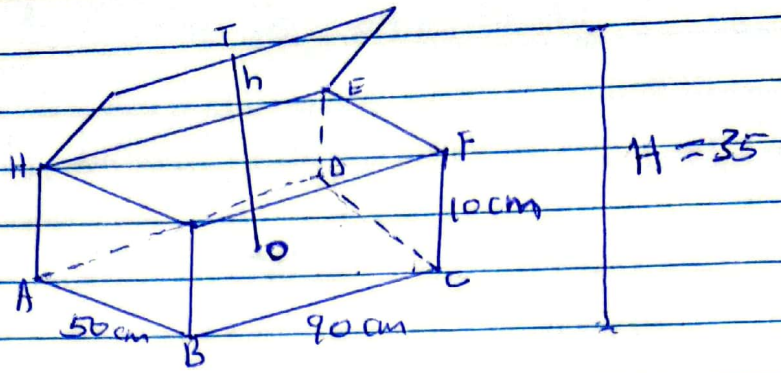
also

$k = \frac{3\lambda}{5} m_1 = \frac{3(5/2)}{5} = 3/2$ A_1

No mark should be given to any answer or procedure once the vector is not well written as a vector.

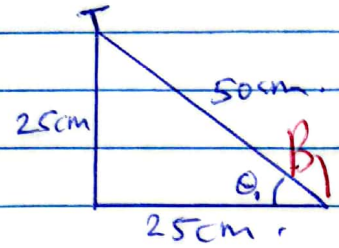
15

a)



$h = 35 - 10 = 25\text{cm}$ B_1

B_0 for $h = 25$

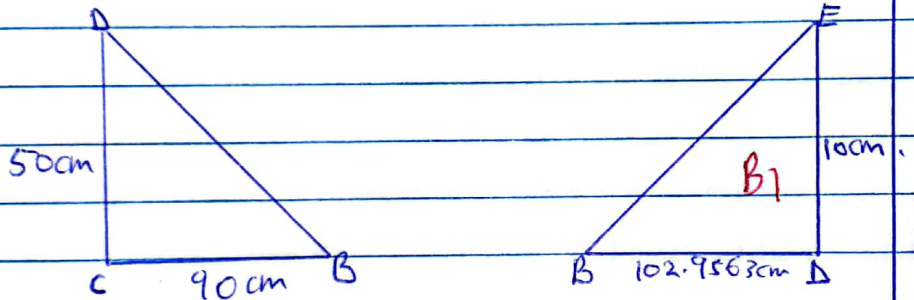


$\tan\theta = \frac{25}{25}$ M_1

$\theta = 45°$ A_1

A_0 for $\theta = 45$

b)



$(BD)^2 = 90^2 + 50^2$

$BD = \sqrt{8100 + 2500}$

$BD = 102.9563\text{ cm}$ B_1

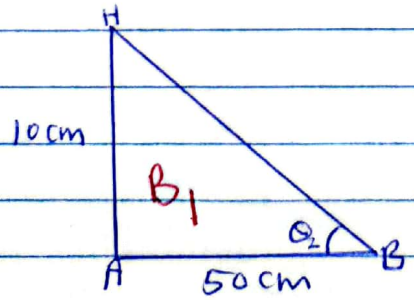
$\therefore BE^2 = (10)^2 + (102.9563)^2$ M_1

$BE = \sqrt{10699.9997}$

$\therefore BE = 103.4408\text{ cm}$ A_1

A_0 for 103.4408

c



$\tan\theta_2 = \frac{10}{50}$ M_1

$\theta_2 = \tan^{-1}\left(\frac{1}{5}\right)$ M_1

$\theta_2 = 11.3°$ A_1

A_0 for $\theta = 11.3$

16 a) i) Taxable Income = 52000 − (1280 + 7800 + 5000) M1 M1

= shs 37920 A1

ii)

Taxable Income	calculations	Income tax
11180	$\frac{10}{100} \times 11180$	1118 M1
10534	$\frac{15}{100} \times 10534$	1580.1 M1
10534	$\frac{20}{100} \times 10534$	2106.8 M1
5672	$\frac{25}{100} \times 5672$	~~1418~~ 1418 M1
		6222.9

∴ Net tax = shs 6222.9 A1

b) $\frac{104}{100} \times 52000$ = shs 54080 M1 B1

~~New taxable income = 54080 − (1280 + 7800~~

New taxable income = 54080 − (1280 + 7800 + 5000)

= shs 40,000 B1

Income tax = (6222.9 − 1418) + $\frac{25}{100} \times 7752$ M1

= 4804.9 + 1938

= shs 6742.9

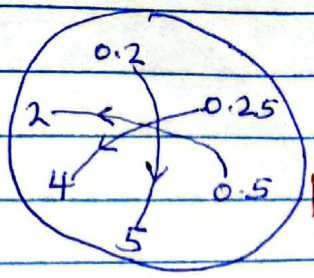
Net Salary = 54080 − 6742.9

= shs 47337.1 A1

12

(17)

a)



B_3

0.5 → 2 B_1

0.25 → 4 B_1

0.2 → 5 B_1

b i) $x = \frac{1+m}{m}$ m_1 m_1

$mx = 1 + m$

$mx - m = 1$ m_1

$m = \frac{1}{x-1}$ m_1

$\therefore h(x) = \frac{1}{x-1}$ A_1

ii) $2x + 1 = 1^2 + 4$ m_1 m_1

$2x = 4$

$x = 2$ A_1

12