KAMSSA 2022 SUBSIDIARY MTC

MARKING GUIDE

1. $\frac{(\sqrt{10}+\sqrt{5})^2 - (\sqrt{10}-\sqrt{5})^2}{2\sqrt{5}}$

$= \frac{(\sqrt{10}+\sqrt{5}+\sqrt{10}-\sqrt{5})(\sqrt{10}+\sqrt{5}-\sqrt{10}+\sqrt{5})}{2\sqrt{5}}$

$= \frac{2\sqrt{10}(\sqrt{5}+\sqrt{5})}{2\sqrt{5}}$

$= 2\ \frac{\sqrt{10}\ 2\sqrt{5}}{2\sqrt{5}}$

$= 2\sqrt{10}$

2. $\frac{(145X2)+(125X3)+(xX5)+(130X4)+(120X1)}{2+3+5+4+1} = 130$

$\frac{290+375+5x+520+120}{15} = 130$

$1305 + 5x = 1950$

$X = 129$

3 $\begin{array}{l} a + 4d = 18 \ldots\ldots\ldots\ldots\ldots\ldots i \\ \underline{4a+14d = 93 \ldots\ldots\ldots\ldots\ldots\ldots ii} \end{array}$

$eqn\ i - eqn\ ii$

$\begin{array}{l} 4a+16d=72 \\ \underline{4a+14d=93} \end{array}$

$2d = -21$

$d = \frac{-21}{2}$

$a + 4\left(\frac{-21}{2}\right) = 18$

$a = 60$

(4) . Let p(A) = x and P(B) = y

P(A n B) = P(A), P(B)

$\frac{1}{4}$ =x , y…….. (i)

P(AuB) = P(A) +P(B) – P(AnB)

$\frac{3}{4}$ = x + y -xy.

X + y = 1

X = 1 – y .

(1 – y)y = $\frac{1}{4}$

Y - y^2 = $\frac{1}{4}$

4y - $4y^2$ =1

$4y^2$ – 4y + 1 = 0

Y = $\frac{1}{2}$.

P(B) = $\frac{1}{2}$.

xy = $\frac{1}{4}$

$\frac{x}{y}$ = $\frac{1}{4}$

X = $\frac{1}{2}$.

P(A) = $\frac{1}{2}$.

5) $3\cos\theta = \frac{8\sin\theta}{\cos\theta}$

$3\cos^2\theta - 8\sin\theta = 0$

$3(1-\sin^2\theta) - 8\sin\theta = 0$

$3\sin^2\theta + \sin\theta - 3 = 0$

$\left(\sin\theta - \frac{1}{2}\right)(\sin\theta + 3) = 0.$

Either

$\sin\theta = \frac{1}{3}$

θ= 19.5°,160.5°.

6) $\mu = 1.8$ σ= 0. 3 ∩ = 1000

$P(1.68 < x < 2.10) = P\left(\frac{1.68-1.8}{0.3} < z < \frac{2.10-1.8}{0.3}\right)$

$= P(-0.4 < z < 1$

=P($0 < z < 0.4$) + P($0 < z < 1$)

= 0.15542 + 0.34134

= 0.49676 x 1000

=496.76

$\approx 497\ Mangoes.$

7) sum of roofs

$x\beta = \frac{3}{2}$ x + $\beta = -\frac{9}{2}$

$x^2 - 1 + \beta^2 - 1 = (x + \beta)^2 - 2x\beta - 2$

$= \left(-\frac{9}{2}\right)^2 - 2\left(\frac{3}{2}\right) - 2$

$= \frac{61}{4}$

Product of roofs.

$(x^2 - 1)\ (\beta^2 - 1) = (\propto\ \beta)^2 - (\propto + \beta)^2 - 2\propto\ \beta + 1$

$= \left(\frac{3}{2}\right)^2 - \left(-\frac{9}{2}\right)^2 - 2\left(\frac{3}{2}\right)$

= - 21

Equation ⇒ $4x^2 - 61 - 84 = 0$

8)

DIAGRAM

For 5kg mass

5g -T =5a……. (1)

For 10kg mass

T – 7.5 = 10a……. (2)

From eqn (1)

T = 5g – 5a

Then 5g – 5a – 7.5 = 10a

5x9.8 – 5a – 7.5 =10a

a = $2.766 m/s^2$

QN 9 (a)

(i) $\sum p(X = x) = 1$

$0.4 + a + 0.3 + 0.2 = 1$

$a = 0.1$

(ii) $ECT(-2x0.4) + (0x0.1) + (1x0.3) + (4x0.2)$

$= -0.8 + 0.3 + 0.8$

= 0.3

(iii) Var(x) =(4x0.4) + (1x 0.3) +0 +(16 x 0.2)

= 1.6 + 0.3+3.2

= 5.1

9(b)

(i) $\int_1^3 ky^2$ dy = 1

$\frac{ky^3}{3}\Big|_1^3$ = 1

$K\left[9 - \frac{1}{3}\right]$ =1

K = $\frac{3}{26}$

(ii)

$P\left(x > \frac{2}{3}\right)$ =$\frac{3}{26}\int_{\frac{2}{3}}^1 y^2$ dy

= $\frac{3}{26}\left[\frac{1}{3} - \frac{\left(\frac{2}{3}\right)^3}{3}\right]$

=$\frac{19}{702}$ or 0.02707

(iii) E(y) = k$\int_1^3 y^3$dy

= $\frac{3}{26}\left[\frac{y4}{4}\right]_1^3$ = $\frac{3}{26}\left(\frac{34}{4} - \frac{1}{4}\right)$

=$\frac{60}{26}$

= OR 2.3076

10(a) Y= $2X^2 + 5X^{-1}$

$\frac{dy}{dx}$ = 4x - $5x^{-2}$

$\left.\frac{dy}{dx}\right|_{x=-2}$ = 4(-2) - 5$(-2)^{-2}$

$=\frac{-37}{4}$

(b) (i)

Y =(x-2)(4-x)

Y= 6x - x^2 – 8

$\frac{dy}{dx}$ = 6 – 2x

At turning point $\frac{dy}{dx}$ = 0

6 – 2x = 0

X = 3

When x = 3

Y= (3 – 2) (4 – 3) = 1

∴ point (3 , 1)

Nature of turning point

$\frac{dy}{dx}$ = 6 – 2x

$\frac{d^2y}{dx^2}$ = - 2, $\frac{d^2y}{d^{x^2}} < 0$

$\therefore (3,1)is\ a\ maximum\ point$

(ii)

$Interapts$

$X - 0\ , y = -8(0,-8)$

$y = 0, x = 2\ or\ x = 4\ (2,0)(4,0)$

$graph$

(iii)

Area =$\int_2^4 6x - x^2 -$ dx

$=\left[3x^2 - \frac{x^3}{3} - 8x\right]_2^4$

$=\left(-\frac{16}{3}\right)$ -$\left(-\frac{20}{3}\right)$

$\frac{4}{3}$ square units

Qn 11

(a) n= 12

$=\frac{12!}{2!2!2!2!}$ $=\frac{479001600}{16}$

=29,937,600

$\frac{1x10!}{2!2!2!}$ = 453,600

P(E) = $\frac{453,600}{29,937,600} = \frac{1}{66}$

OR =0.01515

(b) 2 boys can be chosen from 4 in ${}^4C_2$=6 ways

3 girls can be chosen from 7 in ${}^7C_3$= 35 ways

Number of ways = 6x 35

=210 ways

(c) Atleast 3 boys Type equation here.

$\underline{4\ boys \quad 7\ girls}$

3 2

4 1

${}^4C_3$ x${}^7C_2$ +${}^4C_4$ x${}^7C_1$

84 + 7

= 91 ways

Marks	F	X	fx	c.b	c.f
0 - < 40	2	5	10	10-10	2
10 - < 20	8	15	120	10-20	10
20 - < 30	10	25	250	20-30	20
30 - < 40	14	35	490	30-40	34
40 - < 50	5	45	225	40-50	39
50 - < 60	1	55	55	50-60	50

$\sum f$ =50 $\sum fx$ =1150

(i)

Mean $=\frac{\sum fx}{\sum f}$ $= \frac{1150}{50}$

= 23 marks

(ii)

Mode = $L_1 + \left(\frac{d_1}{d_{1+}\, d_2}\right)$ x c

= $30 + \left(\frac{4}{4+9}\right)$ x 10

= 30 + 3.0769

= 33.0769 $\left(3\ dp^{atleast}\right)$

QN 13

(a) $2\begin{pmatrix}2 & x\\ 3 & y\end{pmatrix} + \begin{pmatrix}1 & 2\\ 4 & 1\end{pmatrix} = \begin{pmatrix}0 & 6\\ 2 & 4\end{pmatrix}$

$\begin{pmatrix}4 & 2x\\ 6 & 2y\end{pmatrix} + \begin{pmatrix}1 & 2\\ 4 & 1\end{pmatrix}\begin{pmatrix}0 & 6\\ 2 & 4\end{pmatrix}$

2x + 2 = 6

x = 2

2y = 4

Y = 2

(b) (i) $\begin{matrix}A\\ B\\ C\end{matrix}\begin{pmatrix}30 & 20\\ 40 & 15\\ 35 & 10\end{pmatrix}$ 3X2

(ii) $\begin{matrix}small\\ large\end{matrix}\begin{pmatrix}30{,}000\\ 40{,}000\end{pmatrix}$ 2x1

(iii) $\begin{pmatrix}30 & 20\\ 40 & 15\\ 35 & 10\end{pmatrix}\begin{pmatrix}30{,}000\\ 40{,}000\end{pmatrix}$

$= \begin{pmatrix}900{,}000 + 800{,}000\\ 1200{,}000 + 600{,}000\\ 1050{,}000 + 400{,}000\end{pmatrix}$

$= \begin{matrix}A\\ B\\ C\end{matrix}\begin{pmatrix}1700{,}000\\ 1800{,}000\\ 1450{,}000\end{pmatrix}$

Total sales = 1700,000 +1800,000 +1450,000

= shs 495,000

Qn 14

Diagram

At equilibrium

Horizontally p $\cos\theta$ = 20 $\cos\theta 0 + 15$

P $\cos\theta$ = 27.8575 .....(i)

Vertically p $\sin\theta$ = 20 $\sin 50$

P $\sin\theta$ = 15.32088 .....(ii)

(ii).....(i)

$\tan\theta$ = $\frac{15.32088}{27.8575}$

θ = 28.8°

P $\cos 28.8°$ = 27.8575

P = 31.79 N

(b) part 1

t = 30S , at 1.5 ms^{-2}

u =o

u = u + at

v = 0 + 1.5x 30

v= 45 ms^{-1}

Part (ii)

t = 60S, a = 0.3ms^{-2}

U = 45 ms^{-1} ,v = u + at

V = 45+0.3 x 60

V = 63 ms^{-1}

Part (iii)

t = 25S

V =U = 63ms^{-1}

Acceleration = slope

= $\frac{DV}{Dt}$ = $\frac{0-65}{25}$

= - 2.6 ms^2

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