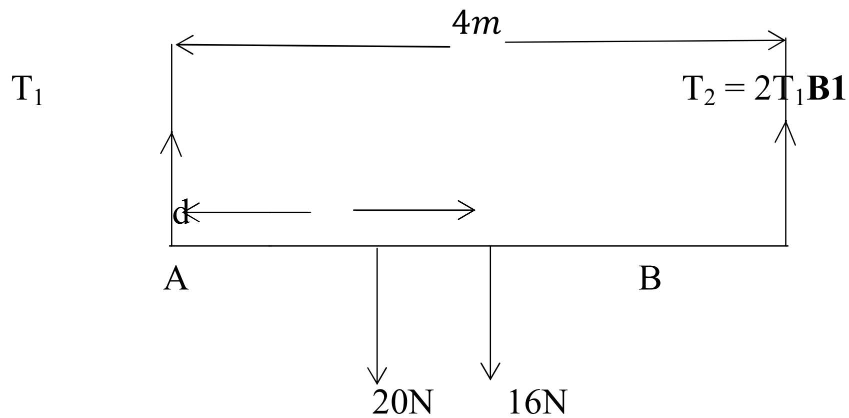
**JINJA JOINT EXAMINATIONS BOARD**

**MOCK EXAMINATIONS 2022**

**P425/2 MATHEMATICS**

**MARKING GUIDE**

1.




(T) : $T_1 + 2T_1 = 36$ **M1**

$T_1 = 12$ **B1**

$\therefore\ T_2 = 24$

M(A) : $20 \times 2 + 16 \times d = 24 \times 4$ **M1**

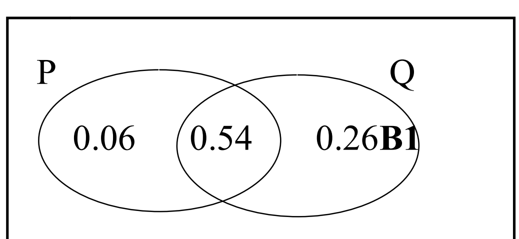
$d = 3.5\text{m}$ **A1**

**05**

2. $P(P \cap Q) = P(P) \times P(Q/P)$ **B1**

$= 0.6 \times 0.9$

$= 0.54$



0.14

(i) P (P or Q but not both P and Q) = 0.06 + 0.26

= 0.32 **A1**

(ii) P(P(Q) $= \frac{P(P\cap Q)}{P(Q)}$

$= \frac{0.54}{0.8}$ **M1**

$= \frac{54}{80}$ **A1**

**05**

3. (a) $\frac{20-15}{13.6-12} = \frac{20-D}{13.6-12.8}$ **B1M1**

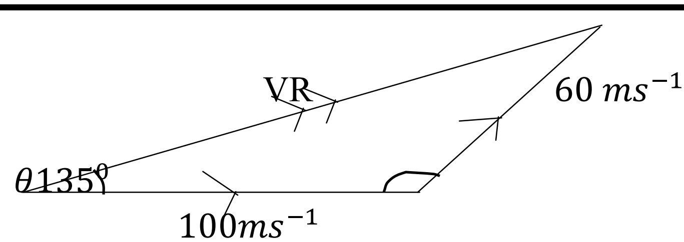
$D = 17.5$ **A1**

(b) $\frac{34.7-31}{F-12} = \frac{31-25}{5.0-10.5}$ **MI**

$F = 16.08\overline{3}$ **A1**

**05**

4. (a)




$V_R^2 = 100^2 + 60^2 - 2\times 60\times 100\times cos135^0$

$V_R = 148.6112\, ms^{-1}$

(b) $\frac{148.6112}{\sin 135^0} = \frac{60}{sin\theta}$

$\theta \;=\; 16.6^0$ **B1**

$\therefore$ Direction is $N\;73.4^0 E$ **A1**

**05**

5. $P\;=0.46,\;q=0.54,\;\;n=100$

$\mu\;=np=100\;\times 0.46$ $\qquad\sigma=\;\sqrt{100\;\times 0.46\;\times 0.54}$

$=$ $\qquad = 4.98397$ **B1**

$P(X\;<50)=P(Y\;<49.5)$ **B1**

$P\left(\frac{Z<4\;\;.5-46}{4.98397}\right)$ **M1**

$P\;(Z\;<0.702)$

$0.5+0.2586$ **M1**

$=0.7586$ **A1**

**05**

6. $h=\frac{\frac{\pi}{3}-0}{4}\;=\;\frac{\pi}{12}$ **B1**

**B1**

| $x$ | $y_0\,,y_4$ | $y_1,\dots\dots y_3$ |
|---|---|---|
| 0 | 1.000 | |
| $\frac{\pi}{12}$ | | 1.255 |
| $\frac{\pi}{4}$ | | 1.462 |
| $\frac{\pi}{3}$ | 1.425 | 1.551 |
| Sum | 2.425 | |
| | | 4.268 |

**B1**

$\int_0^{\frac{\pi}{3}} e^x \cos x\,dx\;\;=\frac{1}{2}\times\;\frac{\pi}{12}\times\;[2.425\;\times 2\;(4.268)]$ **M1**

$=1.434$

$1.43\;(3s.f)$ **A1**

**05**

7.

| $Rx$ | 3 | 6 | 7 | 1 | 8 | 4.5 | 2 | 4.5 |
|---|---|---|---|---|---|---|---|---|
| $Ry$ | 2 | 5 | 6 | 1 | 8 | 7 | 4 | 3 |
| $d$ | 1 | 1 | 1 | 0 | 0 | -2.5 | -2 | 1.5 |

**B1**

**B1**

$\sum d^2 = 15.5$ **B1**

$r_s = 1 - \frac{6 \times 15.5}{8 \times 63}$ **M1**

$= 0.8155$ **A1**

**05**

8. $\boldsymbol{v} = e^t\boldsymbol{i} + 2e^{-2t}\boldsymbol{i} - \sin t\boldsymbol{k}$

$\boldsymbol{a} = e^t\boldsymbol{i} - 4e^{-2t}\boldsymbol{j} - cos\boldsymbol{k}$ **M1**

$\therefore force, \boldsymbol{F} = 2\,(e^t\boldsymbol{i} - 4e^{-2t}\boldsymbol{j} - cost\boldsymbol{k})$

$= 2e^t\boldsymbol{i} - 8e^{-2t}\boldsymbol{j} - cost\boldsymbol{k}$ **B1**

Power $= \boldsymbol{F} . \boldsymbol{V}$

$$= \begin{pmatrix} 2e^t \\ -8e^{-2t} \\ -2cost \end{pmatrix} \cdot \begin{pmatrix} e^t \\ 2e^{-2t} \\ -sint \end{pmatrix}$$

$= 2e^{2t} + -16e^{-4t} + sin2t$ **M1**

When $t = 4$; power = $2e^{2t} - 16e^{-4(4)} + sin2\,(4)$ **M1**

= 5961.92 units **A1**

**05**

9. (a) $\mu = 52, \quad \sigma = 16$

(i) $P(X < 40) = P\left(Z < \frac{40-52}{16}\right)$ **M1**

$= P(Z < -0.75)$

$= 0.5 - 0.2734$

$= 0.2266$ **B1**

$\therefore$ Number of candidates in the school $= \frac{20}{0.2266}$ **M1**

$= 88.2613$ **A1**

(ii) $P(X \geq 68) = P\left(Z \geq \frac{68-}{16}\right)$ **M1**

$= P(Z \geq 1.000)$

$= 0.5 - 0.3413$

$= 0.1587$ **B1**

$\therefore$ Number who got distinctions.

$= 0.1587 \times 88.2613$ **M1**

$= 14.0071$ **A1**

(b) $S.E = \frac{16}{\sqrt{16}} = 4$ **B1**

**M1** **M1**

$\therefore (46 < \bar{X} < 58) = P\left(\frac{46-52}{4} < Z < \frac{58-52}{4}\right)$

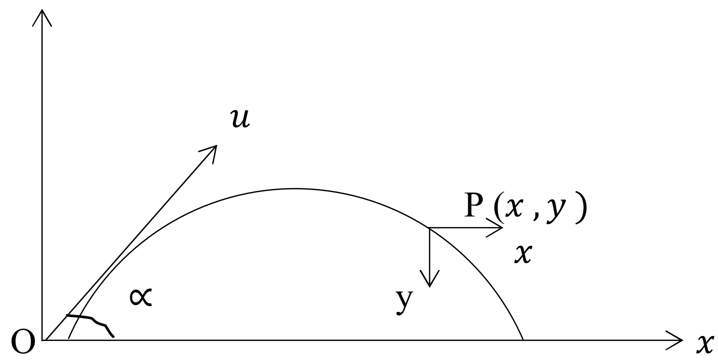
$= P(-1.5 < Z < 1.5)$

$= 2 \times 0.4332$

$= 0.8664$ **A1**

**12**

10. (a)




If the particle is projected with speed $u$, at an angle $\propto$ to the horizontal, then,

$\dot{x} = u\cos\propto$ ------- (1) **B1**

$\dot{y} = u\sin\propto -gt$ ---- (2) **B1**

$\Longrightarrow\ x = u\cos\propto t$ ----(3) **B1**

$y = u\sin\propto t - \frac{1}{2}gt^2$ --- (4) **B1**

Substituting (3) into (4) for t,

$$y = u\sin\propto\left(\frac{x}{u\cos\propto}\right) - \frac{gx^2}{2u^2\cos^2\propto}$$ **M1**

$$y = x\tan\propto - \frac{gx^2}{2u^2}(1+\tan\propto)$$ **B1**

(b) $y = 9$ , $x = 72$

(i) using $y = x\tan\propto - \frac{gx^2}{2u^2}(1+\tan\propto)$

$$9 = 72\tan\propto - \frac{10\,(72)^2}{2(30)^2} - (1+\tan\propto)$$ **M1**

$$16\tan^2\propto -40\tan\propto +21 = 0$$ **B1**

$$\tan\propto = \frac{40\pm16}{32}$$ **M1**

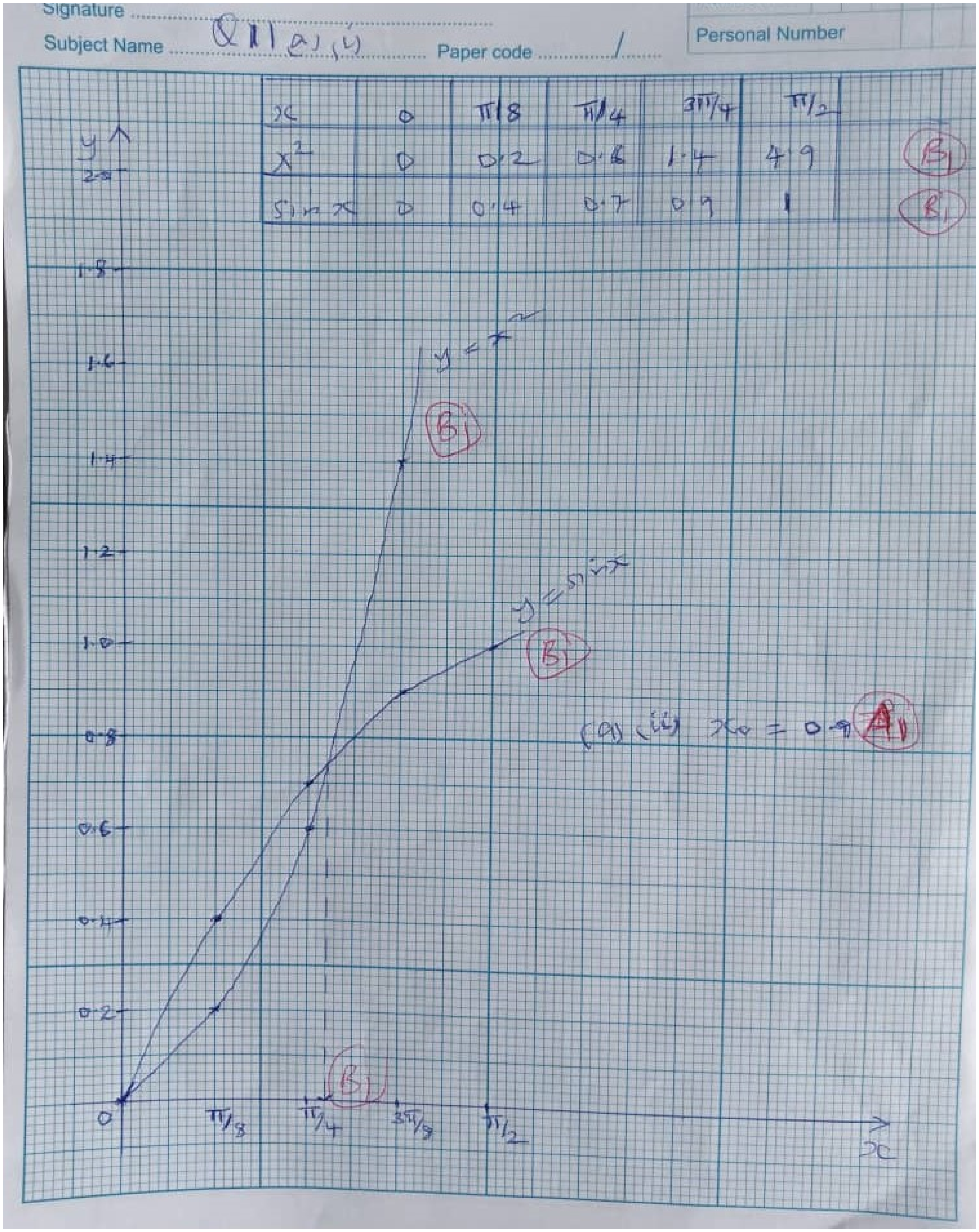
$$\frac{56}{32} \text{ or } \frac{24}{32}$$

$$\therefore \tan\propto = \frac{3}{4} \text{ or } \frac{7}{4}$$

$\Longrightarrow \propto = 36.9^0 \quad and\ 60.2^0$ **M1 A1 A1**

**12**

11. (a) (i)



Signature
Subject Name Q11 (a) (i)
Paper code /
Personal Number
x 0 π/8 π/4 3π/4 π/2
x² 0 0.2 0.6 1.4 4.9
sin x 0 0.4 0.7 0.9 1
y = x²
y = sin x
(a) (ii) x₀ = 0.9


(a) (ii) $x_0 = 0.9$ **A1**

(b) $f(x) = \ x^2 - \sin x$

$f(x) = 2x - cosx$ **M1**

$x_1 = 0.9 - \frac{(0.9^2 - \sin 0.9)}{2(0.9) - \cos 0.9}$ **M1**

$= 0.8774 \qquad e_1 = 0.0226$ **B1**

$x_2 \ = 0.8774 - \frac{(0.8774^2 - \sin 0.8774)}{2\ (0.8774) - \cos(0.8774)}$ **M1**

$= 0.8767 \qquad e_2 = 0.0007$ **B1**

$\therefore root = 0.877$ **A1**

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**12**

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12.

(a) $V_t \ = \ \int (e^{-2t}\ \boldsymbol{i} - 2cost\ \boldsymbol{j} + 4sin2t\ \boldsymbol{k})dt$

$= \frac{-1}{2} e^{-2t}\boldsymbol{i} - 2\ sint\ \boldsymbol{j} - 2\cos 2t\ \boldsymbol{k}\ + \boldsymbol{C}$ **M1**

$V_t = 0 = \boldsymbol{i} = \boldsymbol{2}j + 4\boldsymbol{k}$

$\Longrightarrow \boldsymbol{i} - 2\boldsymbol{j} + 4\boldsymbol{k} = \frac{-1}{2} e^{-2(0)}\boldsymbol{i} - 2sin0\boldsymbol{j} - 2cos2(0)\boldsymbol{k} + \boldsymbol{C}$ **M1**

$\boldsymbol{C} = \frac{3}{2}\ \boldsymbol{i} - 2\boldsymbol{j} + 6\boldsymbol{k}$ **B1**

$$\therefore \boldsymbol{V}_t \ = \begin{pmatrix} \frac{-1}{2} e^{-2t} & + & \frac{\boldsymbol{3}}{\boldsymbol{2}} \\ -2sint & - & 2 \\ -2cos2t & + & 6 \end{pmatrix}$$ **A1**

$$\text{(b) } \boldsymbol{V}_t = \frac{\pi}{2} \ = \begin{pmatrix} \frac{-1}{2} e^{-\pi} & + & \frac{3}{2} \\ -2sin\frac{\pi}{2} & - & 2 \\ -2cos\pi & + & 6 \end{pmatrix}$$ **B**

$$\begin{pmatrix} 1.4784 \\ -4 \\ 8 \end{pmatrix}$$

Speed $= \sqrt{(1.4784)^2 + (-4)^2 + 8^2}$ **M1**

$= 9.06563$ **A1**

(c) $\boldsymbol{r}_t = \int \left(\frac{-1}{2}e^{-2t} + 3\right)\boldsymbol{i} - (2 + 2sint)\,\boldsymbol{j} + (\boldsymbol{6} - 2cos2t)\,\boldsymbol{k}\,dt$

$= \left(\frac{1}{4}e^{-2t} + \frac{3}{2}t\right)\boldsymbol{i} - (2t + 2cost)\,\boldsymbol{j} + (6t - 4sin2t)\boldsymbol{k} + \boldsymbol{C_1}$ **M1**

when $t = 0$;

$2\boldsymbol{i} - \boldsymbol{j} + 4\boldsymbol{k} = \frac{1}{4}\boldsymbol{i} - 2\boldsymbol{i} + 0\boldsymbol{k} + \boldsymbol{C_1}$ **M1**

$\boldsymbol{C}_{\boldsymbol{1}} = \frac{7}{4}\boldsymbol{i} + \boldsymbol{j} + 4\boldsymbol{k}$ **B1**

$\therefore \boldsymbol{r}_t = \left(\frac{1}{4}e^{-2t} + \frac{3}{2}t + \frac{7}{4}\right)\boldsymbol{i} + (2t + 2cost + 1)\boldsymbol{i} + (6t - 2sin2t + 4)\boldsymbol{k}$ **M1** **A1**

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**12**

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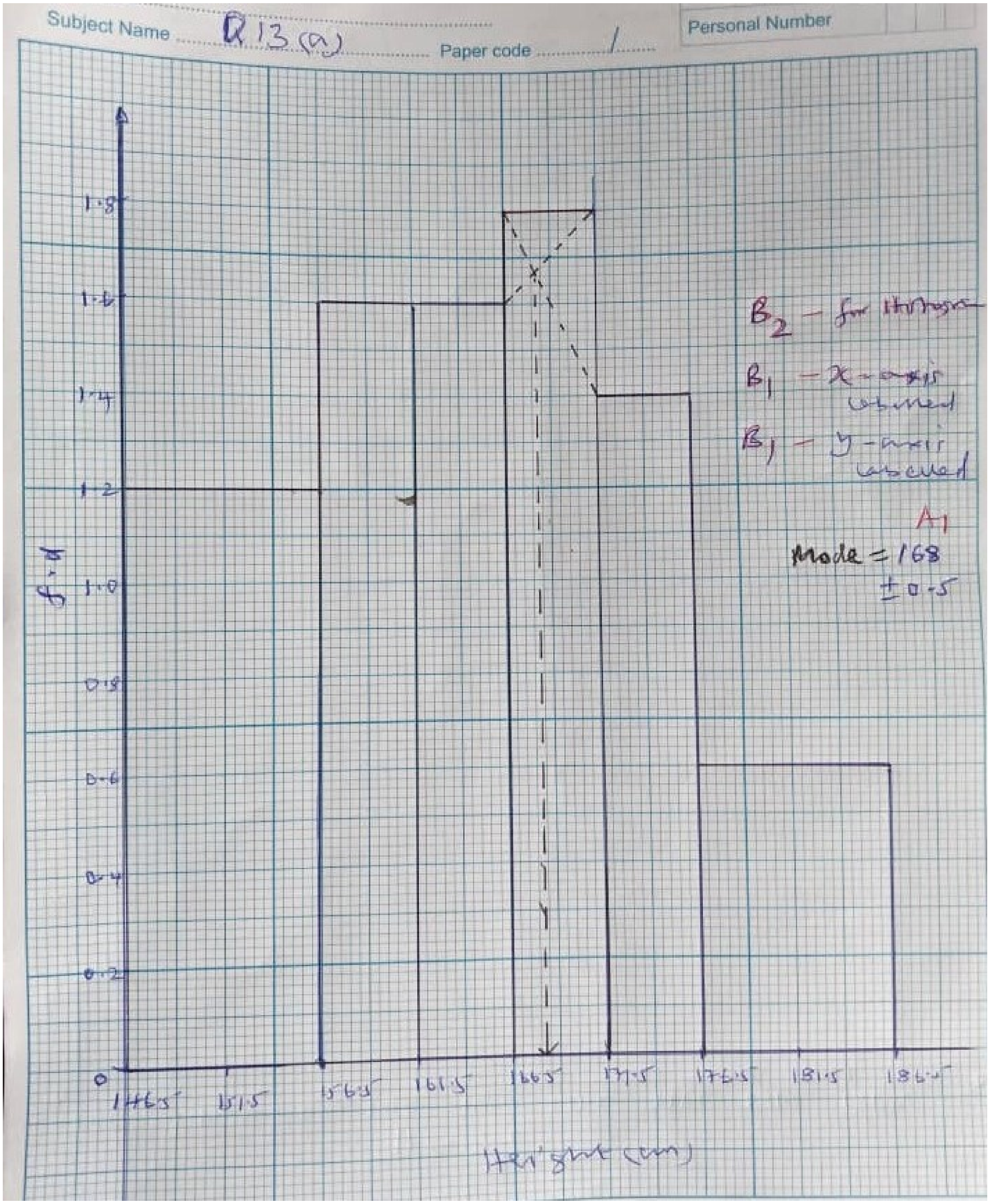
13. (a)

| Height | $f$ | X | Xf | $X^2f$ | $f.d$ |
|---|---|---|---|---|---|
| 147 – 156 | 12 | 151. 5 | 1818 | 275427 | 1.2 |
| 157 – 161 | 8 | 154 | 1272 | 202248 | 1.6 |
| 162 – 166 | 8 | 164 | 1312 | 215168 | 1.6 |
| 167 – 171 | 9 | 169 | 1521 | 257049 | 1.8 |
| 172 – 176 | 7 | 174 | 1218 | 211932 | 1.4 |
| 177 – 186 | 6 | 181.5 | 1089 | 197653.5 | 0.6 |
| Sum | 50 | | 8230 | 1,359,477.5 | |

**B1** **B1** **B1**




(b) (i) Mean height $= \frac{8230}{50}$ **M1**

$= 164.6$ **A1**

(ii) Standard deviation $= \left[\frac{1,359,477.5}{50} - (164.6)^2\right]^{\frac{1}{2}}$ **M1**

= 9.8178 **A1**

**12**

14. (a) $\frac{\Delta l}{L} \times 100 = 5$ $\quad\quad$ $\frac{\Delta w}{w} \times 100 = 4.2$

$\Delta L = \frac{5 \times 5.25}{100}$ $\quad\quad$ $\Delta w = \frac{4.2 \times 0.44}{100}$

$= 0.0625$ **B1** $\quad\quad$ = 0.01848 **B1**

A max= $(1.25 + 0.0625) \times (0.44 + 0.01848)$ **M1**

= 0.602

= 0.60 **A1**

A min = $(1.25 - 0.0625) \times (0.44 - 0.01848)$**M1**

= 0.500 **M1**

= 0.50 **A1**

(b) $e = \frac{A^2}{B} - \frac{a^2}{b}$ **M1**

$= \frac{(a+e_1)^2}{(b+e_2)} - \frac{a^2}{b}$

$= \frac{b\ (a^2+2ae_1+e_1^2) - a^2\ (b+e_2)}{b\ (b+e_2)}$

$= \frac{2abe_1 + e_1^2\ b - a^2 e_2}{b\ (b+e_2)}$

$= \frac{2ab\ \ _1 + e_1^2 b - a^2 e_2}{b^2\ (1+\frac{e_2}{b})}$

If $|e_1| <<< |A|$and$|e_2| <<< |B|$ **B1**

$\frac{e_2}{b} \approx 0\ and\ e_1^2 \approx 0$

$\therefore e = \frac{2\ a\ b\ e_1 - a^2 e_2}{b^2}$

$= \frac{a^2}{b}\left[\frac{2e_1}{a} - \frac{e_2}{b}\right]$

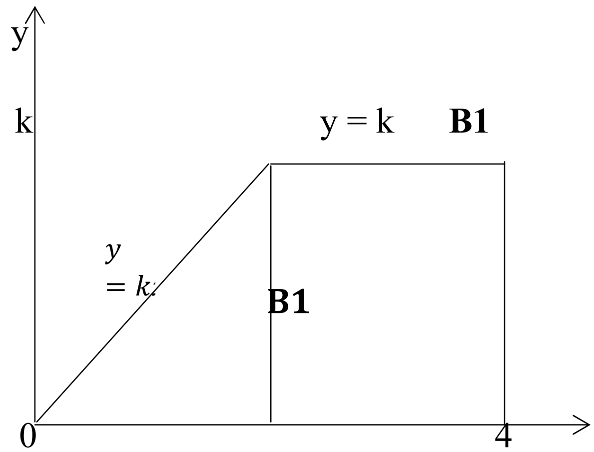
$|e| \leq \frac{a^2}{b}\left[\left|\frac{2e_1}{a}\right| + \left|\frac{e_2}{b}\right|\right]$ **M1B1**

erel $= \frac{|e|}{\left|\frac{a^2}{b}\right|} \leq \frac{a^2}{b} \times \frac{b}{a^2}\left[\left|\frac{2e_1}{a}\right| + \left|\frac{e_2}{b}\right|\right]$ **M1**

(erel) max = $2\left|\frac{e_1}{a}\right| + \left|\frac{e_2}{b}\right|$ **B1**

**12**

15.(a)




**B1** for axes

(b) (i) $\frac{1}{2} \times 1 \times k + 3k = 1$ **M1**

$K = \frac{2}{7}$ **A1**

(ii) $E(x) = \int_0^1 x.\frac{2}{7}\, xdx + \int_1^4 x.\frac{2}{7}\, dx$

$= \frac{2}{21}[x^3]_0^1 + \frac{1}{7}[x^2]_1^4$ **M1**

$= \frac{2}{21} + \frac{1}{7}(16-1)$ **M1**

$= \frac{47}{25}$ or 2.2381 **A1**

(i) $\int_0^1 \frac{2}{7}\, xdx = \frac{1}{7}[x^2]_0^1$

$= \frac{1}{7} < \frac{1}{2}$ **B1**

$\therefore median = \frac{1}{7} + \int_1^m \frac{2}{7}\, dx = \frac{1}{7}$

$\Longrightarrow \frac{2}{7}[x]_1^m = \frac{5}{4}$ **M1**

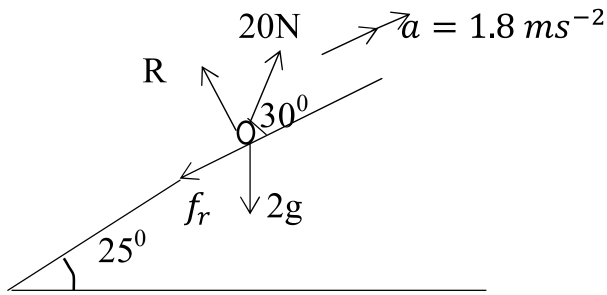
$\Longrightarrow \frac{2}{7}[m-1] = \frac{5}{4}$ **M1**

$m = \frac{9}{4}$ or 2.25 **A1**

**12**

16.

(a)




**B1**

( ) : $R + 20\cos 60^0 - 2g\cos 25 = 0$ **M1**

$R = 7.76336N$ **B1**

( ) : $20cos30^0 \ - f_r - 2g\ cos65^0 = 2 \times 1.8$**M1**

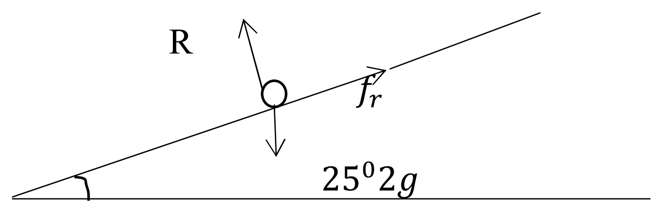
$f_r = 5.4372\ N$ **B1**

$\therefore coeff.of\ friction, \mu = \frac{f_r}{R} = \frac{5.4372}{7.7636}$ **M1**

$= 0.7$ **A1**

(b)

**B1**




( ) : $R = 2g\ cos25^0$ **M1**

$= 2\ \times 9.8\ cos25^0$

$= 17.7636\ N$

$F_{max}\ =\ \mu R$ **M1**

$= 0.7\ \times 17.7636 \quad = 12.435N$**B1**

Particle will remain at rest if the friction force is large enough to balance the component of its weight down the plane.

Component weight $= 2\ \times 9.8\ \times cos65^0$

$= 8.2833\ N$ **M1**

Since $F_{max} > 8.28\ N,$ particle will remain at rest. **B1**

**12**

**E N D**