WAKISHA MOCK EXAMINATION 2023 P425/2 LAKE MATH 2
PROPOSED GUIDE

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SECTION B
QN. 9.

class	Frequency	x	fx	fx^2	cf	c.b
120-124	5	122	610	74420	5	119.5 - 124.5
125-129	17	127	2159	274193	22	124.5 - 129.5
130-134	20	132	2640	348480	42	129.5 - 134.5
135-139	25	137	3425	469225	67	134.5 - 139.5
140-144	15	142	2130	302460	82	139.5 - 144.5
145-149	6	147	882	129654	88	144.5 - 149.5
150-154	2	152	304 B_1	46208 B_1	90	149.5 - 154.5

$\Sigma fx = 12150$ $\Sigma fx^2 = 1644648$

9 (a)

Mean height, $= \frac{\Sigma fx}{\Sigma f}$

$= \frac{12150}{90}$ m_1

Mean height $= 135$ cm A_1

Standard deviation $= \sqrt{\frac{\Sigma fx^2}{\Sigma f} - \left(\frac{\Sigma fx}{\Sigma f}\right)^2}$

S.D $= \sqrt{18,273.778 - 135^2}$ m_1

S.D $= 6.9841$ cm A_1

Ignore; units

9 (b) shown on the graph paper.

9 c(i)

$\left(\frac{N}{2}\right)^{th}$ value 45^{th} value.

Median $= 135$ cm A_1 Awarded with or without units

9c (ii)

Middle 60% height range
$= P_{80} - P_{20}$

From the graph $P_{80} = \frac{80}{100} \times 90$

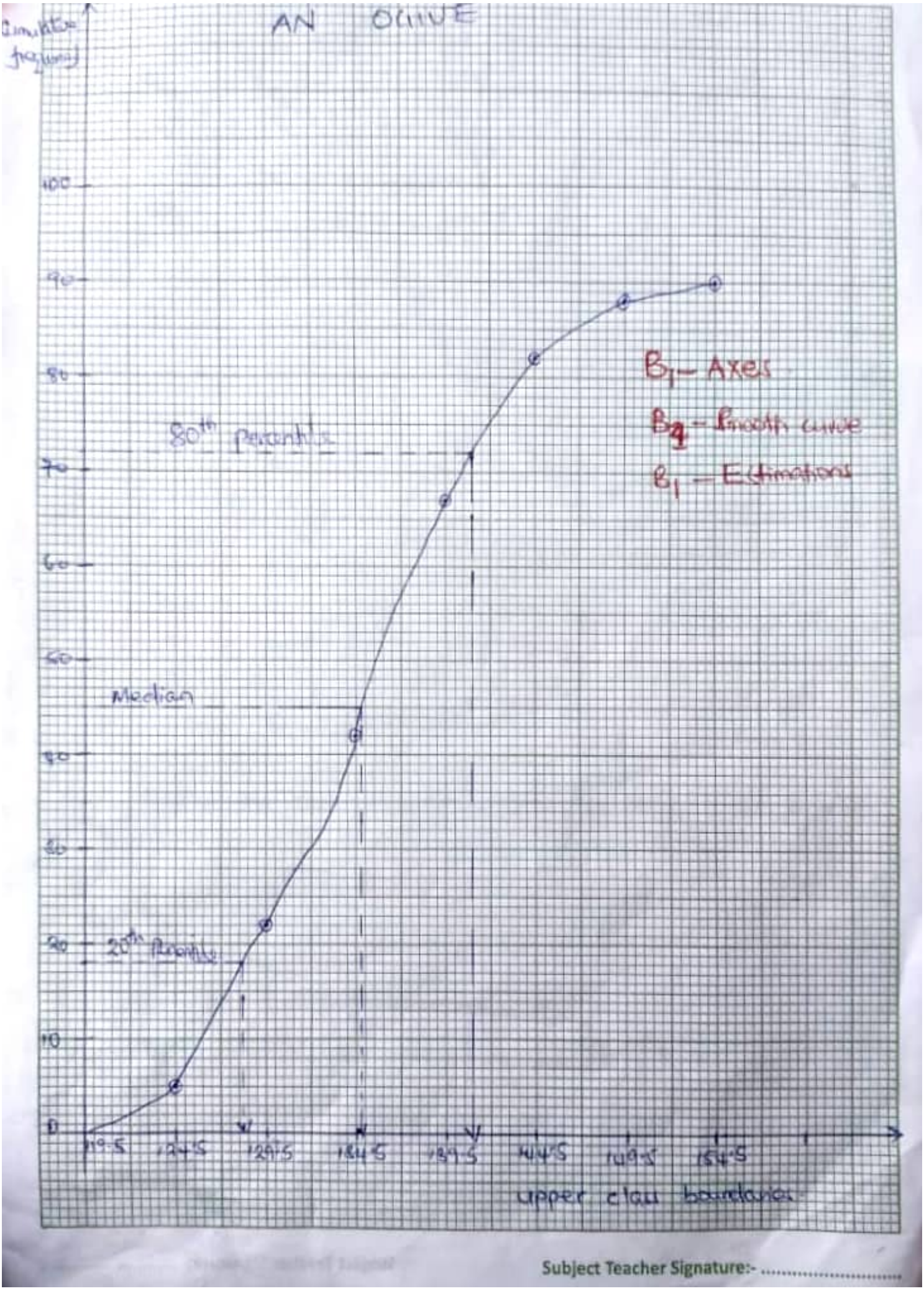
$P_{80} = 141$

$P_{20} = 128.5$

$141 - 128.5$ m_1 Must be obtained from the graph

Middle 60% height range $= 12.5$ cm A_1

TOTAL: 12 Marks



Subject Teacher Signature:- .....

Q4:10

a) Let $X = N^{\frac{1}{4}}$

$X^4 - N = 0$

$f(x) = X_n^4 - N$

$f'(x) = 4X_n^3$ B_1

From Newton Raphson formula;

$$X_{n+1} = X_n - \frac{f(X_n)}{f'(X_n)}$$

$$X_{n+1} = X_n - \frac{(X_n^4 - N)}{4X_n^3}$$ m_1

$$X_{n+1} = \frac{4X_n^4 - X_n^4 + N}{4X_n^3}$$

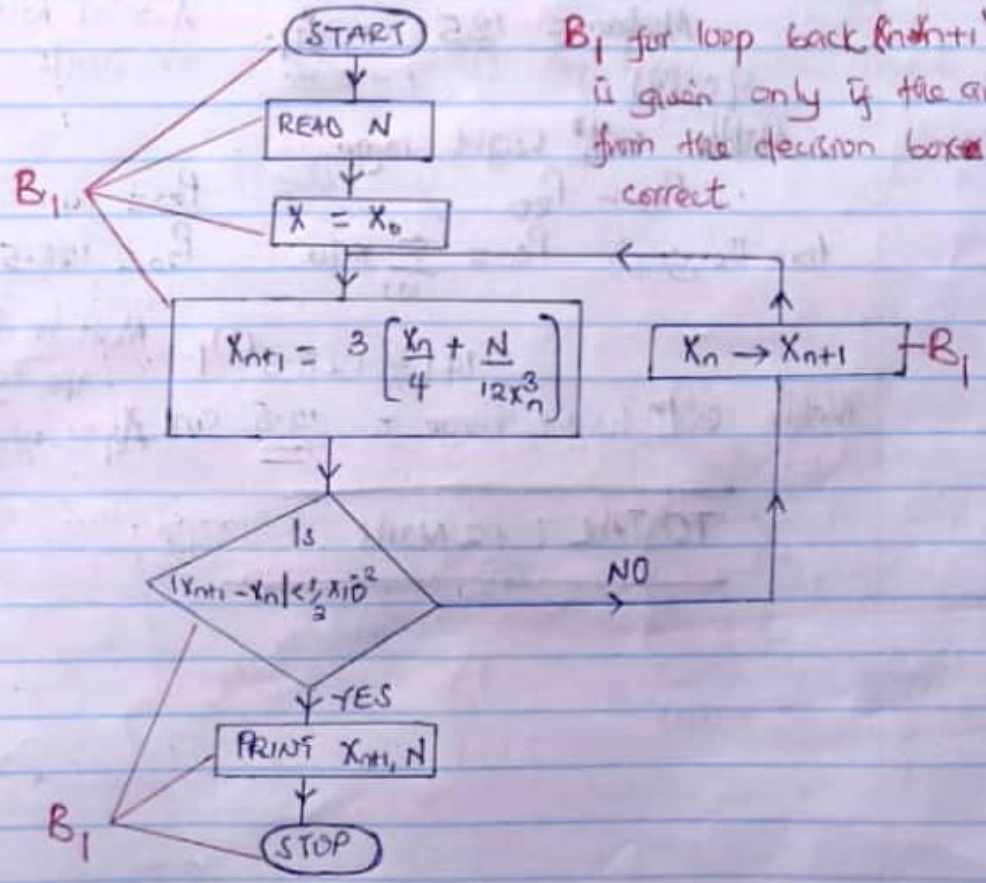
$$X_{n+1} = \frac{3X_n^4}{4X_n^3} + \frac{N}{4X_n^3}$$ B_1

$$X_{n+1} = \frac{3X_n}{4} + \frac{3N}{12X_n^3}$$

$$X_{n+1} = 3\left[\frac{X_n}{4} + \frac{N}{12X_n^3}\right] : n = 0, 1, 2, \ldots$$ As required.

B_1 - For concluding As required.

10 (b)



B_1 for loop back ($X_n \rightarrow X_{n+1}$) is given only if the arrows from the decision box is correct.

10 (b)

DRY RUN.

$N = 99.$

$$X_{n+1} = 3\left[\frac{X_n}{4} + \frac{99}{12X_n^3}\right]$$

$$X_1 = 3\left[\frac{3}{4} + \frac{99}{324}\right]$$

Ignore this working

$$= 3.166667.$$

$$X_2 = 3\left[\frac{3.166667}{4} + \frac{99}{12(3.16667)^3}\right]$$

$$X_2 = 3.154418$$

$$X_3 = 3\left[\frac{3.154418}{4} + \frac{99}{12(3.154418)^3}\right]$$

$$X_3 = 3.15433$$

$|X_3 - X_2| < \frac{1}{2} \times 10^{-2}$

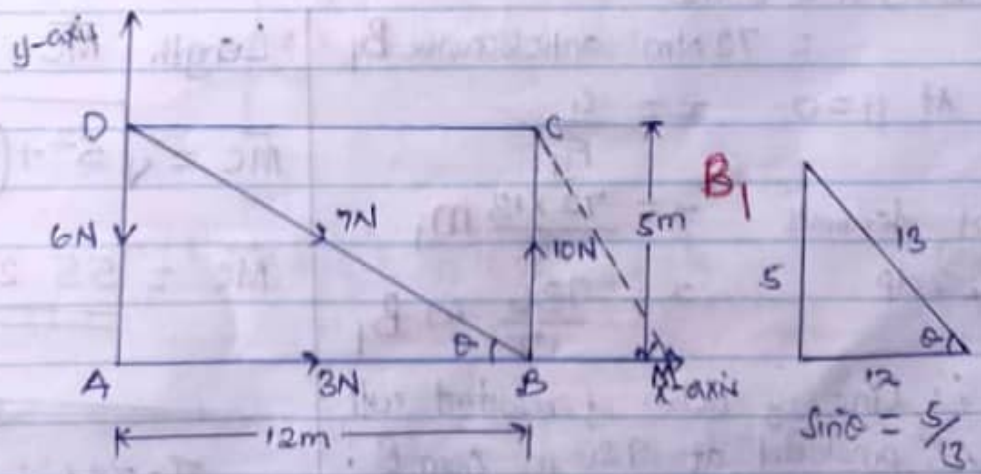
TOTAL 12 marks

N	X_n	X_{n+1}	$\lvert X_{n+1} - X_n \rvert$	
99	3	3.16667	0.16667	B_1
99	3.16667	3.1544	0.01227	B_1
99	3.1544	3.15433	0.000	B_1

Since $|X_3 - X_1| < \frac{1}{2} \times 10^{-2}$

Therefore the root is 3.15 (2dp): A_1 Deny; If not given to required dp

QN 11 (a)



$\sin\theta = \frac{5}{13}$

$\cos\theta = \frac{12}{13}$

Resultant force $= \begin{bmatrix} 3 + 7\cos\theta \\ 10 - 6 - 7\sin\theta \end{bmatrix}$ m_1

$$\begin{pmatrix} F_x \\ F_y \end{pmatrix} = \begin{bmatrix} 3 + 7 \cdot \frac{12}{13} \\ 4 - 7 \times \frac{5}{13} \end{bmatrix}$$

$$\begin{pmatrix} F_x \\ F_y \end{pmatrix} = \begin{bmatrix} 123/13 \\ 17/13 \end{bmatrix}$$

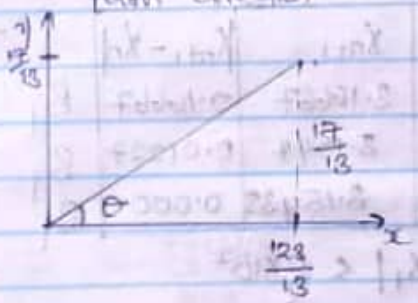
Accept; To atleast four decimal places

Resultant force $= \frac{123}{13}\underset{\sim}{i} + \frac{17}{13}\underset{\sim}{j}$ B_1

Magnitude $= \sqrt{\left(\frac{123}{13}\right)^2 + \left(\frac{17}{13}\right)^2}$

Magnitude of Resultant = 9.55N : B_1

Faith direction



$\tan\theta = \frac{F_y}{F_x}$

$\theta = \tan^{-1}\left(\frac{17}{123}\right)$

$\theta = 7.87°$ B_1

∴ The resultant force is 9.55N in the direction N 82.13° E A_1

Deny; Without units

1(b)(6)

BJ; $G = 6 \times 12$

$= 72$ Nm anticlockwise B_1

At $y = 0$ $\quad x = \frac{G}{F_y}$

$x = \frac{72 \times 13}{17}$ m_1

Accept decimals to atleast 2dp

$x = \frac{936}{17}$ m B_1

∴ Line of action of resultant cuts AB produced at $\frac{936}{17}$ m from B. B_1

Length $\overline{MC}$

$\overline{MC} = \sqrt{5^2 + \left(\frac{936}{17}\right)^2}$ m_1

$\overline{MC} = 55.29$ m A_1

TOTAL: 12 marks

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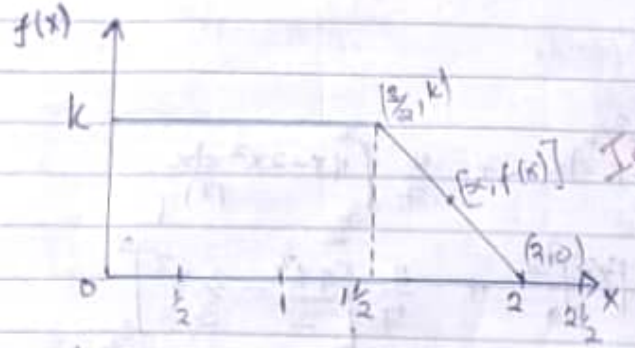
QN 12



(i) Area = 1

$\frac{1}{2}h(a+b) = 1$ m_1

$\frac{1}{2}k\left(\frac{3}{2}+\frac{4}{2}\right) = 1$

$7k = 4$

$k = \frac{4}{7}$ A_1

(ii) Probability density function, $f(x)$.

For $0 \le x \le \frac{3}{2}$

$f(x) = \frac{4}{7}$ B_1

For $\frac{3}{2} \le x \le 2$

$\frac{-k}{0.5} = \frac{-f(x)}{2-x}$ m_1

$2k(2-x) = f(x)$

$f(x) = \frac{4}{7}(4-2x)$ B_1

$\therefore f(x) = \begin{cases} \frac{4}{7}; & 0 \le x \le \frac{3}{2} \\ \frac{4}{7}(4-2x); & \frac{3}{2} \le x \le 2 \\ 0; & \text{Elsewhere} \end{cases}$ A_1

(iii)

$P\left(\frac{1}{2} \le x \le \frac{7}{4}\right) = \frac{4}{7}\int_{\frac{1}{2}}^{\frac{3}{2}} dx + \frac{4}{7}\int_{\frac{3}{2}}^{\frac{7}{4}} (4-2x)\,dx$ m_1

$= \frac{4}{7}\left[\frac{3}{2}-\frac{1}{2}\right] + \frac{4}{7}\left[\left(7-\frac{49}{16}\right)-\left(6-\frac{9}{4}\right)\right]$

$= \frac{4}{7} + \frac{4}{7}\left[\frac{63}{16}-\frac{39}{4}\right]$ B_1

$= \frac{4}{7} + \frac{4}{7}\cdot\frac{3}{16}$

$P\left(\frac{1}{2} \le x \le \frac{7}{4}\right) = \frac{19}{28}$ A_1 Accept to atleast 4dp

(iv)

$$E(X) = \int_{-\infty}^{+\infty} x f(x)\,dx$$

$$E(X) = \frac{4}{7}\int_{0}^{3/2} x\,dx + \frac{4}{7}\int_{3/2}^{2} 4x - 2x^2\,dx \quad m_1$$

$$E(X) = \frac{2}{7}\left[x^2\right]_0^{3/2} + \frac{4}{7}\left[\frac{4x^2}{2} - \frac{2}{3}x^3\right]_{3/2}^{2}$$

$$E(X) = \frac{2}{7}\cdot\frac{9}{4} + \frac{4}{42}\left[12x^2 - 4x^3\right]_{3/2}^{2}$$

$$E(X) = \frac{9}{7\times 2} + \frac{4}{42}\left[16 - (13.5)\right] \quad B_1$$

$$\frac{9}{14} + \frac{4}{42}\cdot\frac{5}{2}$$

$$E(X) = \frac{37}{42}$$

$$E(X) = \frac{37}{42} \quad A_1$$

TOTAL: 12 Marks

TEACHER; OPELE DANIEL

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MTC/CHEM.

QN·13 (a)

Let exact value be $y_1 y_2$

error in approximation be Δz

$\Delta z + z = Z$

$\Delta z + x_1 x_2 = y_1 y_2$

$\Delta z + x_1 x_2 = (e_1 + x_1)(x_2 + e_2)$ $M_1 B_1$

$\Delta z + x_1 x_2 = x_2 e_1 + e_1 e_2 + x_1 x_2 + x_1 e_2$.

Assumption;

since $e_1 \ll x_1$, $e_2 \ll x_2 \Rightarrow e_1 e_2 \simeq 0$ B_1

$\Delta z = x_2 e_1 + x_1 e_2$

$\frac{\Delta z}{z} = \frac{x_2 e_1}{x_1 x_2} + \frac{x_1 e_2}{x_1 x_2}$ B_1

$\left|\frac{\Delta z}{z}\right| = \left|\frac{e_1}{x_1} + \frac{e_2}{x_2}\right|$

$\left|\frac{\Delta z}{z}\right| \leq \left|\frac{e_1}{x_1}\right| + \left|\frac{e_2}{x_2}\right|$ B_1

$R \cdot E_{max} = \left|\frac{e_1}{x_1}\right| + \left|\frac{e_2}{x_2}\right|$ B_1

13 (b)

Let $P = 2.675\left(4.800 - \frac{15.2}{0.92}\right)$

$P_{max} = 2.6755\left\{4.8005 - \frac{15.15}{0.925}\right\}$ M_1

$P_{max} = -30.9766$ B_1

$P_{min} = 2.6745\left[4.7995 - \frac{15.25}{0.915}\right]$ M_1

$P_{min} = -31.7387$ B_1

Interval = $(-31.7387, -30.9766)$ A_1

Accept; any other correct alternative used.

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QN. 14. (a).

$\underset{\sim}{r} = 4\sin 3t\,\underset{\sim}{i} + 8\cos 2t\,\underset{\sim}{j}$

(i)

At time $t = 0$

$\underset{\sim}{r}_{(t=0)} = 4\sin 0\,\underset{\sim}{i} + 8\cos 0\,\underset{\sim}{j}$ B_1

$\underset{\sim}{r}_{(t=0)} = (8\underset{\sim}{j})\ m$ A_1

Velocity $= \frac{dr}{dt}$.

$\frac{dr}{dt} = 12\cos 3t\,\underset{\sim}{i} + -24\sin 3t\,\underset{\sim}{j}$

$\frac{dr}{dt} = 12\cos 3t\,\underset{\sim}{i} - 24\sin 3t$ m_1 B_1

$V_{(t=0)} = 12\cos 0\,\underset{\sim}{i}$

$V_{(t=0)} = (12\underset{\sim}{i})\ ms^{-1}$ A_1

(ii).

But $F = ma$

$\frac{dV}{dt} = -36\sin 3t\,\underset{\sim}{i} - 72\cos 2t\,\underset{\sim}{j}$ m_1

$a = -9(4\sin 3t\,\underset{\sim}{i} + 8\cos 3t\,\underset{\sim}{j})$ B_1

Force $= 3x - 9(4\sin 3t\,\underset{\sim}{i} + 8\cos 3t\,\underset{\sim}{j})$

Force $= -27\underset{\sim}{r}$ B_1 As required.

B_1 - For concluding as required.

14 (b)

Velocity $= 10ms^{-1}$, cross-sectional Area $= \left(\frac{5}{10000}\right)m^2$

$h = 4m$

Taking density of water $= 1000kgm^{-3}$

Mass of water raised and issued per second

$m = A\rho V$

$\text{Mass} = \frac{5}{10000} \times 1000 \times 10$

$\text{Mass} = 5kgs^{-1}$ B_1

Potential Energy given to raise the water

$P.E = mgh$

$= 5 \times 9.8 \times 4$

$= 196\ JI^{-1}$ B_1

Kinetic energy given to raise the water

$K.E = \frac{1}{2}mv^2$

$K.E = \frac{1}{2} \times 5 \times (10)^2$

$K.E = 250\ JI^{-1}$ B_1

Rate at which the pump is working

$P_{total} = P.E + K.E$

$= 446\ JI^{-1}$ A_1

TOTAL: 12 marks

QN. 15 (a)

Let X be the random variable for the Marks Scored.

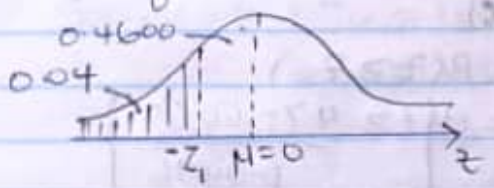
$P(X<40) = \frac{14}{350}$, $P(X>60) = \frac{21}{350}$ B_1

Let $P(X<40) = P(Z<Z_1)$

$= P\left(Z < \frac{40-M}{\sigma}\right)$

$P\left(Z < \frac{40-M}{\sigma}\right) = 0.04$

Ignore; Normal distribution curve



$P(0<Z<Z_1) = 0.4600$ By Symmetry (Tab)

$-Z_1 = 1.751$

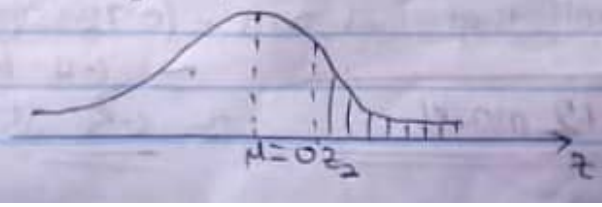
$40-M = -1.751\sigma$

$M - 1.751\sigma = 40$ ——(i) B_1

Also, Let $P(X>60) = P(Z>Z_2)$

$= P\left(Z > \frac{60-M}{\sigma}\right)$

$P\left(Z > \frac{60-M}{\sigma}\right) = 0.06$



$P(0 < z < z_2) = 0.4400$

$z_2 = 1.555$ (Tab)

$\frac{60-\mu}{\sigma} = 1.555$

$\mu + 1.555\sigma = 60$ ——(ii) B_1

$\mu - 1.751\sigma = 40$ M_1

$\mu + 1.551\sigma = 60$

Mean, $\mu = 50.59$ A_1 Standard deviation, $\sigma = 6.0496$. A_1

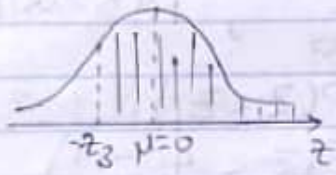
15 (b)

let $P(x \geq 50) = P(z \geq z_3)$

$= P\left[z \geq \frac{50 - 50.59}{6.0496}\right]$

$P(z > -0.0975)$ B_1

Sketch



$P(z > -0.0975) = 0.5 + P(0 < z < 0.0975)$ By symmetry.

$= 0.53884$ A_1 (cal)

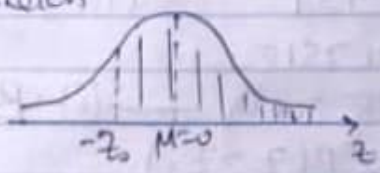
15 (c)

let $P(x \geq 47) = P(z \geq z_0)$

$= P\left[z \geq \frac{47 - 50.59}{6.0496}\right]$

$P(z \geq -0.5934)$ B_1

Sketch



$P(z > 0.5934) = 0.5 + P(0 < z < 0.5934)$ By symmetry.

$= 0.72354$ B_1

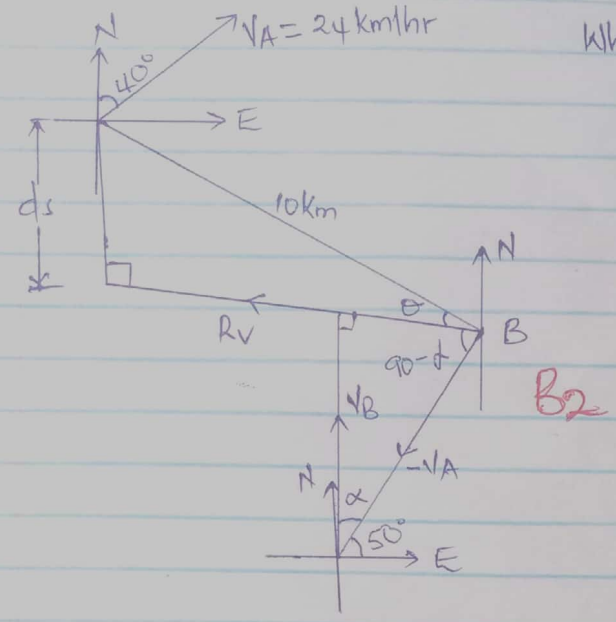
More students that will pass $= (0.72354 \times 350) - (0.53884 \times 350)$ B_1

$= 64.645$

$\simeq 65$ students (mwe passed) A_1

TOTAL: 12 marks

QN. 16



Where R_v = Magnitude of Relative velocity.

Accept; Any other correct alternative method

B_2

16 (a)

$\cos\alpha = \frac{22}{24}$

$\alpha = 23.556$ B_1

The course that must be set $= 90 - (\alpha + 50)$ B_1

$= 16.444°$

∴ The course that B must set is N 16.44° E A_1

16 (b)

Closest distance; ds

$90 - \alpha + \theta + 70 = 180$ m_1

$\theta = 43.556$ B_1

$ds = 10 \sin 43.556$

$ds = 6.89$ Km

∴ Closest distance between two ships is 6.89km A_1

16 (c)

Time taken; From $R_{ut} = 10 \cos 43.556$

$R_v = \sqrt{24^2 - (22)^2}$ m_1

$R_v = 9.59166$ B_1

$t = \left(\frac{10 \cos 43.556}{9.59166}\right) \times 60$ B_1

$t = 45.33$ minutes A_1

TOTAL: 12 marks