.S.5 PRINCIPAL MATH, PAPER 2 EOT 1 2026 Amosi Copy.

SCORING SCHEME (X/80)

EXPECTED RESPONSE AND SCORE	COMMENT
ITEM 1: (10 SCORES)	

(a) **Let the combined mean score and standard deviation be $\overline{X_c}$ and δ_c respectively**

For group A; $\sum x_A = 40\ x\ 65 = 2600$ M1

For group B; $\sum x_B = 60\ x\ 72 = 4320$ M1

$n = n_A + n_B = 40 + 60 = 100$

$\overline{X_c} = \frac{\sum x_A + \sum x_B}{n_A + n_B} = \frac{2600+4320}{100}$ M1

$\overline{X_c} = 69.2$ A1

The combined mean of the students score is 69.2 B1

Also; Combined standard deviation $\delta_c = \sqrt{\left(\frac{\sum x_A{}^2 + \sum x_B{}^2}{n_A + n_B}\right) - (\overline{X_c})^2}$

$\delta_c = \sqrt{\left(\frac{130000+358200}{100}\right) - (69.2)^2}$ M1 $= \sqrt{93.36}$

$\delta_c = 9.6623$ A1

The combined standard deviation of the students' score is 9.6623 B1

(b) Arranging the scores in order of size

54, 66, 73, 88, 92

Lower quartile; $Q_1 = \frac{54+66}{2} = 60$ M1

Upper quartile; $Q_3 = \frac{88+92}{2} = 90$

Interquartile range = $90 - 60 = 30$ M1

The interquartile range of the students' score is 30 B1

ITEM 2: (05 SCORES)

Resultant velocity vector = **p + q**

$$\begin{pmatrix} 7 \\ -1 \end{pmatrix} = \begin{pmatrix} 3 \\ 4 \end{pmatrix} + \begin{pmatrix} x \\ y \end{pmatrix}$$

Horizontally; $3 + x = 7$

$x = 7 - 3 = 4$

Vertically; $4 + y = -1$

$y = -1 - 4 = -5$

Hence; **q** = (4**i** -5**j**) ms^{-1}

Actual size of velocity vector **q** $= |q| = \sqrt{(4)^2 + (-5)^2}$

$= \sqrt{41} = 6.4031\ ms^{-1}$

The actual size of the velocity vector q is 6.4031 ms^{-1}

ITEM 3: (05 SCORES)

Let R_A and R_B be the ranks of committee A and B respectively

R_A	6	2	4	1	5	8	3	7
R_B	1	3	7	8	4	5	2	6
d	5	-1	-3	-7	-1	3	1	1
d^2	25	1	9	49	1	9	1	1

$\sum d^2 = 96$

Using Spearman's rank correlation coefficient; $r_s = 1 - \frac{6\sum d^2}{n(n^2-1)}$

$r_s = 1 - \frac{6\,x\,96}{8(8^2-1)}$

$= -0.1429$

The rank correlation coefficient between the results of the two committees is – 0.1429

Interpretation/comment

There is a very low negative correlation between the results of the two committees.

Alternatively;

The players' blame towards their coach is not significant at both levels of significance based on 8 pairs of observations.

ITEM 4: (20 SCORES)

A frequency distribution table showing the weights in kg of 70 players

Weight (kg)	f	c.f	c	f/c	x	f.x
40 – 50	5	5	10	0.5	45	225
50 – 55	10	15	5	2.0	52.5	525
55 – 60	9	24	5	1.8	57.5	517.5
60 – 65	20	44	5	4.0	62.5	1250
65 – 70	6	50	5	1.2	67.5	405
70 – 85	15	65	15	1.0	77.5	1162.5
85 – 90	5	70	5	1.0	87.5	437.5
SUM	**70**					**4522.5**

(a) Average weight; $\bar{X} = \frac{\Sigma fx}{\Sigma f} = \frac{4522.5}{70}$

$\bar{X} = 64.6071$ kg

Since 64.6071 kg is less than 75 kg, the team doctor should introduce the food supplements.

Popular weight of the players = modal weight/mode

Modal class is (60 – 65) since it has the highest frequency density of 4.0

Modal weight $= l_0 + \left(\frac{d_1}{d_1+d_2}\right) x\ c$

$= 60 + \left(\frac{2.2}{2.2+2.8}\right) x\ 5 = 62.2$ kg

The modal weight is 62.2 kg

Second quartile of the players' weight = median weight/middle weight

Median class is 60 – 65, located at the 35th position using cumulative frequency

Median weight $= l_0 + \left(\frac{\frac{1}{2}N - cf_b}{f_m}\right) x\ c$

$= 60 + \left(\frac{35-24}{20}\right) x\ 5 = 62.75$ kg

The second quartile of the players' weight is 62.75 kg

Since both the popular and second quartile of the players' weight are **greater than 60 kg, the program can be considered positive.**

ITEM 5: (20 SCORES)

Item 5.

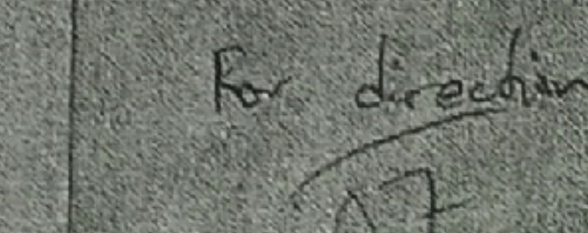
For student A

For forces in 2 dimensions

Resultant of forces $= \underset{\sim}{b} + \underset{\sim}{e} + \underset{\sim}{g} = \begin{pmatrix} 6 \\ -3 \end{pmatrix} + \begin{pmatrix} 3 \\ 1 \end{pmatrix} + \begin{pmatrix} -1 \\ -5 \end{pmatrix} = \begin{pmatrix} 8 \\ -7 \end{pmatrix}$ N

Size of resultant force $= \sqrt{8^2 + (-7)^2}$ m $= \sqrt{113} = 10.6301$ N

For direction



from $\tan\theta = \frac{7}{8}$ m

$\theta = \tan^{-1}\left(\frac{7}{8}\right) = 41.19°$ m

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∴ The size of the resultant force is 10.6301N acting at 41.19° below the horizontal.

For forces in 3 dimensions

Resultant of forces $= \underset{\sim}{a} + \underset{\sim}{c} + \underset{\sim}{d} + \underset{\sim}{f}$

$= \begin{pmatrix} 2 \\ 7 \\ 7 \end{pmatrix} + \begin{pmatrix} 0 \\ -4 \\ -3 \end{pmatrix} + \begin{pmatrix} 8 \\ 4 \\ 9 \end{pmatrix} + \begin{pmatrix} 2 \\ 3 \\ 4 \end{pmatrix} = \begin{pmatrix} 12 \\ 10 \\ 17 \end{pmatrix}$ N

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Modulus of resultant forces $= \sqrt{12^2 + 10^2 + 17^2} = \sqrt{533}$ m

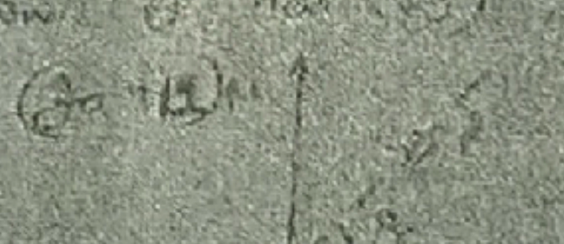
$= 23.0868$ N

∴ The modulus of resultant of forces in 3 dimensions is 23.0868N

For student B

Resultant force $= \begin{pmatrix} -\sqrt{3}a + 2\sqrt{3} \\ 8 \end{pmatrix} + \begin{pmatrix} 3\sqrt{3}a \\ 4a - 1 \end{pmatrix} + \begin{pmatrix} -\sqrt{3} \\ -a + 5 \end{pmatrix} = \begin{pmatrix} 2\sqrt{3}a + \sqrt{3} \\ 3a + 12 \end{pmatrix}$ N

from θ $\tan(\sqrt{3})$: $\tan\theta = 2\sqrt{3}$



So: $\frac{3a + 12}{2\sqrt{3}a + \sqrt{3}} = \sqrt{3}$ m

$3a + 12 = 6a + 3$ N

$3a = 9$

$a = 3$ N

∴ The value of "a" = 3

Resultant force $= \begin{pmatrix} 2\sqrt{3}(3) + \sqrt{3} \\ 3(3) + 12 \end{pmatrix} = \begin{pmatrix} 7\sqrt{3} \\ 21 \end{pmatrix}$

Size of resultant force $= \sqrt{(7\sqrt{3})^2 + 21^2}$ N $= \sqrt{588} = 24.2487$ N

∴ The size of the single force with same effect of 3 forces = 24.2487N.

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ITEM 6: (20 SCORES)

Item 6 (a)(i)

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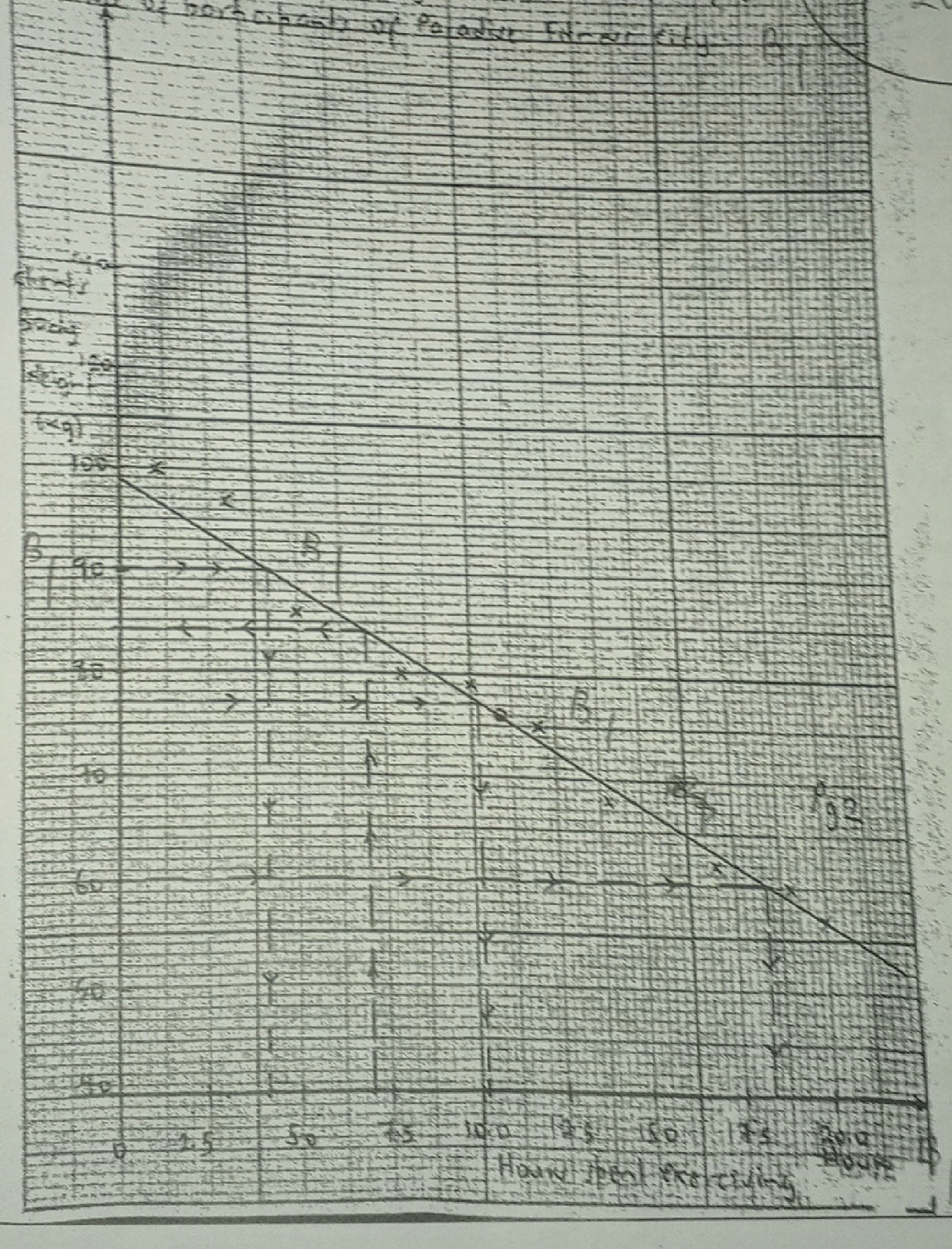
Student's Name ______________________

Signature ______________________

Subject Name: Applied Mathematics Paper code: P425/2

x/20

A scatter graph representing the data collected from a sample of participants of Paradise Fitness City



Item 6 (a)(ii)

Let the hours spent exercising = x B2

Let the client's body weight (kg) = y B1

$\bar{x} = \frac{\sum x}{n}$

$\bar{x} = \frac{1+3+5+9+10+12+14+17+19+20}{10}$

$\bar{x} = \frac{109}{10}$

$\bar{x} = 10.9$ B1

$\bar{y} = \frac{\sum y}{n}$

$= \frac{100+97+86+80+79+75+69+62+60+57}{10}$

$= \frac{764}{10}$

$\bar{y} = 76.4$ B1

$(\bar{x}, \bar{y}) = (10.9, 76.4)$

From the graph

Participant L also recorded a body weight of 27kg B1

about 10.25 ± 0.25 hours (± 10 hours)

OK

from the graph (4.125, 90) (14.375, 60)

Gradient $m = \frac{y_2 - y_1}{x_2 - x_1}$

$= \frac{60 - 90}{14.375 - 4.125}$ M1

$= \frac{-30}{14.25}$

$m = -\frac{40}{19}$ B1

At (4.125, 90) $y = mx + c$ P53

$90 = -\frac{40}{19} \times 4.125 + c$

$90 = -\frac{165}{19} + c$ M1

$90 + \frac{165}{19} = C$

$C = \frac{1875}{19}$ B1

From $y = mx + c$

$y = \frac{-40}{19}x + \frac{1875}{19}$ B1

For $x = 420$ minutes

Number of hour

$x = \frac{420}{60}$

$x = 7$ hours B1

$y = \frac{-40}{19} \times 7 + \frac{1875}{19}$ M1

$y = \frac{1595}{19}$ kg

$y = 83.9474$ kg. A1

OR From the graph $y = 84$ kg ± 10kg

Participant K who spent 420 minutes exercising had a body weight of 84kg. B1

From the equation for $y = 77$ kg

$77 = \frac{-40}{19}x + \frac{1875}{19}$

$\frac{40x}{19} = \frac{1875}{19} - 77$ M1

$\frac{40x}{19} = \frac{412}{19}$

$40x = 412$

$x = 10.3$ hours A1

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(a) (ii) There is a negative relationship between the hours spent exercising and client's body weight. B1

(b)

A table representing the data collected from a sample of participants:

Participant	x	R_x	y	R_y	$d = R_x - R_y$	d^2
A	1	10	100	1	9	81
B	3	9	97	2	7	49
C	5	8	86	3	5	25
D	8	7	80	4	3	9
E	10	6	79	5	1	1
F	12	5	75	6	1	1
G	14	4	68	7	-3	9
H	17	3	62	8	-5	25
I	19	2	60	9	-7	49
J	20	1	57	10	-9	81
						$\Sigma d^2 = 330$

B1 B1 B1 B1

$$\rho = 1 - \frac{6\Sigma d^2}{n(n^2-1)}$$

$$= 1 - \frac{6 \times 330}{10(10^2-1)}$$ M1

$$= 1 - \frac{1980}{990}$$

$\rho = -1$ A1

There is a negative high correlation between hours spent exercising and client's body weight. B1

Since there is a negative relationship, the management will not increase on the hours the clients spend exercising since the management can only increase the hours if there is a positive relationship. B1

END.

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