21.1 maths paper (Answers).

question 01

01) a) rational b) irrational c) rational
d) rational e) irrational

02) a) p^8 b) $p^{-15} \rightarrow \underline{1/p^{15}}$ c) $p^{-20} \rightarrow \underline{1/p^{20}}$

d) $y^3 \times y^{-15} \rightarrow y^{-12} \rightarrow \underline{1/y^{12}}$ e) $256m^4$

03) a) $4^x = 64$

$\underline{x = 3}$

b) $3^{2x} = 9^4$

$3^{2x} = (3^2)^4$

$3^{2x} = 3^8$

$2x = 8$ $\underline{x = 4}$

c) $2^x = 1/32 \rightarrow 2^5$

$2^x = 2^{-5}$

$\underline{x = -5}$

04) a) $y^1 = y$ b) $\frac{1}{d^6}$ c) $\frac{z^7}{y^6}$

05) a) $9 \times 9 \times 3$

$\underline{81 \times 3}$

b) $\cancel{(4+1)^5} \times \frac{1}{\cancel{(4+1)^5}} = \underline{1}$

c) $b^{15} b^2$

$\underline{b^{17}}$

question 02

01) ⓐ ∉ (not element) ⓑ ∈ (element) ⓒ (sub set) ⊆ ⓓ ∈ ⓔ = (equal)

How to get the answer for question e)

$2x^2 + 3x - 2 = 0$

සූත්‍රය.

$$\boxed{x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}}$$

ආදේශය.

$a = 2$

$b = 3$

$c = -2$

$$x = \frac{-3 \pm \sqrt{3^2 - (4 \times 2 \times (-2))}}{2 \times 2}$$

$$= \frac{-3 \pm \sqrt{9 - (-16)}}{4}$$

$$= \frac{-3 \pm \sqrt{25}}{4}$$

$$\boxed{\text{Answers} = -2 \text{ or } 1/2}$$

$$x = \frac{-3 \pm 5}{4} \longrightarrow x = \frac{-3+5}{4} = \frac{2}{4} = \underline{\frac{1}{2}} \quad x = \frac{-3-5}{4} = \frac{-8}{4} = \underline{-2}$$

Question 02

Ⓐ Ⓑ Ⓒ

02) all - 238 | Foss - 103 | Robot - 82 | Innov - 95

Foss / Robot - 15 , Inno / Robot - 19 , Foss / Inno - 22

6 - nothing *($238 - 6 = 232$ ($A \cup B \cup C$))

$(A \cup B \cup C) = (A) + (B) + (C) - (A \cap B) - (A \cap C) - (B \cap C) + (A \cap B \cap C)$

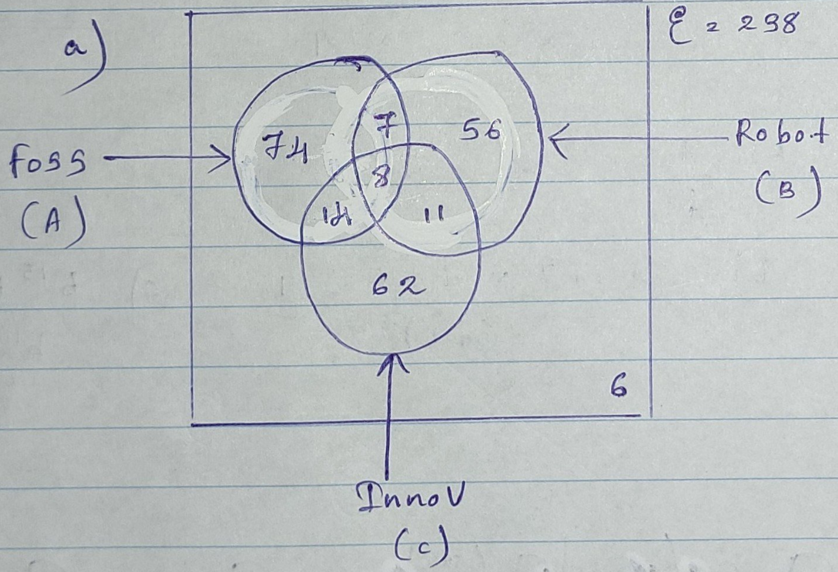
$232 = 103 + 82 + 95 - 15 - 22 - 19 + (A \cap B \cap C)$

$232 = (280 - 56) + (A \cap B \cap C)$

$232 - 224 = (A \cap B \cap C)$

$8 = (A \cap B \cap C)$

a)



b) 143

c) 8

03) a) $\{a, b\} \times \{2, 3, 5\}$

$\{(a,2), (a,3), (a,5), (b,2), (b,3), (b,5)\}$

b) $(A \times B) \rightarrow \{(a,3), (a,5), (b,3), (b,5)\}$

$(A \times C) \rightarrow \{(a,2), (a,3), (b,2), (b,3)\}$

$(A \times B) \cup (A \times C) \rightarrow \{(a,3), (a,5), (b,3), (b,5), (a,2), (a,3), (b,2), (b,3)\}$

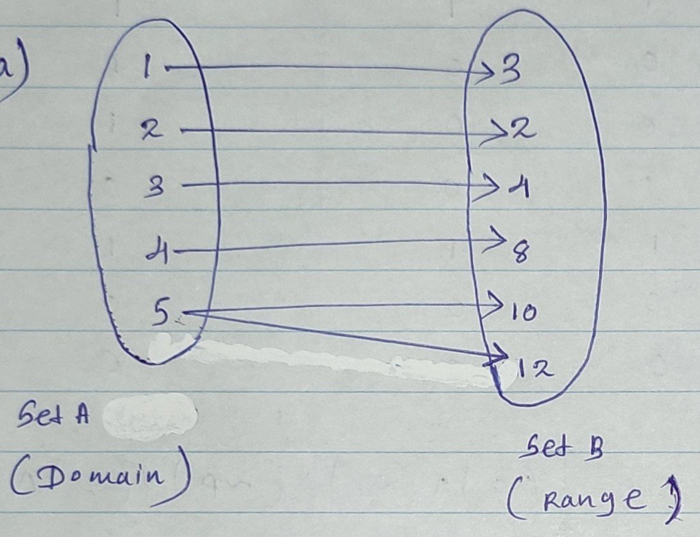
c) $(B \cap C) \rightarrow \{3\} \times \{a, b\}$

ans = $\{(a,3), (b,3)\}$

question 02

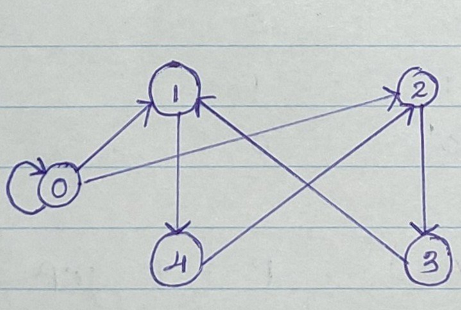
03) d) ans → {(a, 3), (b, 3)

04) a)



b) no, it is not a function. because, element of the domain is not paried with exactly one element of the range.

05) {(0,0), (0,1), (0,2), (1,4), (2,3), (3,1), (4,2)}



question 03 (propositional logic)

a) A proposition is a statement which is either true of false but not both.

ex: colombo is in Sri Lanka.

17 is a prime number.

normal proposition only have one statement. and in a composite proposition they are composed of sub statements

eg:- 17 is a prime number and 10 is an even number.

No: 0 - False / 1 - True. Date: / /

02) a)

p	q	r	~p	~q	(~q)∧r	(~p)∨(~q)∧r
0	0	0	1	1	0	1
0	0	1	1	1	1	1
0	1	0	1	0	0	1
0	1	1	1	0	0	1
1	0	0	0	1	0	0
1	0	1	0	1	1	1
1	1	0	0	0	0	0
1	1	1	0	0	0	0

b)

p	q	r	~p	~r	(q)∧(~r)	(~p)∨(q)∧(~r)
0	0	0	1	1	0	1
0	0	1	1	0	0	1
0	1	0	0	1	1	1
0	1	1	0	0	0	0
1	0	0	1	1	0	1
1	0	1	1	0	0	1
1	1	0	0	1	1	1
1	1	1	0	0	0	0

03) a)

p	q	(p∧q)	~(p∧q)		p	q	~p	~q	(~p)∨(~q)
0	0	0	1		0	0	1	1	1
0	1	0	1	=	0	1	1	0	1
1	0	0	1		1	0	0	1	1
1	1	1	0		1	1	0	0	0

Truth tables are equal.

b)

p	q	(p∨q)	~(p∨q)		p	q	~p	~q	(~p)∧(~q)
0	0	0	1		0	0	1	1	1
0	1	1	0	=	0	1	1	0	0
1	0	1	0		1	0	0	1	0
1	1	1	0		1	1	0	0	0

Truth tables are equal

03) c)

p	q	r	$(p \vee q)$	$(p \vee q) \wedge r$	$\sim(p \vee q) \wedge r$
0	0	0	0	0	1
0	0	1	0	0	1
0	1	0	1	0	1
0	1	1	1	1	0
1	0	0	1	0	1
1	0	1	1	1	0
1	1	0	1	0	1
1	1	1	1	1	0

p	q	r	$\sim p$	$\sim q$	$\sim r$	$(\sim p \wedge \sim q)$	$(\sim p \wedge \sim q) \vee \sim r$
0	0	0	1	1	1	1	1
0	0	1	1	1	0	1	1
0	1	0	1	0	1	0	1
0	1	1	1	0	0	0	0
1	0	0	0	1	1	0	1
1	0	1	0	1	0	0	0
1	1	0	0	0	1	0	1
1	1	1	0	0	0	0	0

The tables are equal.

04) a)

p	q	$p \Rightarrow q$	$q \Rightarrow p$	$(p \Rightarrow q) \wedge (q \Rightarrow p)$
0	0	1	1	1
0	1	1	0	0
1	0	0	1	0
1	1	1	1	1

b)

p	q	$p \wedge q$	$\sim(p \wedge q)$	$(q \Leftrightarrow p)$	$\sim(q \Leftrightarrow p)$	$\sim(p \wedge q) \vee \sim(q \Leftrightarrow p)$
0	0	0	1	1	0	1
0	1	0	1	0	1	1
1	0	0	1	0	1	1
1	1	1	0	1	0	0

05) a)

p	q	r	$(p \Rightarrow q)$	$(q \Rightarrow r)$	$(p \Rightarrow r)$	$[(p \Rightarrow q) \wedge (q \Rightarrow r)]$	$[(p \Rightarrow r) \wedge (q \Rightarrow r) \Rightarrow (p \Rightarrow r)$
0	0	0	1	1	1	1	1
0	0	1	1	1	1	1	1
0	1	0	1	0	1	0	1
0	1	1	1	1	1	1	1
1	0	0	0	1	0	0	1
1	0	1	0	1	1	0	1
1	1	0	1	0	0	0	1
1	1	1	1	1	1	1	1

This table is a tautalogy

b)

p	q	r	$\neg p$	$\neg r$	$(\neg p \Rightarrow \neg r)$	$(\neg p \Rightarrow \neg r) \vee q$
0	0	0	1	1	1	1
0	0	1	1	0	0	0
0	1	0	1	1	1	1
0	1	1	1	0	0	1
1	0	0	0	1	1	1
1	0	1	0	0	1	1
1	1	0	0	1	1	1
1	1	1	0	0	1	1

This table is a contigent proposition

c)

p	q	r	$(p \Rightarrow r)$	$q \Rightarrow (p \Rightarrow r)$
0	0	0	1	1
0	0	1	1	1
0	1	0	0	0
0	1	1	1	1
1	0	0	1	1
1	0	1	1	1
1	1	0	0	0
1	1	1	1	1

This table is a contigent proposition.

d)

p	q	$(p \Rightarrow q)$	$(q \Rightarrow p)$	$(p \Rightarrow q) \vee (q \Rightarrow p)$
0	0	1	1	1
0	1	1	0	1
1	0	0	1	1
1	1	1	1	1

This table is a totalogy.

question 04. (matrix)

01) a) ~~$\begin{bmatrix} 3 & 2 & 1 \\ 8 & 3 & 4 \end{bmatrix}_{2\times③} + \begin{bmatrix} 1 & -1 \\ -2 & 2 \\ 0 & 1 \end{bmatrix}_{③\times 2} \rightarrow \begin{bmatrix} 3+(-4)+0 & -3+4+1 \\ 8+(-6)+0 & -8+6+4 \end{bmatrix}$~~

~~Anser = $\boxed{2\times2}$~~

~~$\begin{bmatrix} -1 & 2 \\ 2 & 2 \end{bmatrix}$~~

~~$4+(2-2)+1 \quad 2+4+1$~~
~~$8+1+4 \quad 7+5+5$~~

~~$\begin{bmatrix} 5 & 7 \\ 13 & 17 \end{bmatrix}_{h}$~~

b) ~~$2A - 3B$~~

~~$\begin{bmatrix} 6 & 4 & 2 \\ 16 & 6 & 8 \end{bmatrix} - \begin{bmatrix} 3 & -3 \\ -6 & 6 \\ 0 & 3 \end{bmatrix} \rightarrow \begin{matrix} 3+10+2 & 9+(-2)+-1 \\ 13+12+8 & 19+0+5 \end{matrix}$~~

~~$2A = \begin{bmatrix} 6 & 4 & 2 \\ 16 & 6 & 8 \end{bmatrix}$~~

~~$\begin{bmatrix} 15 & 6 \\ 33 & 24 \end{bmatrix}$ //~~

~~$3B = \begin{bmatrix} 3 & -3 \\ -6 & 6 \\ 0 & 3 \end{bmatrix}$~~

මේ තේරෙන් නැත හදන්න බැහැ.

c) Anser = $\boxed{2\times2}$

$$\begin{bmatrix} 3+(-4)+0 & -3+4+1 \\ 8+(-6)+0 & -8+6+4 \end{bmatrix}$$

$$\begin{bmatrix} -1 & 2 \\ 2 & 2 \end{bmatrix}_{h}$$

02) $A = \begin{bmatrix} -3 & -5 \\ 2 & 6 \end{bmatrix} \rightarrow \begin{pmatrix} 6 & 5 \\ -2 & -3 \end{pmatrix}$

determinant $|A| = (-3 \times 6) - (2 \times -5)$

$-18 - (-10)$

$\underline{\underline{-8}}$

$\begin{bmatrix} 6 & -5 \\ 2 & -3 \end{bmatrix}$

$A^{1} = \frac{1}{|A|} \begin{bmatrix} 6 & 5 \\ -2 & -3 \end{bmatrix}$

$A^{-1} = \frac{1}{|-8|} \begin{bmatrix} 6 & 5 \\ -2 & -3 \end{bmatrix}$

$A^{-1} = \begin{bmatrix} -6/8 & -5/8 \\ -2/-8 & -3/-8 \end{bmatrix}$

$= \begin{bmatrix} -0.75 & -0.625 \\ 0.250 & 0.375 \end{bmatrix}$ //

$B = \begin{bmatrix} 7 & 3 \\ -2 & -1 \end{bmatrix} \rightarrow \begin{pmatrix} -1 & -3 \\ 2 & 7 \end{pmatrix}$

$|B| = (7 \times -1) - (-2 \times 3)$

$= -7 - (-6)$

$= \underline{\underline{-1}}$

$^{1} = \frac{1}{-1} \begin{bmatrix} -1 & -3 \\ 2 & 7 \end{bmatrix}$

$= \begin{bmatrix} -1/-1 & -3/-1 \\ -2/1 & -7/1 \end{bmatrix}$

$= \begin{bmatrix} 1 & 3 \\ -2 & -7 \end{bmatrix}$ //

03) $3x + 4y = 25$ —① $\rightarrow$ $4y = 25 - 3x$

$4x + 3y = 24$ —② $\rightarrow$ $3y = 24 - 4x$

(y උක්ත කර ගනිම.)

$\frac{4y}{4} = \frac{25}{4} - \frac{3x}{4}$

$y = \frac{25}{4} - \frac{3x}{4}$ —③

$\frac{3y}{3} = \frac{24}{3} - \frac{4x}{3}$

$y = \frac{24}{3} - \frac{4x}{3}$ —④

③ = ④ , y = y නිසා,

$\frac{25}{4} - \frac{3x}{4} = \frac{24}{3} - \frac{4x}{3}$

ඔයා මං හදලා තියෙනවා වැරදී.
(2x2 matrix use කරලා එහා හදන්න හදලා තියෙනවා)

No:
question 04

Date: 9.9.05.

03) $3x + 4y = 25 - ①$

$4x + 3y = 24 - ②$

$$\underset{A}{\begin{bmatrix} 3 & 4 \\ 4 & 3 \end{bmatrix}} \underset{B}{\begin{bmatrix} x \\ y \end{bmatrix}} = \underset{C}{\begin{bmatrix} 25 \\ 24 \end{bmatrix}}$$

$$B = \frac{C}{A} = CA^{-1}$$

determination $= (3 \times 3) - (4 \times 4)$

$= 9 - 16$

$= -7$

transpose of A $= \begin{bmatrix} 3 & -4 \\ -4 & 3 \end{bmatrix}$

inverse $A^{-1} = \frac{1}{|A|} \begin{bmatrix} \text{traspose}\overset{\text{matrix}}{} \text{'A'} \end{bmatrix}$

$$= \frac{1}{-7} \begin{bmatrix} 3 & -4 \\ -4 & 3 \end{bmatrix}$$

$$= \begin{bmatrix} -\frac{3}{7} & \frac{4}{7} \\ \frac{4}{7} & -\frac{3}{7} \end{bmatrix}$$

$$= \begin{bmatrix} -0.428 & 0.5714 \\ 0.5714 & -0.428 \end{bmatrix}$$

```
  0.428
7|30
  28
   20
   14
    60
    56
     40
```

```
  0.5714
7|40
  35
   50
   49
    10
     7
     30
```

$B \; / \begin{bmatrix} x \\ y \end{bmatrix} = C \times A^{-1}$

$$= \underset{2 \times 1}{\begin{bmatrix} 25 \\ 24 \end{bmatrix}} \underset{2 \times 2}{\begin{bmatrix} -\frac{3}{7} & \frac{4}{7} \\ \frac{4}{7} & -\frac{3}{7} \end{bmatrix}}$$

Answer matrix $= 2 \times 1$

$$B = \begin{bmatrix} \left(-\frac{75}{7} + \frac{96}{7}\right) \\ \left(\frac{100}{7} + \left(-\frac{72}{7}\right)\right) \end{bmatrix} \to \begin{bmatrix} \frac{21}{7} \\ \frac{28}{7} \end{bmatrix} \qquad x = 3 \quad y = 4$$

$$= \begin{pmatrix} \frac{-75+96}{7} \\ \frac{100-72}{7} \end{pmatrix}$$

Q4) $A = \begin{bmatrix} 1 & 7 & -6 \\ 8 & 4 & 3 \\ -6 & -2 & 5 \end{bmatrix}$

find determinant, det(A)

$$1 \times 1 \begin{bmatrix} 4 & 3 \\ -2 & 5 \end{bmatrix} + (-1 \times 7) \begin{bmatrix} 8 & 3 \\ -6 & 5 \end{bmatrix} + (-1 \times 6) \begin{bmatrix} 8 & 4 \\ -6 & -2 \end{bmatrix}$$

$$= 1(20-(-6)) + [(-7)(40-(-18)) + (-6)(-16-(-24))$$

$$= 26 + (-7 \times 58) + (-6) \times (-16+24) \to (8)$$

$$= 26 - 406 - 48$$

$$\det(A) = \underline{\underline{-428}}$$

$$\text{minors} = \begin{bmatrix} \begin{pmatrix} 4 & 3 \\ -2 & 5 \end{pmatrix} & -\begin{pmatrix} 8 & 3 \\ -6 & 5 \end{pmatrix} & \begin{pmatrix} 8 & 4 \\ -6 & -2 \end{pmatrix} \\ -\begin{pmatrix} 7 & -6 \\ -2 & 5 \end{pmatrix} & \begin{pmatrix} 1 & -6 \\ -6 & 5 \end{pmatrix} & -\begin{pmatrix} 1 & 7 \\ -6 & -2 \end{pmatrix} \\ \begin{pmatrix} 7 & -6 \\ 4 & 3 \end{pmatrix} & -\begin{pmatrix} 1 & -6 \\ 8 & 3 \end{pmatrix} & \begin{pmatrix} 1 & 7 \\ 8 & 4 \end{pmatrix} \end{bmatrix}$$

$$\begin{bmatrix} 20+6 & -(40-(-18)) & (-16-(-24)) \\ -(35-(-12)) & 5-(-36) & -(-2-(-42)) \\ 21-(-24) & -(3-(-48)) & 4-56 \end{bmatrix}$$

$$CA = \begin{bmatrix} 26 & -58 & 8 \\ -47 & 41 & -40 \\ 45 & -51 & -52 \end{bmatrix} \qquad (c.m)^T = \begin{bmatrix} 26 & -47 & 45 \\ -58 & 41 & -51 \\ 8 & -40 & -52 \end{bmatrix}$$

$$A^{-1} = \frac{(c.m.)^T}{|A|}$$

$$= \begin{pmatrix} 26 & -47 & 45 \\ -58 & 41 & -51 \\ 8 & -40 & -52 \end{pmatrix} \times \frac{1}{-428}$$

$$= \begin{bmatrix} -\frac{26}{428} & \frac{47}{428} & -\frac{45}{428} \\ \frac{58}{428} & -\frac{41}{428} & \frac{51}{428} \\ -\frac{8}{428} & \frac{40}{428} & \frac{52}{428} \end{bmatrix}$$ simplify කරන්න.

Question 5 | Coordinate Geometri.

① a. $\frac{2y}{2} = \frac{-5x}{2} + \frac{7}{2}$

Gradient → -2.5

Interception → 3.5

b. $y - 3x = -5$

$y = 3x - 5$

Gradient → 3

Interception → -5

c. $y = 4$

Gradient → 0

Interception → 4

② $4x + 7y = 20$

$7y = -4x + 20$

$y = -\frac{4}{7}x + \frac{20}{7}$

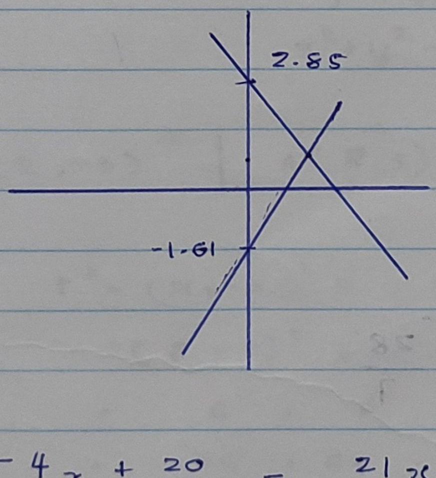
$y = -0.57x + 2.85$

$21x - 13y = 21$

$\frac{21x}{13} - \frac{21}{13} = \frac{13y}{13}$

$1.61x - 1.61 = y$

$y = 1.61x - 1.61$



$-\frac{4}{7}x + \frac{20}{7} = \frac{21}{13}x - \frac{21}{13}$

$\frac{20}{7} + \frac{21}{13} = \frac{21}{13} + \frac{4}{7}$

$\frac{260 + 147}{91} = \frac{147x}{91} + \frac{52x}{91}$

$\frac{407}{199} = \frac{199x}{199}$

$x = 2.045$

$x = 2.045$ ~~eq~~. ②

$(1.61 \times 2.045) - 1.61$

$y = 1.68.$

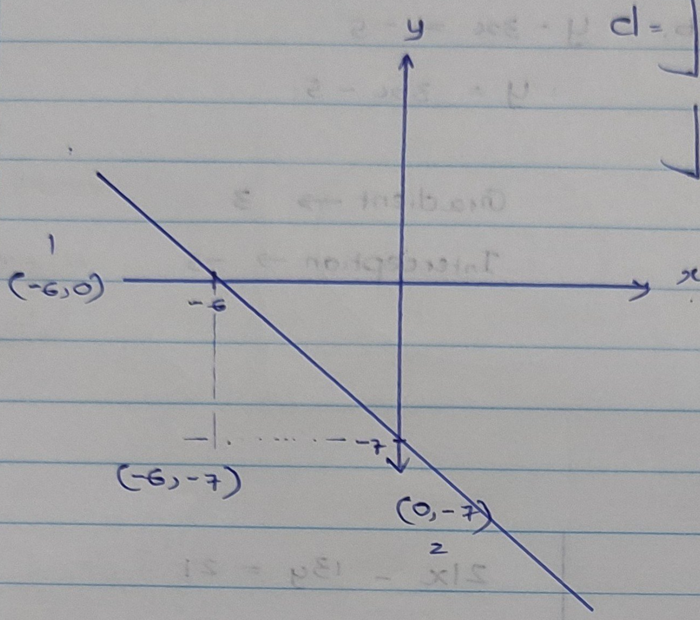
$(2.045 , 1.68)$

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Date №

③ $P(-6, -7)$

$3x + 4y = 11$



$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$\sqrt{[0 + (-6)]^2 + [-7 - 0]^2}$$

$$\sqrt{36 + 49}$$

$$\sqrt{85}$$

9.21

④

a) $y - y_1 = \frac{y_2 - y_1}{x_2 - x_1}(x - x_1)$ $(3, 4) \mid (-4, -6)$

$$y - 4 = \frac{-6 + -4}{-4 - 3}(x - 3)$$

$$y - 4 = \frac{10}{7}(x - 3)$$

$$y - 4 = \frac{10}{7}x - \frac{30}{7}$$

$$y = \frac{10}{7}x - \frac{30}{7} + \frac{28}{7}$$

$$y = \frac{10}{7}x - \frac{2}{7}$$

$$\boxed{y = 1.42x - 0.28}$$

$A = \{2, 3, 12, 24\}$ $|P(A)| = 2^4$

$= 16$

$(3,4)$

b) $y = 2x + 3$

$m_1 = 2$

$c = 3$

$m_1 \times m_2 = -1$

$2 \times m_2 = -1$

$m_2 = -\frac{1}{2}$

$y - y_1 = m(x - x_1)$

$y - 4 = -\frac{1}{2}(x - 3)$

$y - 4 = -\frac{1}{2}x + \frac{3}{2}$

$y = -\frac{1}{2}x + \frac{3}{2} + \frac{8}{2}$

$\boxed{y = -\frac{1}{2}x + 12}$

⑤

a) $C(2,3)$ $r = 5$

$\cancel{x^2 + y^2}$

$(x-a)^2 + (y-b)^2 = r^2$

$(x-2)^2 + (y-3)^2 = 25$

$x^2 - 4x + 4 + y^2 - 6y + 9 = 25$

$x^2 + y^2 - 4x - 6y = 12$

$x^2 + y^2 - 4x - 6y - 12 = 0$

b) $\overset{1}{C(2,-3)}$ | $\overset{2}{A(8,5)}$

$r^2 = (x_2 - x_1)^2 + (y_2 - y_1)^2$

$= (8-2)^2 + (5 + (+3))^2$

$= 6^2 + 8^2$

$= 36 + 64$

$r = 10$

$(x-a)^2 + (y-b)^2 = r^2$

$(x-2)^2 + (y + (+3))^2 = 100$

$x^2 - 4x + 4 + y^2 + 6y + 9 = 100$

$x^2 + y^2 - 4x + 6y = 87$

$3 \rightarrow 2^3$

$2 \rightarrow 2^2$

$4 \rightarrow 2^4$

c) $x^2+y^2+2gx+2Fy+c=0$

(4,2) | (2,0) | (0,2)

$(4,2) \longrightarrow \quad 16+4+8g+4f+c=0 \quad -①$

$(2,0) \longrightarrow \quad 4+4g+c=0 \quad -②$

$(0,2) \longrightarrow \quad \boxed{4+4f+c=0} \quad -③$

①-③

$16+8g=0$

$16 = \frac{\cancel{-8g}}{\cancel{-8}}$

$\frac{16}{-8} = g$

$g=-2$

g = -2 ඔව. ②

$4+(-8)+c$

$-4+c=0$

$c=4$

$4+4F+4=0$

$8+4F=0$

$\frac{\cancel{4}F}{\cancel{4}} = \frac{-8}{4}$

$F=-2$

$x^2+y^2+-4g+-4F+4=0$

⑥

a) $(6, 35)$ $c(3, 3)$

$x = 6 \times \cos(35) = 4.91$

$y = 6 \times \sin(35) = 3.44$

$(7.91, 6.44)$

b) $(20, 45)$ $c(-4, 5)$

$x = 20 \times \cos(45) = 14.14$

$y = 20 \times \sin(45) = 7.07$

$(10.14, 12.07)$

⑦ $x^2 + y^2 - 8x - 6y + 21 = 0$

$r = \sqrt{g^2 + f^2 - c}$

Center $(4, 3)$

$= \sqrt{-4^2 + -3^2 - 21}$

$= \sqrt{16 + 9 - 21}$

$= \sqrt{4} = r$

$r = 2$

1. $(4 + 2\cos(30°), 3 + 2\sin(30°))$
2. $(4 + 2\cos(45°), 3 + 2\sin(45))$
3. $(4 + 2\cos(60), 3 + 2\sin(60))$