

a)

$$-1 \cdot (-1) + (y-5) \cdot 3 = 0$$

$$3y = 15 - 1$$

$$y = \frac{14}{3} \quad B = \left(2, \frac{14}{3}\right)$$

$$-1, y-5 = k \cdot (-1, 3)$$

$$-1 = k$$

$$k = 1$$

$$y-5 = 3k$$

$$y = 8$$

$$B(2, 8)$$

⑩

$$a.) [15 \ -13 \ -8]$$

$$d.) [2 \ 8 \ -2 \ 12]$$

$$c.) [47]$$

9.)

a.) aho
LM

$2 \times 2 \quad 2 \times 2$

$2 = 2$

b.)

$3 \times 3 \quad 3 \times 3$

$3 = 3$

GM aho

c.) NP

$2 \times 2 \quad 2 \times 2$

$2 = 2$ aho

c.) AK

$3 \times 2 \quad 2 \times 3$
 $2 = 2$

KA

$2 \times 3 \quad 3 \times 2$
 $3 = 3$

aho

d.) NP

$2 \times 2 \quad 2 \times 2$
 $2 = 2$

e.) FQ

$4 \times 2 \quad 2 \times 4$
 $2 = 2$

QF

$2 \times 4 \quad 4 \times 2$
 $4 = 4$

aho

f.) RJ

$1 \times 3 \quad 3 \times 1$
 $3 = 3$

JR aho

$2 \times 1 \quad 1 \times 2$

8.)

a.) $A \cdot B$

$$\begin{array}{cc} 3 \times 2 & 3 \times 3 \\ \hline 3 \neq 2 & \text{nemôžne!} \end{array}$$

c.) M

$$\begin{array}{cc} 3 \times 1 & 2 \times 2 \\ \hline \end{array}$$

$1 \neq 2$ nemôžne!

i) kN

$$\begin{array}{cc} 2 \times 3 & 2 \times 2 \\ \hline 3 \neq 2 & \text{nemôžne!} \end{array}$$

b.)

$$\begin{array}{cc} 1 \times 3 & 3 \times 1 \\ \hline 3 = 3 & \text{možno!} \end{array}$$

$$R5 [-38]$$

5.

a.)

425 425

^

He

b.)

402 522

^

He

c.)

He

①

a) $A+B$

$$\begin{bmatrix} 2 & 1 & 3 \\ 2 & 7 & -5 \\ 9 & 0 & -1 \end{bmatrix}$$

b) $C+D$

~~\emptyset~~

c)

~~\emptyset~~

d)

$$\begin{bmatrix} -7 & 0 & 8 \\ -1 & 3 & 1 \\ 9 & 9 & -5 \end{bmatrix}$$

c) $4A$

d) $2A - 3B$

$$\begin{bmatrix} -16 & 8 & 12 \\ 0 & 20 & -4 \\ 21 & 4 & -8 \end{bmatrix}$$

$$\begin{bmatrix} -8 & 4 & 6 \\ 0 & 10 & -2 \\ 11 & 2 & -4 \end{bmatrix}$$

$$- \begin{bmatrix} 12 & -3 & 0 \\ 6 & 6 & -12 \\ 9 & -3 & 3 \end{bmatrix}$$

$$= \begin{bmatrix} 10 & 7 & 6 \\ -6 & 4 & 11 \\ 3 & -1 & -7 \end{bmatrix}$$

i)

$$\begin{bmatrix} -1 & 1 & 12 \\ -1 & 5 & 8 \end{bmatrix}$$

2.)

j.)

$$\begin{bmatrix} -17 & 2 & -7 \\ 2 & -3 & -5 \\ -9 & -1 & -5 \end{bmatrix}$$

k.)

$$\begin{bmatrix} 28 & -7 \\ 0 & 14 \end{bmatrix}$$

$$28 + 14 = 42$$

$$4 \times 42 = 168$$

l.)

~~0~~

h.) $A - A = 0$

i.) $\begin{bmatrix} 15 & 0 \\ -5 & 10 \\ 5 & 5 \end{bmatrix}$

i.) 5

3.

1.)

$$B \times C = \begin{bmatrix} 1 & 15 & 3 \\ 6 & 2 & 10 \end{bmatrix}$$

~~2.)~~

$$A) \quad 10 - E =$$

$$\begin{bmatrix} -5 & 4 & -1 \\ 0 & -1 & -1 \\ -1 & 1 & 1 \end{bmatrix}$$

$$F) \quad B - B^T = \begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}$$

$$B^T = \begin{bmatrix} 4 & 0 \\ -1 & 2 \end{bmatrix}$$

$$\begin{bmatrix} -5 & 0 & -1 \\ 4 & -1 & 1 \\ -1 & 1 & 1 \end{bmatrix}$$

c.)

$$3E = \begin{bmatrix} 18 & 39 \\ -3 & 36 \\ 12 & 39 \end{bmatrix}$$

$$3E \times D = \begin{bmatrix} 92 & 108 & 75 \\ 12 & -3 & 21 \\ 36 & 28 & 63 \end{bmatrix}$$

i.)

$$th = 61$$

$$\begin{bmatrix} 11 & 11 & 13 \\ 11 & 29 & 18 \\ 13 & 18 & 21 \end{bmatrix}$$

g.)

$$DA =$$

$$\begin{bmatrix} 0 & 12 \\ -2 & 1 \\ 11 & 8 \end{bmatrix}$$

$$(b4)^T = \begin{bmatrix} 0 & -2 & 11 \\ 11 & 1 & 8 \end{bmatrix}$$

11 c.)

$$2x - 5y = 0$$

$$2x = 5y$$

$$x = \frac{5}{2}y$$

$$\sqrt{x^2 + y^2} = 21$$

$$= \sqrt{\frac{25}{4}y^2 + y^2} = 21$$

$$= y^2 \cdot \frac{29}{4} = 21^2$$

$$y^2 = \frac{1764}{29}$$

①

a)

$$\vec{C} \cdot \vec{U} = 3x + 4y = 0$$

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

$$|\vec{U}| = 15$$

$$= \sqrt{x^2 + \frac{9}{16}x^2} = 15$$

$$= \sqrt{\frac{25}{16}x^2} = 15$$

$$= 25 \cdot 2 = 3600$$

$$x = 12$$

b)

$$-2x + 2y = 0$$

$$2y = 2x$$

$$y = x$$

$$|\vec{U}| = 9$$

$$= \sqrt{2 \cdot \left(\frac{1}{2}\right)^2}$$

$$\vec{U} = (12, -9) = \sqrt{x^2 + \frac{81}{4}}$$

$$= 5 \cdot 2 = 10$$

$$y =$$

$$x = 12$$

⑥

$$LP = PL$$

$$1 \times 1 \quad 2 \times 2$$

Kučin možny

$$L.P = \begin{bmatrix} 6 & 8 & 5 & 3 \\ 5 & 2 & 4 & 1 \end{bmatrix}$$

$$P.L = \begin{bmatrix} 2 & 2 & 2 & 0 \\ 9 & 6 & 8 & 5 \end{bmatrix}$$

$$LP \neq PL$$

(f.)

$$B = \begin{bmatrix} 2 & 0 \\ 0 & -1 \end{bmatrix} \quad B^T = \begin{bmatrix} 2 & 0 \\ 0 & -1 \end{bmatrix}$$

symetrické

$$C = \begin{bmatrix} -1 & 1 \\ -1 & 1 \end{bmatrix} \quad \text{stochastic matrix}$$

$$D = \begin{bmatrix} -1 & 1 \\ 4 & 2 \end{bmatrix} \quad \text{stochastic matrix}$$

$$\begin{bmatrix} 5 & 0 & 0 \\ 0 & 5 & 0 \\ 0 & 0 & 5 \end{bmatrix} \quad \text{diagonal}$$

19

a.)

$$A^{11} B_{3 \times 3} = \begin{bmatrix} 6 & 7 & 4 \\ 1 & 4 & 1 \\ 1 & 1 & 1 \end{bmatrix}$$

$$A^{11} B_{4 \times 4} = \begin{bmatrix} 1 & 1 & 2 & 1 \\ 8 & 7 & 2 & 1 \end{bmatrix}$$

b.)

$$A^{11} B_{3 \times 3} \begin{bmatrix} 6 & 3 & 6 & 7 & 5 & 7 \end{bmatrix} \quad A^{11} B_{4 \times 4} = \begin{bmatrix} 9 & 0 & 6 & 3 \end{bmatrix}$$

c.)

$$A^{11} B_{3 \times 3}$$

$$\begin{bmatrix} 4 & 1 \\ 2 & 1 \\ 6 & 2 \end{bmatrix}$$

$$A^{11} B_{4 \times 4}$$

$$\begin{bmatrix} 1 & 2 \\ 1 & 1 \\ 0 & 1 \\ -1 & 2 \end{bmatrix}$$

$$P_3 = [0, 0, 1]$$

$$P_1 = [1, 0, 0]$$

$$P_2 = [0, 1, 0]$$

$$\cos \theta = -1$$

$$\frac{V_{124} \cdot V_4}{V_{124}} = -1$$

$$L_2 = \cos^{-1}(-1)$$

$$\cos \theta_1 = \frac{P_0 \cdot P_1}{|P_0| \cdot |P_1|}$$

$$= \frac{90 + 20}{\sqrt{124} \cdot \sqrt{100}}$$

$$= \frac{11}{\sqrt{124}}$$

$$L_1 = \cos^{-1}\left(\frac{11}{\sqrt{124}}\right)$$

$$\cos \theta_3 = \frac{-15 + 5}{\sqrt{25 + 25} \cdot \sqrt{4}}$$

$$= \frac{-10}{-10} = 1$$

$$= \frac{V_{124} \cdot V_4}{V_{124} \cdot V_4}$$

$$L_3 = \cos^{-1}(1)$$

$$= \cos^{-1}\left(\frac{1}{1}\right)$$

④ 6)

$$\text{Proj}_b \vec{v} = \begin{bmatrix} \frac{9}{7} & \frac{3}{7} & \frac{6}{7} \end{bmatrix}$$

$$b - \text{Proj}_b \vec{v} = \begin{bmatrix} -\frac{2}{7} & -\frac{38}{7} & \frac{12}{7} \end{bmatrix}$$

$$\text{Proj}_b \vec{a} = \begin{bmatrix} \frac{2}{7} & -\frac{10}{7} & \frac{8}{7} \end{bmatrix}$$

$$a - \text{Proj}_b \vec{a} = \begin{bmatrix} \frac{40}{7} & \frac{24}{7} & \frac{20}{7} \end{bmatrix}$$

$$c) \quad b - \text{Proj}_a \vec{v} = \begin{bmatrix} \frac{29}{6} & -1 & -\frac{1}{6} & \frac{7}{3} \end{bmatrix}$$

$$\text{Proj}_a \vec{v} = \begin{bmatrix} \frac{1}{6} & 0 & \frac{1}{6} & -\frac{1}{3} \end{bmatrix}$$

$$\text{Proj}_a \vec{v} = \begin{bmatrix} \frac{1}{6} & -\frac{1}{30} & 0 & \frac{1}{15} \end{bmatrix}$$

$$a - \text{Proj}_a \vec{v} = \begin{bmatrix} \frac{5}{6} & \frac{1}{30} & 1 & -\frac{31}{15} \end{bmatrix}$$

13.

$$a \rightarrow b = 2+4-25-14$$

$$|a \rightarrow b| = \sqrt{2^2 + 4^2 + 25^2 + 14^2} = 44.1 \approx 30$$

$$phogab = -\frac{14}{30}$$

$$= 2 \cdot -\frac{14}{30} = 1 \cdot -\frac{14}{30} = 5 \cdot -\frac{14}{30} = \left[-\frac{38}{30}, -\frac{14}{30}, -\frac{95}{30} \right]$$

$$6-phogab \rightarrow = \left[1, 4, 5 \right] - \left[-\frac{38}{30}, -\frac{14}{30}, -\frac{95}{30} \right] = \left[\frac{34}{30}, \frac{134}{30}, -\frac{11}{6} \right]$$

$$phogab \rightarrow = -\frac{14}{42} \cdot \left[1, 4, 5 \right] = 5a-phogab \rightarrow = \left[\frac{103}{42}, \frac{59}{21}, \frac{115}{42} \right]$$

11.

(c)

$$8 = -\frac{3}{2}k$$

$$\frac{24}{32} = k$$

$$k = -\frac{3}{4}$$

$$-6 = 8k$$

$$-\frac{6}{8} = k$$

$$k = -\frac{3}{4}$$

$$-9 = 2k$$

$$k = -\frac{9}{2}$$

$$-8 = \frac{3}{2}k$$

$$-\frac{24}{32} = k$$

$$k = -\frac{3}{4}$$

$$-2 = k \cdot \frac{5}{3}$$

$$-6 = 5k$$

$$-\frac{6}{5} = k$$

$$k = -\frac{3}{4}$$

$$k = -\frac{3}{4}$$

sl'houdebeide

(12)

$$a) -2 = 6k \Rightarrow k = -\frac{1}{3}$$

$$3 = -4k \Rightarrow k = -\frac{3}{4}$$

$$1 = -3k \Rightarrow k = -\frac{1}{3}$$

nie sú rovnobežné!

$$k = -\frac{1}{3} \neq -\frac{3}{4} \neq -\frac{1}{3}$$

b.)

$$10 = \frac{5}{6}k \quad -8 = -\frac{2}{3}k$$

$$0 = \frac{3}{4}k$$

$$2x = 0 \cdot k$$

$$2x = k \cdot 5$$

$$60 = 5k$$

$$-24 = -2k$$

$$0 = k$$

$$5y = -5k$$

$$k = -\frac{60}{5} = -12$$

$$-\frac{24}{-2} = k$$

$$k = 0$$

$$k = -\frac{54}{5}$$

$$k = 12$$

nie sú rovnobežné!

$$k = 12 \neq 12 \neq 0 \neq -\frac{54}{5}$$

① c.)

$$|\vec{AB}| = \sqrt{1+8}$$

$$|\vec{BC}| = \sqrt{9+0}$$

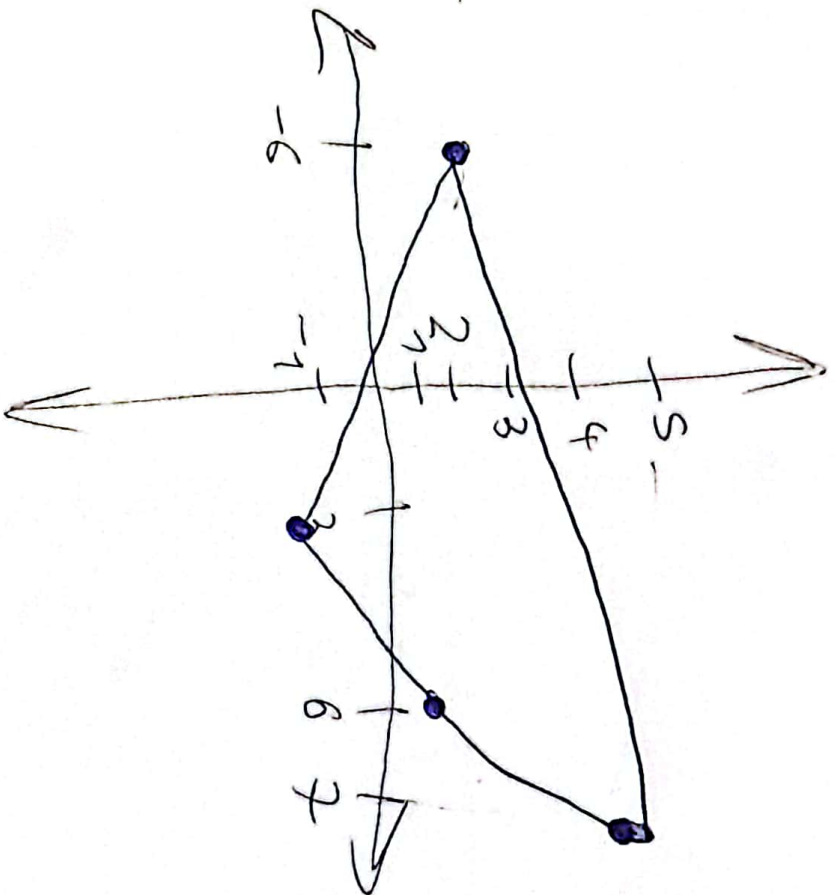
$$|\vec{CD}| = \sqrt{1+3}$$

$$|\vec{DA}| = \sqrt{1+7}$$

Abstände

$$|\vec{AC}| = \sqrt{5+2}$$

$$|\vec{BD}| = \sqrt{1+5}$$



①

b.)

$$\Rightarrow |AB| = 5$$

$$\Rightarrow |BC| = 5$$

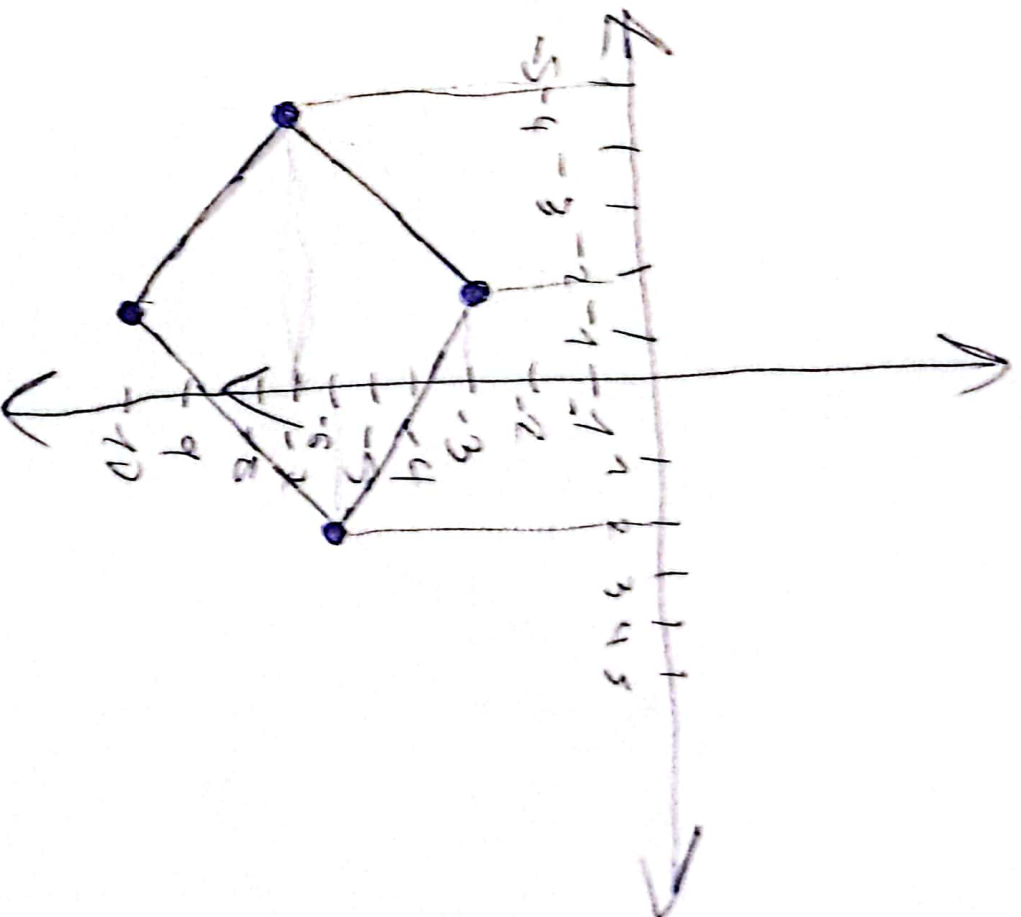
$$\Rightarrow |CD| = 5$$

$$\Rightarrow |DA| = 3$$

orthocenter?

$$\Rightarrow |AC| = \sqrt{50}$$

$$\Rightarrow |BD| = \sqrt{50}$$



9.

a.)

$$|\vec{AB}| = \sqrt{13}$$

$$|\vec{BC}| = \sqrt{20}$$

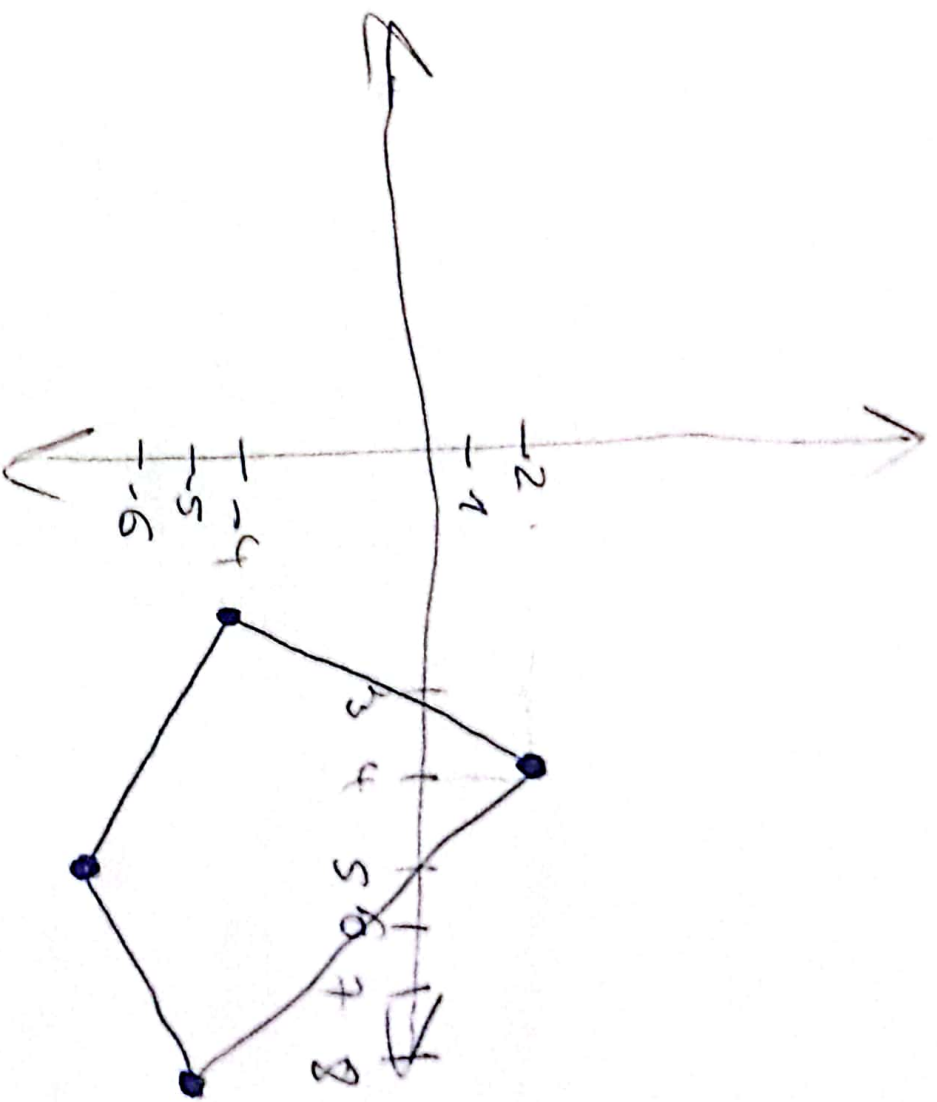
$$|\vec{CD}| = \sqrt{45}$$

$$|\vec{DA}| = \sqrt{52}$$

Chlopic'kyo

$$|\vec{AC}| = 7$$

$$|\vec{BD}| = \sqrt{65}$$



8.

a.)

$$|AB| = \sqrt{-2^2 + 2^2} = \sqrt{4+4} = \sqrt{8} = 2\sqrt{2}$$

$$|BC| = \sqrt{0^2 + 2^2} = \sqrt{4} = 2$$

$$|AC| = \sqrt{-2^2 + (-5)^2} = \sqrt{29}$$

$$AC = \left(\frac{-1+(-3)}{2}, \frac{2+(-3)}{2} \right) = \left[-2, -\frac{1}{2} \right]$$

$$BD = \left[\frac{-3+x}{2}, \frac{4+y}{2} \right]$$

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

$$x = -1$$

$$y = -5$$

$$D = (-1, -5)$$

8.

a.)

$$|AB| = \sqrt{20}$$

$$|BC| = 2\sqrt{2}$$

$$|AC| = 2\sqrt{2}$$

$$AC = \left[\frac{3+x}{2}, \frac{2+y}{2} \right] = [4, 4]$$

$$BD = \left[\frac{x+y}{2}, \frac{4+y}{2} \right]$$

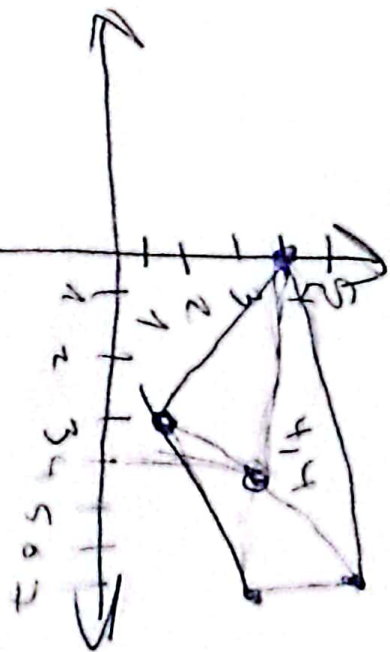
$$\frac{x+y}{2} = 4$$

$$\frac{4+y}{2} = 4$$

$$y = -1$$

$$y = 4$$

$$D(-1, 4)$$



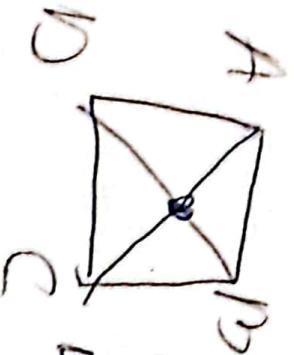
8.)

a.)

$$|AB| = \sqrt{3^2 + 6^2} = \sqrt{45}$$

$$|BC| = \sqrt{3^2 + (-2)^2} = \sqrt{13}$$

$$|AC| = \sqrt{6^2 + 4^2} = \sqrt{52}$$



$$AC \left[\begin{array}{cc} -\frac{4+x}{2} & -\frac{2x-2}{2} \end{array} \right] = \left(-\frac{2}{2}, \frac{0}{2} \right) = (-1, 0)$$

$$BD \left[\begin{array}{cc} -\frac{1+x}{2} & \frac{4+y}{2} \end{array} \right]$$

$$\left[\begin{array}{cc} -1 & 0 \end{array} \right] = \left[\begin{array}{cc} -1 & 0 \end{array} \right]$$

$$\frac{-1+x}{2} = -1$$

$$x = -1$$

$$\frac{4+y}{2} = 0$$

$$y = [-1, -4]$$

$$4+x = 0$$

$$y = -4$$

7.

a.)

$$2x \rightarrow + (-3, 6) = (0, -2)$$

$$2x \rightarrow = (3, -8)$$

$$x \rightarrow = \left(\frac{3}{2}, -4\right)$$

b.)

$$3x \rightarrow - (3, -1) = 2 \cdot (0, 2)$$

$$3x \rightarrow = (0, 4) + (3, -1)$$

$$3x \rightarrow = (3, 3)$$

$$x \rightarrow = (1, 1)$$

c.)

$$3x \rightarrow + 5(2, 4) = 4(1, -2)$$

$$3x \rightarrow = (4, -8) - (10, 20)$$

$$3x \rightarrow = (-6, -28)$$

$$x \rightarrow = \left(-2, \frac{28}{3}\right)$$

c.)

$$x+y=0$$

$$x = -y$$

$$|\vec{v}| = \sqrt{x^2 + y^2} = 8$$

$$= x^2 + y^2 = 8^2$$

$$= x^2 + y^2 = 64$$

$$(-4y)^2 + y^2 = 64$$

$$16y^2 = 64$$

$$y^2 = \frac{64}{16}$$

$$y = \pm \sqrt{\frac{64}{16}}$$

$$y = \pm \frac{8\sqrt{16}}{\sqrt{16}}$$

$$\vec{v}(x, y) = \left(\frac{-32\sqrt{16}}{\sqrt{16}}, \frac{8\sqrt{16}}{16} \right)$$

$$\vec{v}(x, y) = \left(\frac{32\sqrt{16}}{16}, -\frac{8\sqrt{16}}{16} \right)$$

(6)

b.)

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

$$2y = 3x$$

$$y = \frac{3}{2}x$$

$$\sqrt{x^2 + \left(\frac{3}{2}\right)^2 x^2} = 10$$

$$\sqrt{\frac{13}{4}x^2} = 10$$

$$\sqrt{\frac{13}{2}}x = 10$$

$$x = \frac{20}{\sqrt{13}}$$

$$\frac{3}{2} \cdot \frac{20}{\sqrt{13}} = \frac{60}{2\sqrt{13}}$$

$$\Rightarrow V = \left(\frac{20}{\sqrt{13}}, \frac{60}{2\sqrt{13}} \right)$$

4.

a.)

$$\begin{aligned} AB &\Rightarrow \sqrt{(1+3)^2 + (4+2)^2} \\ &= \sqrt{52} \end{aligned}$$

$$\begin{aligned} BC &\Rightarrow \sqrt{(-5-1)^2 + (0-4)^2} \\ &= \sqrt{52} \end{aligned}$$

$$\begin{aligned} AC &\Rightarrow \sqrt{(-5+5)^2 + 6^2} \\ &= \sqrt{8} \end{aligned}$$

$$\underline{\underline{AB = BC}}$$

b.)

$$\begin{aligned} AB &\Rightarrow \sqrt{4^2 + 2^2 + 3^2} \\ &= \sqrt{29} \end{aligned}$$

$$\begin{aligned} BC &\Rightarrow \sqrt{1^2 + 2^2 + 5^2} \\ &= \sqrt{28} \end{aligned}$$

$$\begin{aligned} AC &\Rightarrow \sqrt{3^2 + 4^2 + 2^2} \\ &= \sqrt{29} \end{aligned}$$

$$\underline{\underline{AB = AC}}$$

5.)

a.)

$$3x - 2y = 11$$

$$-x + 5y = 3$$

$$-x + 10 = 3$$

$$-x = -7$$

$$x = 7$$

$$x = 5y - 3$$

$$15y - 9 - 2y = 11$$

$$C(7, 2)$$

$$13y = 20$$

$$y = 2$$

6.)

$$a.) 3x + 4y = 0$$

$$4y = -3x$$

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

$$\sqrt{x^2 + (-\frac{3}{4}x)^2} = 15$$

$$= \sqrt{(\frac{16+9}{16})x^2} = 15$$

$$= \sqrt{\frac{25}{16}x^2} = 15$$

$$x = 12$$

$$y = -\frac{3}{4} \cdot 12$$

$$y = -9$$

$$\Rightarrow C(12, -9)$$

3.

$$a) \vec{AB} = (x-2, 3)$$

$$|\vec{AB}| = \sqrt{(x-2)^2 + 3^2} = 5$$

$$x^2 - 4x - 12 = 0$$

$$x_1 = \frac{4 + \sqrt{64}}{2} = 6$$

$$x_2 = -2$$

c.)

$$\vec{AB} = (0, (x-5))$$

$$x^2 - 10x - 11 = 0$$

$$x_1 = \frac{10 + \sqrt{164}}{2} = 11$$

$$x_2 = \frac{-2}{2} = -1$$

b.)

$$\vec{AB} = ((x-1), -3)$$

$$\sqrt{(x-1)^2 + 3^2} = 4$$

$$x^2 - 2x - 6 = 0$$

$$x_1 = 1 + \sqrt{7}$$

$$x_2 = 1 - \sqrt{7}$$

①

d.)

$$\vec{AB} = (-2, -3)$$

$$\vec{AC} = (-1, 2)$$

$$\vec{AB} \cdot \vec{AC} = 0$$

$$(-2) \cdot (-1) - 3 \cdot 2 = 0$$

$$2 - 6 = 0$$

$$-4 = 0$$

$$-4 \neq 0$$

$$x = 4$$

$$B(-4, -2)$$

$$\vec{AD} = k \cdot \vec{AC}$$

$$x - 2 = -1k$$

$$x - 2 = 1$$

$$x = 3$$

$$-3 = 3k$$

$$k = -1$$

$$B(3, -2)$$

c.)

$$\vec{AB} = (-2, 1, 4, -5)$$

$$\vec{AC} = (1, -8)$$

$$-2 + (y - 5) - (-8) = 0$$

$$-2 - 8y = -40$$

$$-8y = -38$$

$$y = \frac{38}{8} = \frac{19}{4}$$

$$-2, y - 5 = k, -8k$$

$$y - 5 = -8k \quad -2 = k$$

$$y = 21 \quad k = -2$$

$$B(-1, \frac{11}{4})$$

$$B(-1, 21)$$