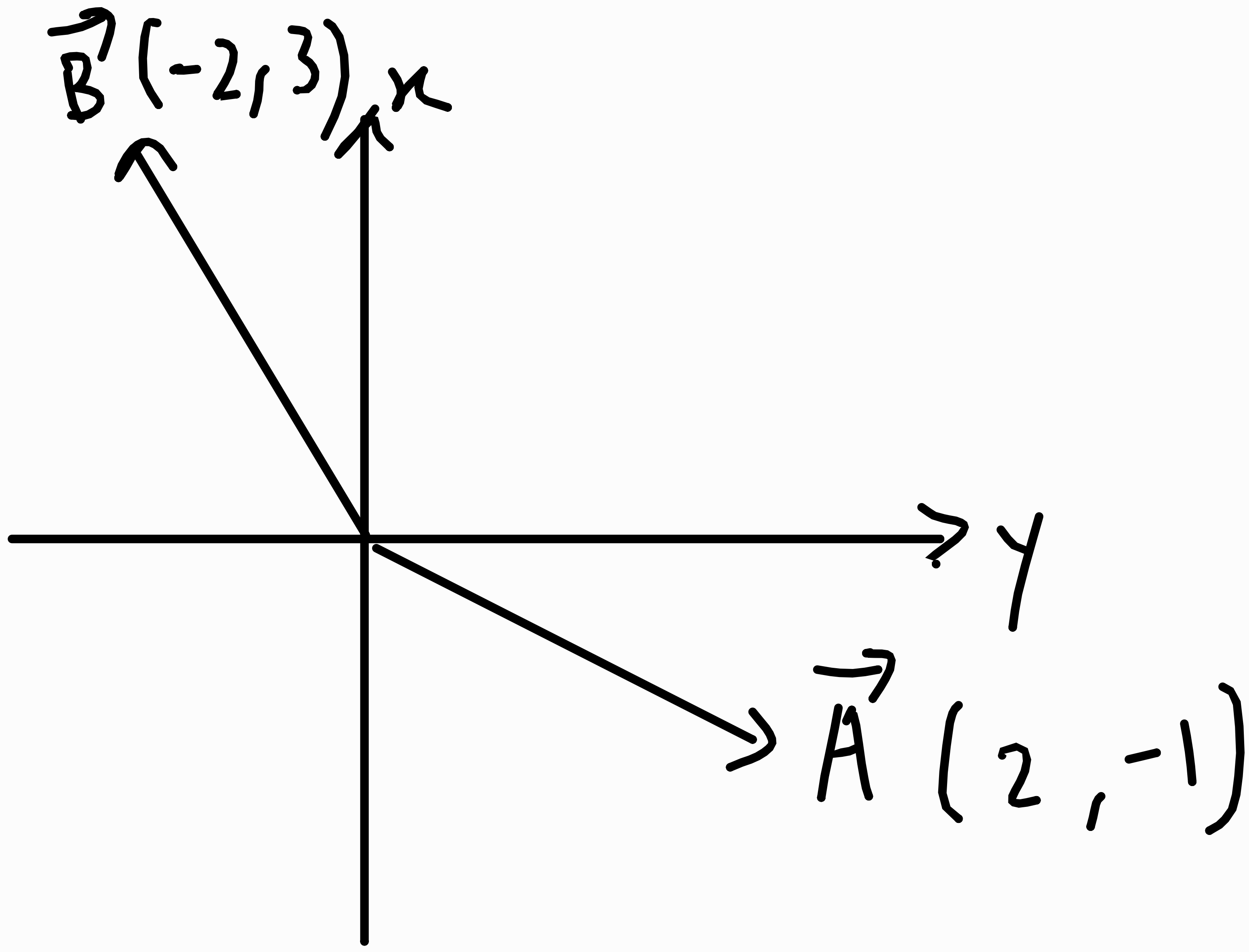
1a)



b) $|\vec{A}| = \sqrt{2^2+1^2}$

$= 2.236067977$

≈ 2.24

$\theta = -\tan^{-1}\left(\frac{1}{2}\right)$

$= -26.56505118^\circ$

$\approx -26.57^\circ$

$\vec{A} = 2.24 \angle -26.57$

1c) $|\vec{B}| = \sqrt{2^2+3^2}$

$= 3.605551275$

≈ 3.61

$\theta = 180 - \tan^{-1}\left(\frac{3}{2}\right)$

$= 123.6900675^\circ$

$\approx 123.69^\circ$

$\vec{A} \cdot \vec{B} = |\vec{A}||\vec{B}| \cos\theta$

$= 2.24 \times 3.61 \cos(123.69^\circ + 26.57^\circ)$

$= -7$

1d) $\vec{A} \times \vec{B} = |\vec{A}||\vec{B}| \sin\theta \, \underset{\sim}{\hat{k}}$

$= 2.24 \times 3.61 \sin(123.69° + 26.57°) \underset{\sim}{\hat{k}}$

$= 4 \underset{\sim}{\hat{k}}$

$\vec{B} \times \vec{A} = -(\vec{A} \times \vec{B})$

$= -4 \underset{\sim}{\hat{k}}$

e) $\vec{C} \times \vec{B} = \left| \begin{array}{ccc|cc} i & j & k & i & j \\ -2 & 3 & 0 & -2 & 3 \\ 0 & 0 & 0.3 & 0 & 0 \end{array} \right|$

$= -0.9 \underset{\sim}{i} - 0.6 \underset{\sim}{j}$

$\vec{C} \times (\vec{C} \times \vec{B}) = \left| \begin{array}{ccc|cc} i & j & k & i & j \\ -0.9 & -0.6 & 0 & -0.9 & -0.6 \\ 0 & 0 & 0.3 & 0 & 0 \end{array} \right|$

$= 0.18 \underset{\sim}{i} - 0.27 \underset{\sim}{j}$

2a) $\vec{v} \cdot \vec{u}$ gives the projection of $\vec{v}$ on $\vec{u}$.

$$\vec{v} \cdot \vec{u} = |\vec{v}||\vec{u}| \cos\theta$$

$$= v \cos(270 - 135 - 30)$$

$$= -0.2588190451025 v$$

$$\approx -0.259 v$$

b) $$\hat{k} \times \vec{v} = |\hat{k}||\vec{v}| \sin 90° \angle (120° + 90°)$$

$$= v \angle 210°$$

$\hat{k} \times \vec{v}$ direction is given by rotating $\vec{v}$ by $90°$ anti-clockwise.

2b) $\hat{k} \times (k \angle \theta) = |\hat{k}||\vec{v}| \sin 90^\circ \angle \left(\theta + \frac{\pi}{2}\right)$

$$= v \angle \left(\theta + \frac{\pi}{2}\right)$$

$\hat{k} \times (v \angle \theta)$ direction is given by rotating $\vec{v}$ by $\frac{\pi}{2}$ (90°) anticlockwise.

$-\hat{k} \times (k \angle \theta) = |\hat{k}||\vec{v}| \sin 90^\circ \angle \left(\theta - \frac{\pi}{2}\right)$

$$= v \angle \left(\theta - \frac{\pi}{2}\right)$$

$-\hat{k} \times (v \angle \theta)$ direction is given by rotating $\vec{v}$ by $\frac{\pi}{2}$ (90°) clockwise.

3a) $\vec{A} = 2\cos 210^\circ \underset{\sim}{i} + 2\sin 210^\circ \underset{\sim}{j}$

$= -\sqrt{3}\,\underset{\sim}{i} - \underset{\sim}{j}$

$\vec{B} = 2.5\cos(-80^\circ)\underset{\sim}{i} + 2.5\sin(-80^\circ)\underset{\sim}{j}$

$= 0.434\underset{\sim}{i} - 2.46\underset{\sim}{j}$

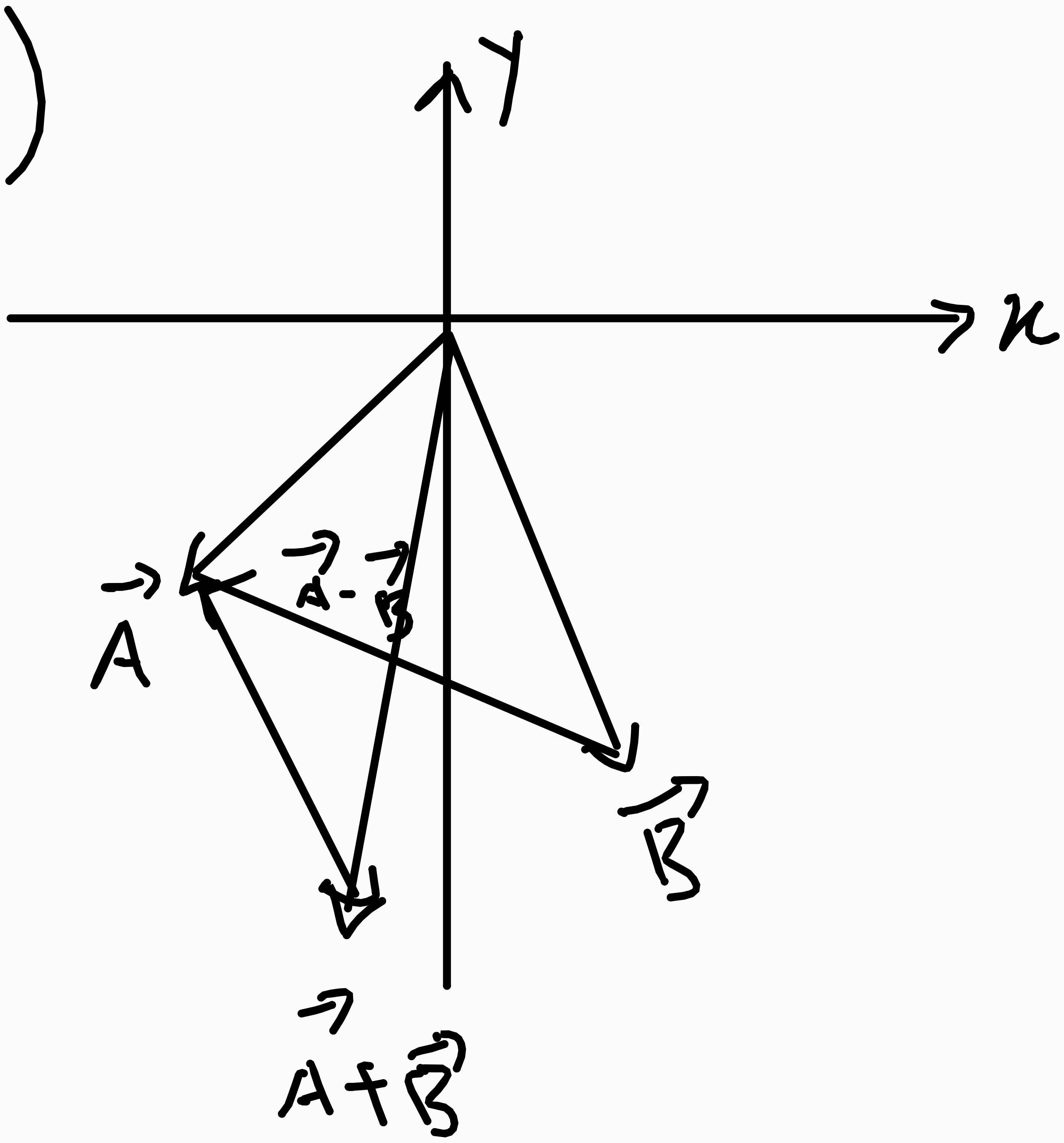
$\vec{A} + \vec{B} = -\sqrt{3}\,\underset{\sim}{i} + 0.434\underset{\sim}{i} - \underset{\sim}{j} - 2.46\underset{\sim}{j}$

$= -1.30\underset{\sim}{i} - 3.46\underset{\sim}{j}$

$\vec{A} - \vec{B} = -\sqrt{3}\,\underset{\sim}{i} - 0.434\underset{\sim}{i} - \underset{\sim}{j} + 2.46\underset{\sim}{j}$

$= -2.17\underset{\sim}{i} + 1.46\underset{\sim}{j}$

3a)



b) $\vec{A}\cdot\vec{B} = |\vec{A}||\vec{B}|\cos\theta$

$= 2 \times 2.5 \cos(360-210-80)$

$= 5\cos 70°$

$\vec{A}\times\vec{B} = |\vec{A}||\vec{B}|\sin\theta$

$= 2\times 2.5 \sin(360-210-80)\hat{k}$

$= 5\sin 70° \hat{k}$

$\vec{B}\times\vec{A} = -\vec{A}\times\vec{B} = -5\sin 70° \hat{k}$

3c) $0.5\hat{k} \times \vec{A} = 0.5 \times 2 \angle (210^\circ + 90^\circ)$

$= 1 \angle 300^\circ$

$-0.5\hat{k} \times \vec{B} = 0.5 \times 2 \angle (-80^\circ - 90^\circ)$

$= 1 \angle -170^\circ$

4a) $-(A\angle\theta) = A\angle(\theta + 180^\circ)$

b) Since $\vec{A}$ is parallel to $\vec{B}$,

$$(A\angle\theta) \times (B\angle\theta) = |\vec{A}||\vec{B}|\sin 0^\circ$$
$$= 0$$

c) $$(A\angle\theta)(B\angle\theta) = |\vec{A}||\vec{B}|\cos 0^\circ$$
$$= AB$$

d) The expression is correct as

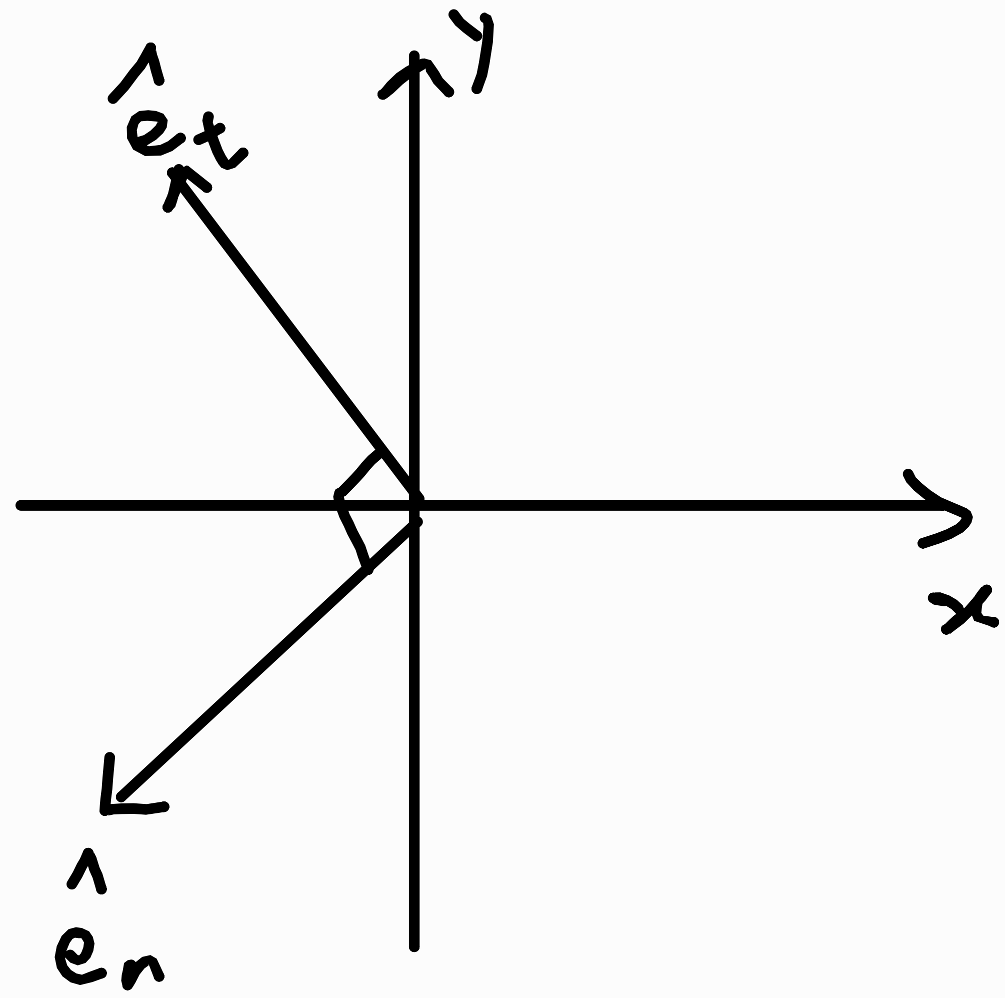
$$B\angle(\theta+\pi) = -B\angle\theta$$

$$\therefore A\angle\theta + B\angle(\theta+\pi) = A\angle\theta - B\angle\theta$$
$$= (A-B)\angle\theta$$

e) $$(A\angle\theta)\times\left(B\angle\left(\theta-\frac{\pi}{2}\right)\right) = |\vec{A}||\vec{B}|\sin\left(\frac{\pi}{2}\right)(-\hat{k})$$
$$= -AB\hat{k}$$

5) $\hat{e}_t = -0.6\hat{i} + 0.8\hat{j}$

$\hat{e}_n = -0.6\hat{i} - 0.8\hat{j}$



$$A \cdot \hat{e}_t = (-312\hat{i} + 72\hat{j}) \cdot (-0.6\hat{i} + 0.8\hat{j})$$
$$= -312 \times -0.6 + 72 \times 0.8$$
$$= 244.8$$

$$A \cdot \hat{e}_n = (-312\hat{i} + 72\hat{j}) \cdot (-0.6\hat{i} - 0.8\hat{j})$$
$$= -312 \times -0.6 + 72 \times -0.8$$
$$= 206.4$$