

Vectors Practice

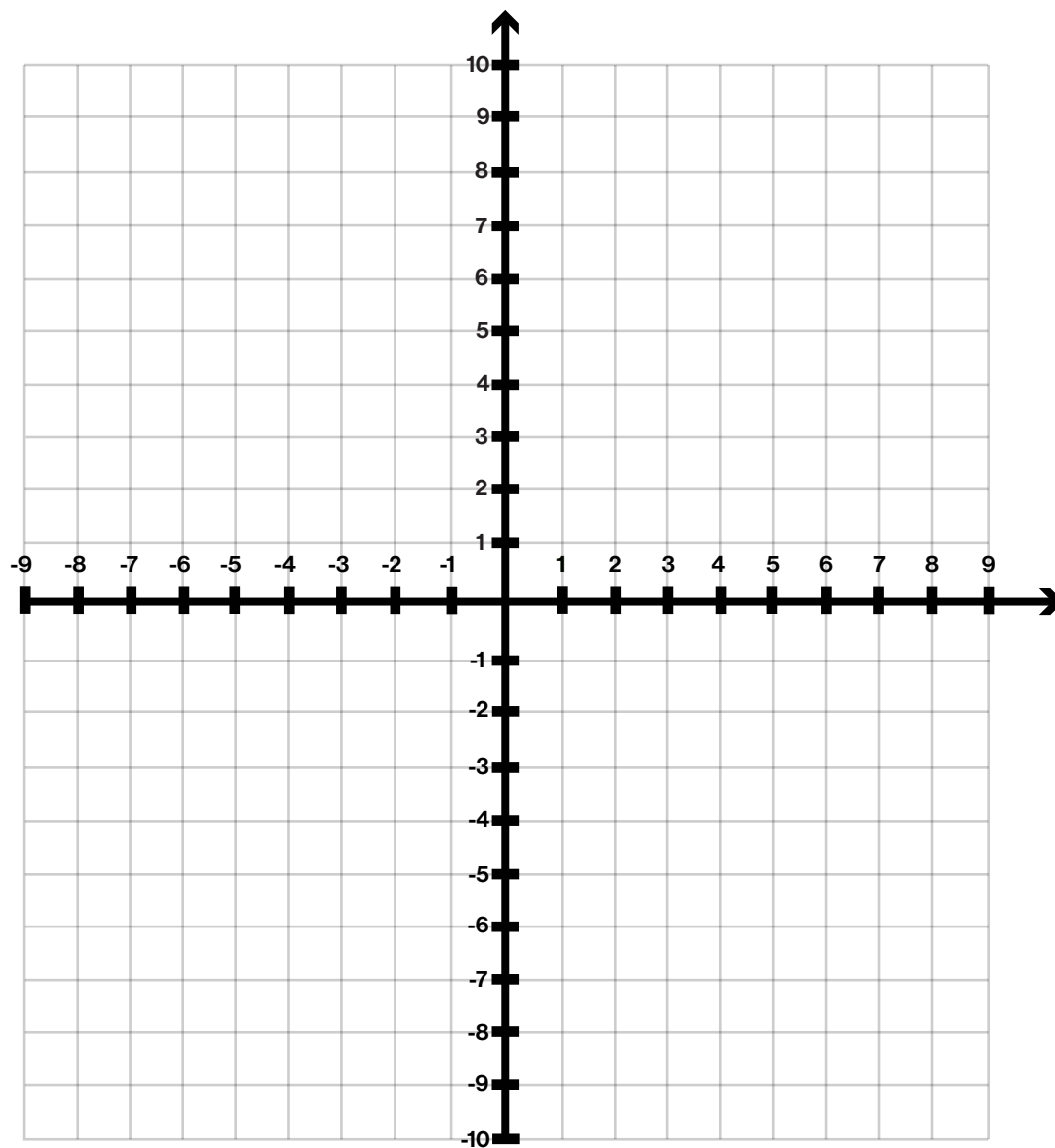
Name: _____

Date: _____

Question 1

Convert to component form and determine the length

I.

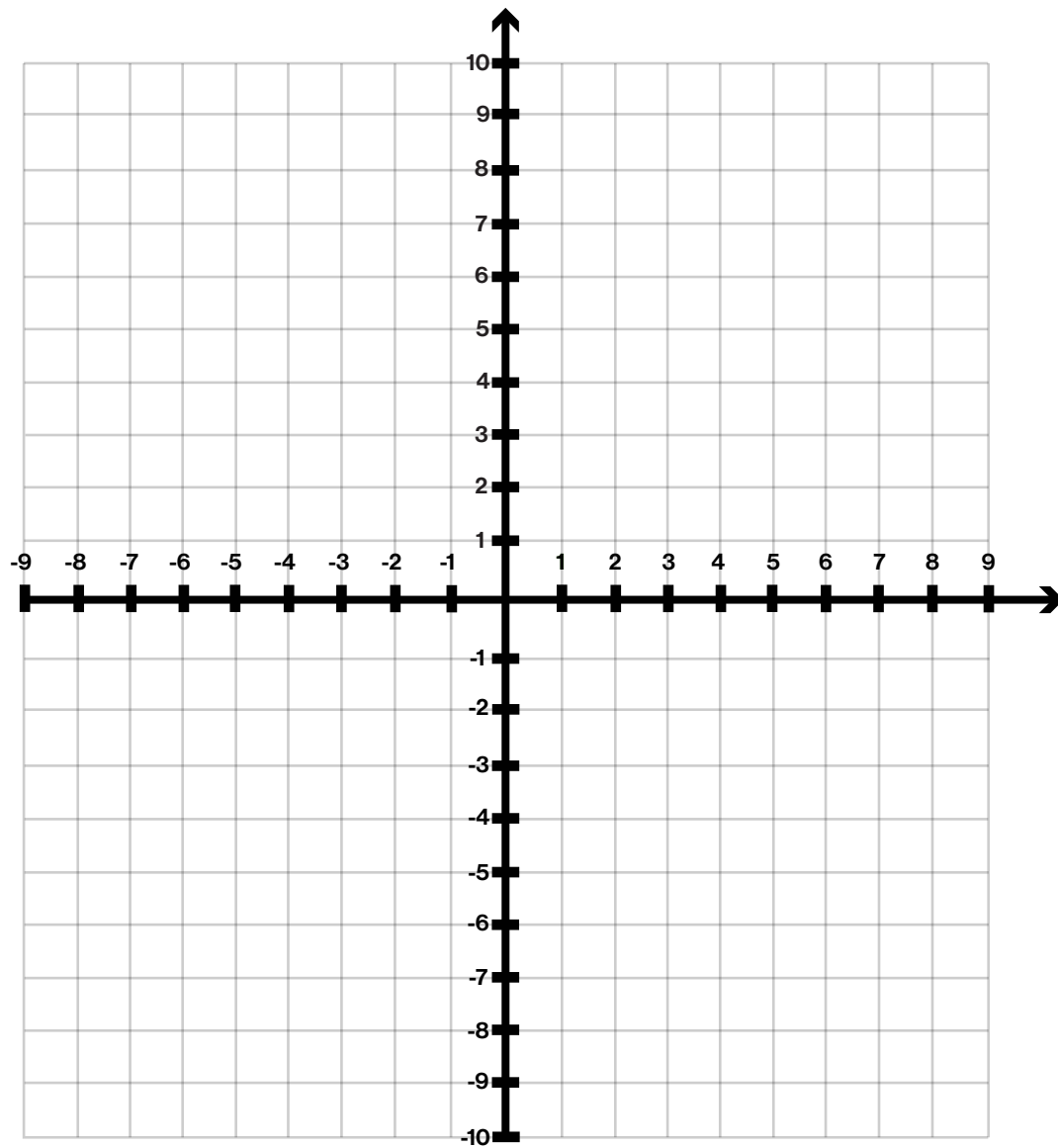


component form :

length :

Vectors Practice

11.



component form :

length :

Vectors Practice

Question 2

Add the vectors (round to the nearest tenths place)

	magnitude	magnitude	angle between vectors
--	-----------	-----------	-----------------------

I.	$ a = 45$	$ b = 35$	$\theta = 90^\circ$
----	------------	------------	---------------------

	magnitude	magnitude	angle between vectors
--	-----------	-----------	-----------------------

II.	$ a = 25$	$ b = 30$	$\theta = 75^\circ$
-----	------------	------------	---------------------

Vectors Practice

Question 3

Complete the operations

$$\mathbf{a} = \langle 5, -2 \rangle \quad \mathbf{b} = \langle -4, 7 \rangle \quad \mathbf{c} = \langle -1, -3 \rangle$$

I. $\mathbf{a} + \mathbf{c}$

II. $|\mathbf{3c} - \mathbf{b}|$

III. $6\mathbf{b} + 5\mathbf{a}$

IV. $\mathbf{b} - \mathbf{a}$

V. $|\mathbf{2c}|$

VI. $-5\mathbf{b}$

VII. $|\mathbf{b}| + |\mathbf{a}|$

VIII. $\mathbf{b} + \mathbf{a} + 2\mathbf{c}$

IX. $\mathbf{a} \cdot \mathbf{c}$

Vectors Practice

Question 4

Find the unit vector with the same direction

I. $\mathbf{a} = \langle -5, 12 \rangle$

Question 5

Express the vector as a linear combination of $\mathbf{i}$ and $\mathbf{j}$

I. $\mathbf{a} = \langle -4, 6 \rangle$

Question 6

Calculate the unit vector $\mathbf{a} = (\cos \theta)\mathbf{i} + (\sin \theta)\mathbf{j}$

I. $\theta = \frac{\pi}{2}$

II. $\theta = \frac{4\pi}{3}$

Vectors Practice

Question 7

Determine the direction angle of θ of the vector (round to the nearest whole number)

I. $a = \langle -2, -5 \rangle$

Question 8

Determine the direction angle and magnitude of the vector (round to the nearest whole number)

I. $a = 3[(\cos 45^\circ)i + (\sin 45^\circ)j]$

II. $b = \langle -1/2, \sqrt{3}/2 \rangle$

III. $c = -i - j$

Vectors Practice

Question 9

Find the angle between the vectors (round to the nearest whole number)

l. $a = \langle 2, -5 \rangle$ $b = \langle 1, 4 \rangle$

Vectors Practice

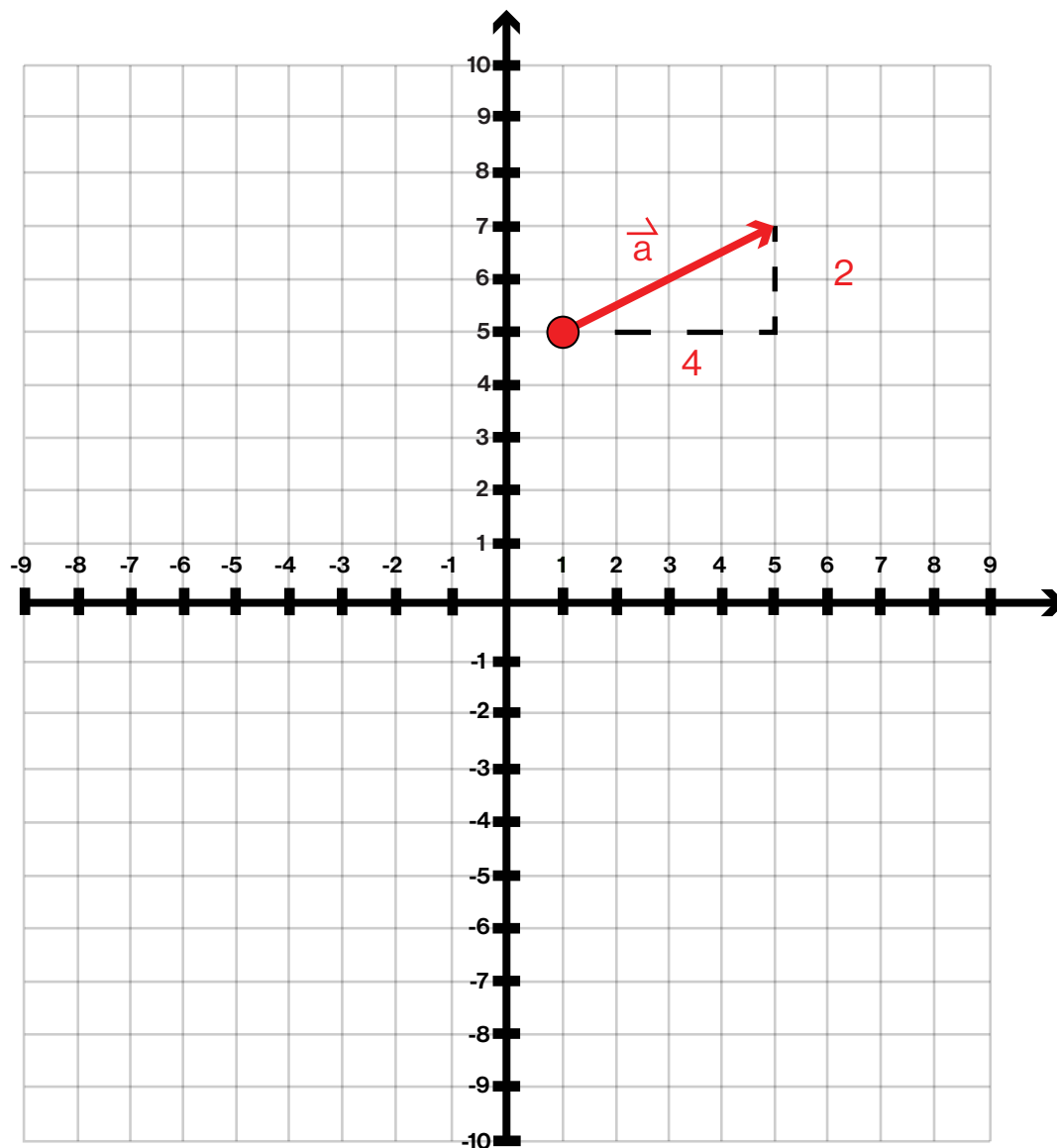
Name: Key

Date: _____

Question 1

Convert to component form and determine the length

1.



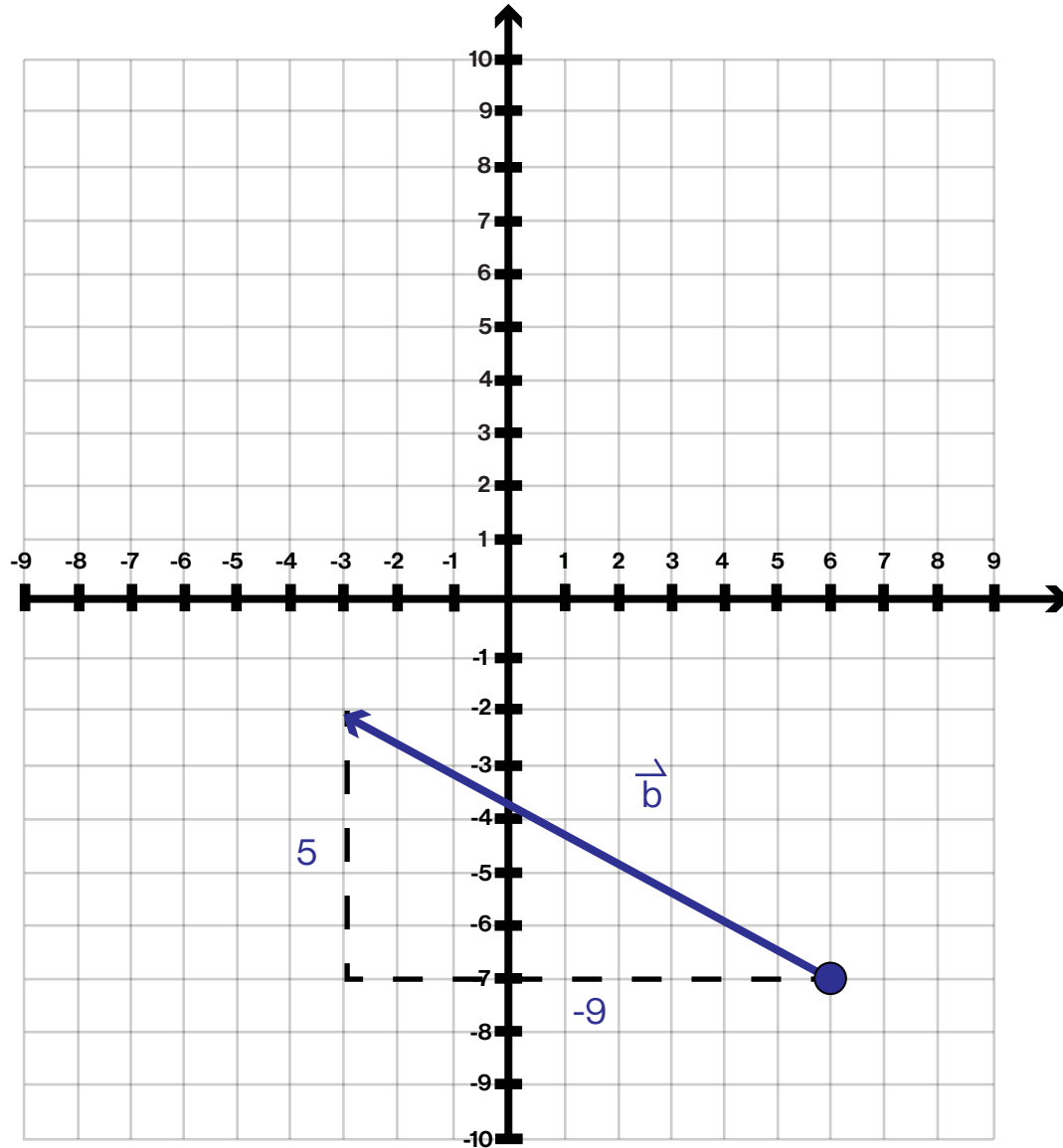
component form :

$$\langle 4, 2 \rangle$$

length :

$$\sqrt{(4)^2 + (2)^2} = 2\sqrt{5}$$

Vectors Practice



component form :

$$\langle -9, 5 \rangle$$

length :

$$\sqrt{(5)^2 + (-9)^2} = \sqrt{106}$$

Vectors Practice

Question 2

Add the vectors (round to the nearest tenths place)

magnitude magnitude angle between vectors

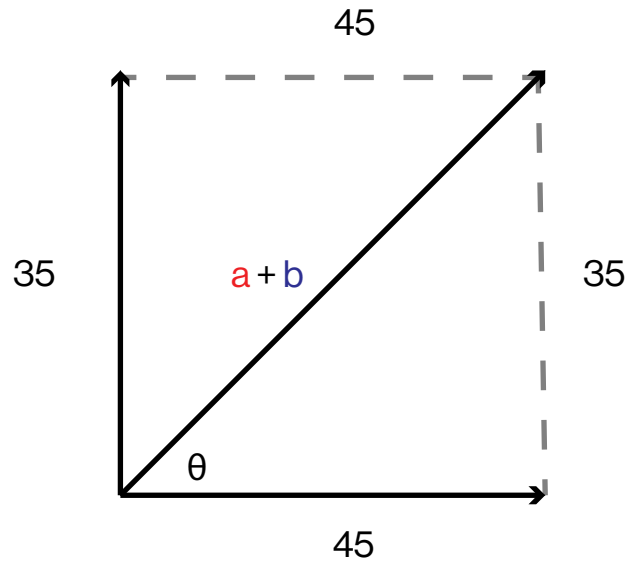
I. $|a| = 45$ $|b| = 35$ $\theta = 90^\circ$

magnitude

$$|a + b| = \sqrt{(45)^2 + (35)^2} = 5\sqrt{130} \approx 57.0$$

$$\theta = 90^\circ \rightarrow \text{right triangle}$$

$$\theta = \tan^{-1} \frac{35}{45} \rightarrow \theta \approx 37.9^\circ$$



magnitude magnitude angle between vectors

II. $|a| = 25$ $|b| = 30$ $\theta = 75^\circ$

magnitude

$$|a + b| = \sqrt{25^2 + 30^2 - 2 \cdot 25 \cdot 30 \cos(105^\circ)}$$

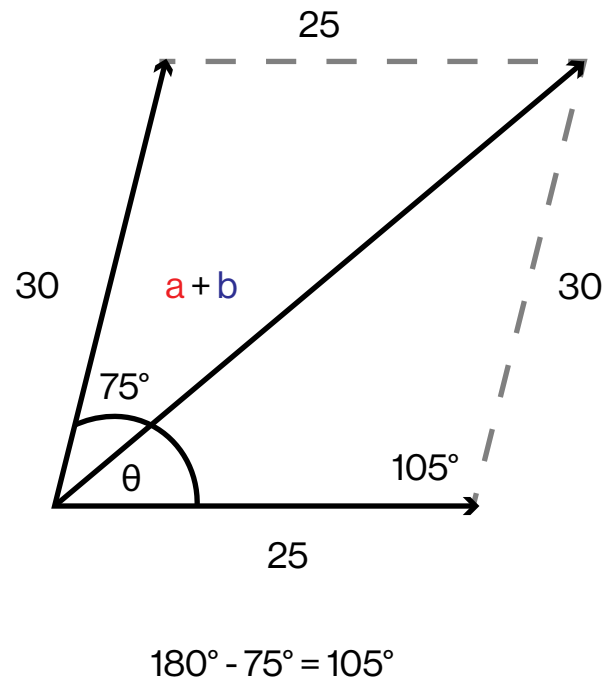
$$|a + b| \approx 43.7$$

$$\theta = 75^\circ \rightarrow \text{oblique triangle}$$

$$\frac{\sin(\theta)}{30} = \frac{\sin(105^\circ)}{43.7} \rightarrow \theta = \sin^{-1} \left(\frac{30 \sin(105^\circ)}{43.7} \right)$$

$$\downarrow$$

$$\theta \approx 41.5^\circ$$



Vectors Practice

Question 3

Complete the operations

$$\mathbf{a} = \langle 5, -2 \rangle \quad \mathbf{b} = \langle -4, 7 \rangle \quad \mathbf{c} = \langle -1, -3 \rangle$$

I. $\mathbf{a} + \mathbf{c}$

$$\langle (5) + (-1), (-2) + (-3) \rangle = \langle 4, -5 \rangle$$

II. $|3\mathbf{c} - \mathbf{b}|$

$$|\langle 3(-1) - (-4), 3(-3) - (7) \rangle| = |\langle 1, -16 \rangle| \rightarrow \sqrt{(1)^2 + (-16)^2} = \sqrt{257}$$

III. $6\mathbf{b} + 5\mathbf{a}$

$$\langle 5(5) + 6(-4), 5(-2) + 6(7) \rangle = \langle 1, 32 \rangle$$

IV. $\mathbf{b} - \mathbf{a}$

$$\langle (-4) - (5), (7) - (-2) \rangle = \langle -9, 9 \rangle$$

V. $|2\mathbf{c}|$

$$|\langle 2(-1), 2(-3) \rangle| = |\langle -2, -6 \rangle| \rightarrow \sqrt{(-2)^2 + (-6)^2} = 2\sqrt{10}$$

VI. $-5\mathbf{b}$

$$\langle -5(-4), -5(7) \rangle = \langle 20, -35 \rangle$$

VII. $|\mathbf{b}| + |\mathbf{a}|$

$$\sqrt{(-4)^2 + (7)^2} = \sqrt{65} \quad \sqrt{(5)^2 + (-2)^2} = \sqrt{29} \rightarrow \sqrt{65} + \sqrt{29}$$

VIII. $\mathbf{b} + \mathbf{a} + 2\mathbf{c}$

$$\langle (-4) + (5) + 2(-1), (7) + (-2) + 2(-3) \rangle = \langle -1, -1 \rangle$$

IX. $\mathbf{a} \cdot \mathbf{c}$

$$(5) \cdot (-1) + (-2) \cdot (-3) = 1$$

Vectors Practice

Question 4

Find the unit vector with the same direction

I. $\mathbf{a} = \langle -5, 12 \rangle$

$$|\langle (-5), (12) \rangle| \rightarrow \sqrt{(-5)^2 + (12)^2} = 13$$

$$\langle -5/13, 12/13 \rangle$$

Question 5

Express the vector as a linear combination of $\mathbf{i}$ and $\mathbf{j}$

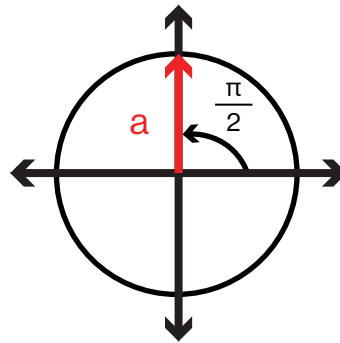
I. $\mathbf{a} = \langle -4, 6 \rangle$

$$-4\mathbf{i} + 6\mathbf{j}$$

Question 6

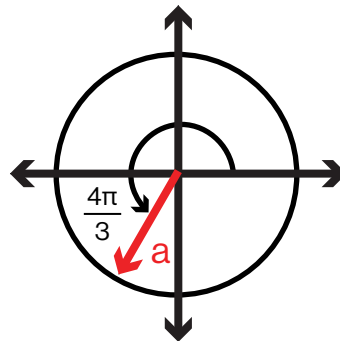
Calculate the unit vector $\mathbf{a} = (\cos \theta)\mathbf{i} + (\sin \theta)\mathbf{j}$

I. $\theta = \frac{\pi}{2}$



$$\mathbf{a} = (\cos \pi/2)\mathbf{i} + (\sin \pi/2)\mathbf{j} = 0\mathbf{i} + 1\mathbf{j} = \mathbf{j} = \langle 0, 1 \rangle$$

II. $\theta = \frac{4\pi}{3}$



$$\mathbf{a} = (\cos 4\pi/3)\mathbf{i} + (\sin 4\pi/3)\mathbf{j} = -\frac{1}{2}\mathbf{i} + \frac{-\sqrt{3}}{2}\mathbf{j} = \langle -1/2, -\sqrt{3}/2 \rangle$$

Vectors Practice

Question 7

Determine the direction angle of θ of the vector (round to the nearest whole number)

I. $\mathbf{a} = \langle -2, -5 \rangle$

$$\theta = \tan^{-1} \frac{-5}{-2} \approx 68^\circ \quad \text{QI}$$

$$68^\circ + 180^\circ = 248^\circ \quad \text{QIII}$$

Question 8

Determine the direction angle and magnitude of the vector (round to the nearest whole number)

I. $\mathbf{a} = 3[(\cos 45^\circ)\mathbf{i} + (\sin 45^\circ)\mathbf{j}]$

$$|\mathbf{a}| = \sqrt{(3\cos 45^\circ)^2 + (3\sin 45^\circ)^2} \rightarrow \begin{array}{cc} \text{magnitude} & \text{direction angle} \\ 3 & 45^\circ \end{array}$$

II. $\mathbf{b} = \langle -1/2, \sqrt{3}/2 \rangle$

$$|\mathbf{a}| = \sqrt{(-1/2)^2 + (\sqrt{3}/2)^2} \rightarrow \begin{array}{cc} \text{magnitude} & \text{direction angle} \\ 1 & 120^\circ \end{array}$$

$$\theta = \tan^{-1} \left(\frac{\frac{\sqrt{3}}{2}}{\frac{-1}{2}} \right) = 60^\circ \quad \text{QI}$$

$$180^\circ - 60^\circ = 120^\circ \quad \text{QII}$$

III. $\mathbf{c} = -\mathbf{i} - \mathbf{j}$

$$|\mathbf{a}| = \sqrt{(-1)^2 + (-1)^2} \rightarrow \begin{array}{cc} \text{magnitude} & \text{direction angle} \\ \sqrt{2} & 225^\circ \end{array}$$

$$\theta = \tan^{-1} \left(\frac{-1}{-1} \right) = 45^\circ \quad \text{QI}$$

$$180^\circ + 45^\circ = 225^\circ \quad \text{QIII}$$

Vectors Practice

Question 9

Find the angle between the vectors (round to the nearest whole number)

1. $\mathbf{a} = \langle 2, -5 \rangle$ $\mathbf{b} = \langle 1, 4 \rangle$

$$(2) \cdot (1) + (-5) \cdot (4) = -18$$

$$|\mathbf{a}| = \sqrt{(2)^2 + (-5)^2} = \sqrt{29} \quad |\mathbf{b}| = \sqrt{(1)^2 + (4)^2} = \sqrt{17}$$

$$\theta = \cos^{-1} \left(\frac{-18}{\sqrt{29} \cdot \sqrt{17}} \right) = 144^\circ$$