

1. Let $\vec{a} = [-1,8]$, $\vec{b} = [2,4]$, $\vec{c} = [-2,5]$ and $\vec{d} = [-5,8]$. Determine each of the following:

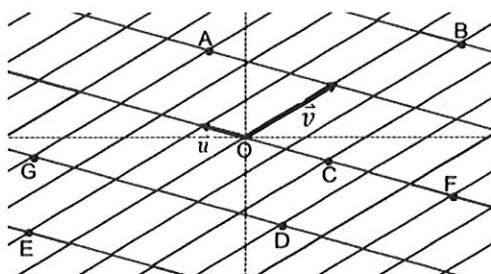
- a) $\vec{a} + \vec{b}$
- b) $\vec{c} - \vec{b}$
- c) $2\vec{a} - 3\vec{b} + 4\vec{c}$
- d) $(\vec{a} \cdot \vec{b})\vec{c}$
- e) $\vec{a} \cdot (\vec{c} - \vec{a})$
- f) $(\vec{a} \cdot \vec{b})(\vec{c} \cdot \vec{d})$
- g) $\vec{a} \downarrow \vec{b}$
- h) $(\vec{b} \downarrow \vec{c}) \cdot (2\vec{i} - 3\vec{j})$
- i) $-\frac{1}{2}\vec{b} + 2\vec{c}$

2. Find the angles between the vectors \vec{a} , \vec{b} , \vec{c} and \vec{d} from question 1. Draw a diagram showing the angles.

3. What does your solution to question 1 part i tell you about the vectors \vec{b} , \vec{c} and \vec{d} ?

4. Use the accompanying figure to write each vector as a linear combination of \vec{u} and \vec{v} .

- a) \vec{OA}
- b) \vec{BC}
- c) \vec{AE}
- d) \vec{BE}
- e) \vec{FA}
- f) $\vec{AD} + \vec{EC}$



5. Use the given information about \vec{a} and \vec{b} to find $\vec{a} \downarrow \vec{b}$ and $\vec{b} \downarrow \vec{a}$. Draw a diagram for each.

- a) $|\vec{a}| = 3$, $|\vec{b}| = 4$ and $\vec{a} \cdot \vec{b} = 0$.
- b) $|\vec{a}| = 2$, $|\vec{b}| = 5$ and $\vec{a} \cdot \vec{b} = -\frac{1}{2}$.
- c) $|\vec{a}| = 3$, $|\vec{b}| = 8$ and $\vec{a} \cdot \vec{b} = 7.4164$.

6. Write each vector as a linear combination of $\vec{u} = [3, -5]$ and $\vec{v} = [-1, 9]$.

- a) $\vec{a} = [7, 3]$
- b) $\vec{b} = [3, 37]$
- c) $\vec{c} = 4\vec{a} + 11\vec{b}$

7. An object with a mass of 100 kg is hanging from two ropes making angles 40° and 30° with the ceiling. Determine the tension in the ropes.

8. Two forces act on an object at an angle of 32° to each other. One force has a magnitude of 150 N and the other 220 N. Determine the resultant force.

9. Greg wishes to cross a river with a current flowing south at 4 mph. His motorboat travels perpendicular to the current at 12 mph east. What is the resultant speed and direction of the boat?

10. A sled is pulled forward by two dogs, each attached to the sled by a tow line. The angle between the two tow lines is 35° . How many times harder must one dog be pulling if the sled's path is at an angle of 20° to the left hand dog's towline?

Answers: 1.a) $[1, 12]$ b) $[-4, 1]$ c) $[-16, 24]$ d) $[-60, 150]$ e) -23 f) 1500 g) $[3, 6]$ h) $[-30]$ i) $[-5, 8]$ 2. $\theta = 33.7^\circ$, $\alpha = 14.7^\circ$, $\beta = 10.2^\circ$ 3. \vec{a} is a linear combination of \vec{b} and \vec{c} . 4.a) $\vec{OA} = 3\vec{u} + \vec{v}$ b) $\vec{BC} = -\vec{u} - 2\vec{v}$ c) $\vec{AE} = -\vec{u} - 2\vec{v}$ d) $\vec{BE} = -2\vec{u} - 3\vec{v}$ e) $\vec{FA} = 2\vec{u} - 4\vec{v}$ f) $\vec{AD} + \vec{EC} = 8\vec{u} + \vec{v}$ 5.a) $\vec{a} \downarrow \vec{b} = 0$ b) $\vec{a} \downarrow \vec{b} = 0$ c) $\vec{a} \downarrow \vec{b} = 0$ 6.a) $\vec{a} = 2\vec{u} + \vec{v}$ b) $\vec{b} = 3\vec{u} + 7\vec{v}$ c) $\vec{c} = 4\vec{u} + 11\vec{v}$ 7. $T_1 = 100 \cos 40^\circ$, $T_2 = 100 \cos 30^\circ$ 8. $R = \sqrt{150^2 + 220^2 - 2(150)(220)\cos 32^\circ}$ 9. $v = \sqrt{12^2 + 4^2}$, $\theta = \tan^{-1}(4/12)$ 10. $\frac{1}{\sin 20^\circ} = \frac{1}{\sin 35^\circ \cos \theta}$