Problem Set 1.1

1

Under what conditions on a, b, c, d is $\begin{bmatrix} c \\ d \end{bmatrix}$ a multiple m of $\begin{bmatrix} a \\ b \end{bmatrix}$? Start with the two equations$c = ma$ and $d = mb$. By eliminating m,find one equation connecting a, b, c, d. You can assume no zeroes in these numbers.

$$m = \frac{c}{a} = \frac{d}{b} \Rightarrow ad = bc$$

2

Going around a triangle from$(0, 0)$to$(5, 0)$to$(0, 12)$to$(0, 0)$, what are those three vectors $\mathbf{u}$,$\mathbf{v}$and$\mathbf{w}$? What is $\mathbf{u} + \mathbf{v} + \mathbf{w}$? What are their lengths?

$$\mathbf{u} = \begin{bmatrix} 5 \\ 0 \end{bmatrix} \quad \mathbf{v} = \begin{bmatrix} -5 \\ 12 \end{bmatrix} \quad \mathbf{w} = \begin{bmatrix} 0 \\ -12 \end{bmatrix}$$

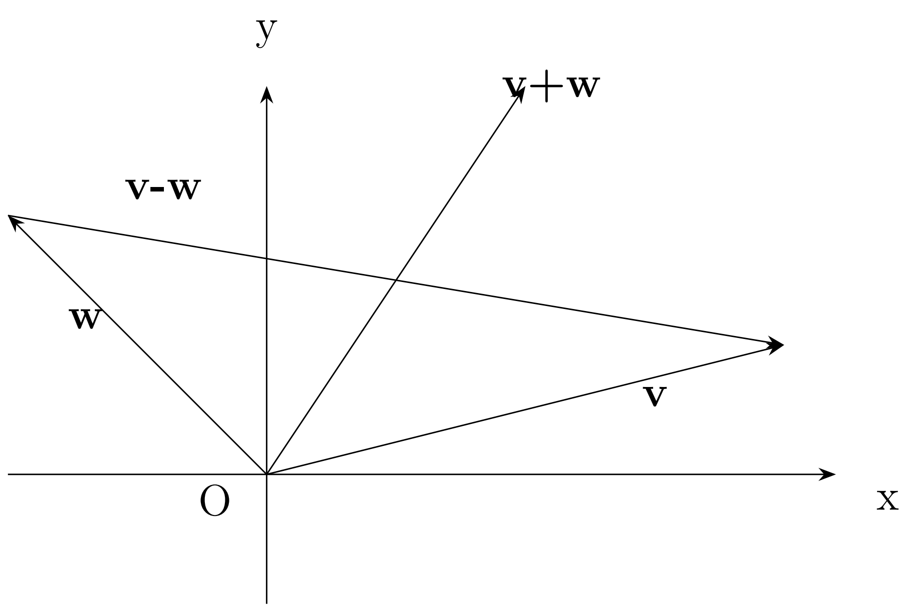
$$\mathbf{u} + \mathbf{v} + \mathbf{w} = \begin{bmatrix} 0 \\ 0 \end{bmatrix} \quad |\mathbf{u}| = 5 \quad |\mathbf{v}| = 13 \quad |\mathbf{w}| = 12$$

3

Describe geometrically all linear combinations of the given vectors.
(a) $\begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$ and $\begin{bmatrix} 3 \\ 6 \\ 9 \end{bmatrix}$:a line. (b) $\begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$ and $\begin{bmatrix} 0 \\ 2 \\ 3 \end{bmatrix}$:a plane.
(c) $\begin{bmatrix} 2 \\ 0 \\ 0 \end{bmatrix}$ and $\begin{bmatrix} 0 \\ 2 \\ 2 \end{bmatrix}$ and $\begin{bmatrix} 2 \\ 2 \\ 3 \end{bmatrix}$:all ofR^3.

4

Draw$\mathbf{v} = \begin{bmatrix} 4 \\ 1 \end{bmatrix}$and $\mathbf{w} = \begin{bmatrix} -2 \\ 2 \end{bmatrix}$ and $\mathbf{v} + \mathbf{w}$and $\mathbf{v} - \mathbf{w}$ in a single xy plane.


y
v+w
v-w
w
v
O
x