Solutions

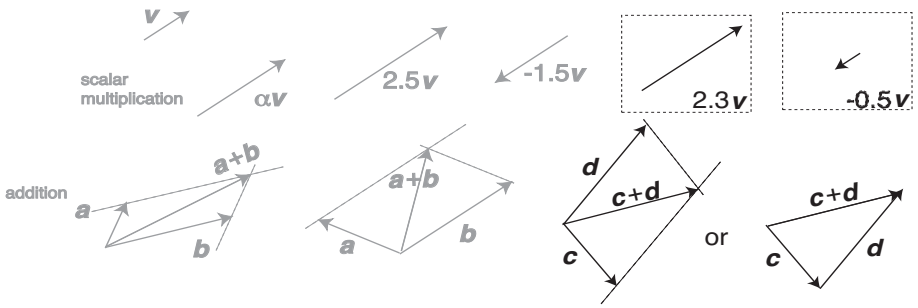

Fig. 1 Vector: scalar multiplication and addition. Here $\alpha > 0$ is assumed. Complete the figures.

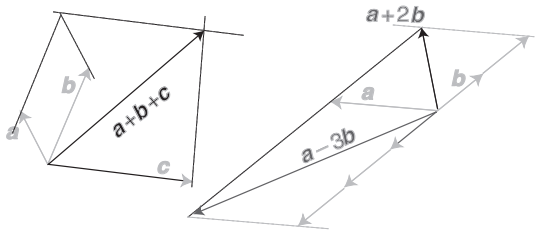

Fig. 2 Exercise. Construct the vectors asked in the figure.

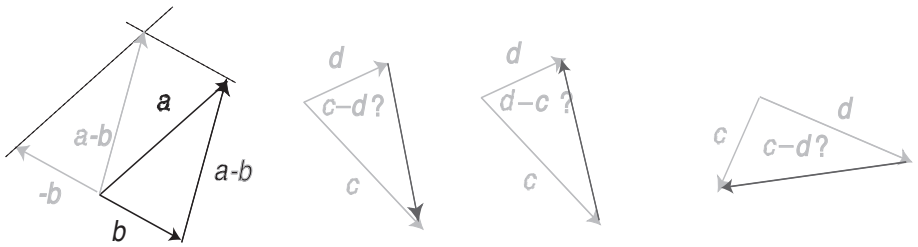

Fig. 3 Subtraction of vectors. Complete the figures.

$*$ $\boldsymbol{a}+\boldsymbol{b}=(1,9)$, $\boldsymbol{a}-\boldsymbol{b}=(3,-1)$, $2\boldsymbol{a}-\boldsymbol{b}=(5,3)$ and $-2\boldsymbol{a}+5\boldsymbol{b}=(-9,17)$.
$*$ $|(2,5)|=5.4=|(-2,5)|$, $|(3,4)|=5$.

$*$ $\sin 45^\circ = 1/\sqrt{2}$, $\sin 0^\circ = 0$, $\sin 90^\circ = 1$, $\sin 45^\circ = 1/\sqrt{2}$, $\cos 45^\circ = 1/\sqrt{2}$, $\tan 45^\circ = 1$, $\sin 30^\circ = 1/2$, $\tan 60^\circ = \sqrt{3}$.

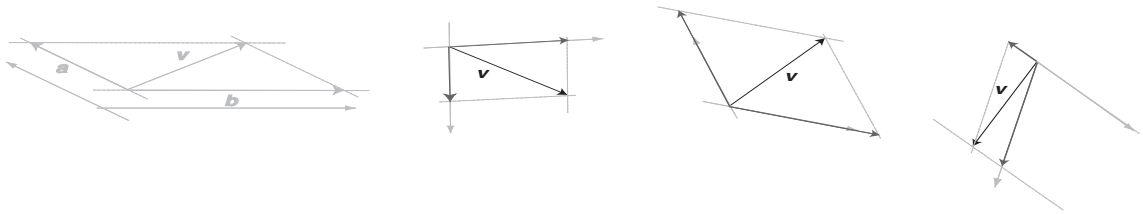

Fig. 4 Decomposition of a vector $\boldsymbol{v}$: Complete the right three figures, constructing '$\boldsymbol{a}$' and '$\boldsymbol{b}$.'

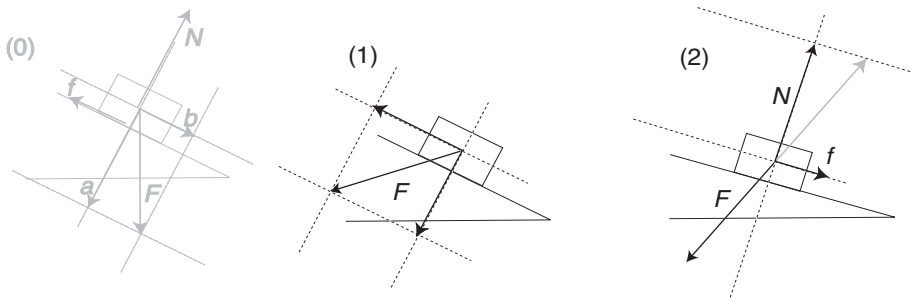

Fig. 5 Decomposition of force into two directions. (1) Suppose you push the block as shown in the figure. Find its components parallel and perpendicular to the surface of the incline. (2) Suppose the force due to gravity + your pushing is $\boldsymbol{F}$ as shown in the figure. Assuming that the block is stationary, find the frictional $\boldsymbol{f}$ and normal forces $\boldsymbol{N}$.

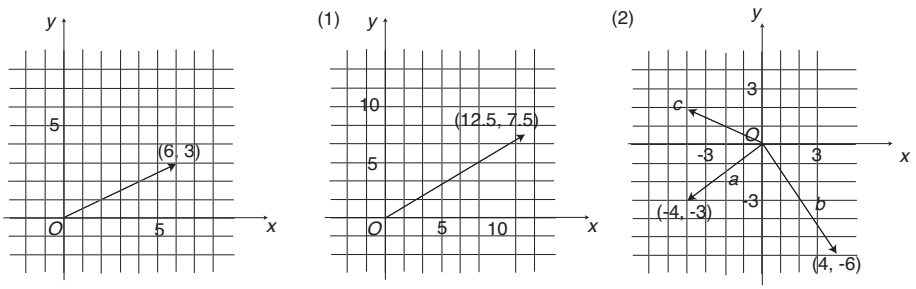

Fig. 6 Coordinate expression of vectors: (1) Find the x and y components. (2) For $\boldsymbol{a}$ and $\boldsymbol{b}$, find components. Draw a vector $\boldsymbol{c}$ given by $(-4, 2)$.

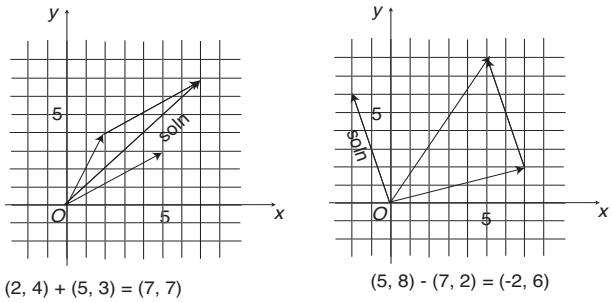

Fig. 7 Draw the results of addition examples.