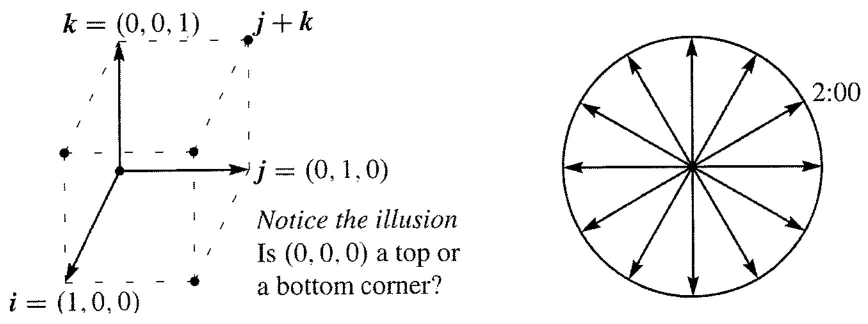

Figure 1.4: Unit cube from $\boldsymbol{i}, \boldsymbol{j}, \boldsymbol{k}$ and twelve clock vectors.

13 (a) What is the sum V of the twelve vectors that go from the center of a clock to the hours 1:00, 2:00, ..., 12:00?

(b) If the 2:00 vector is removed, why do the 11 remaining vectors add to 8:00?

(c) What are the x, y components of that 2:00 vector $v = (\cos\theta, \sin\theta)$?

14 Suppose the twelve vectors start from 6:00 at the bottom instead of $(0, 0)$ at the center. The vector to 12:00 is doubled to $(0, 2)$. The new twelve vectors add to ____.

Problems 15–19 go further with linear combinations of v and w (Figure 1.5a).

15 Figure 1.5a shows $\frac{1}{2}v + \frac{1}{2}w$. Mark the points $\frac{3}{4}v + \frac{1}{4}w$ and $\frac{1}{4}v + \frac{1}{4}w$ and $v + w$.

16 Mark the point $-v + 2w$ and any other combination $cv + dw$ with $c + d = 1$. Draw the line of all combinations that have $c + d = 1$.

17 Locate $\frac{1}{3}v + \frac{1}{3}w$ and $\frac{2}{3}v + \frac{2}{3}w$. The combinations $cv + cw$ fill out what line?

18 Restricted by $0 \le c \le 1$ and $0 \le d \le 1$, shade in all combinations $cv + dw$.

19 Restricted only by $c \ge 0$ and $d \ge 0$ draw the "cone" of all combinations $cv + dw$.

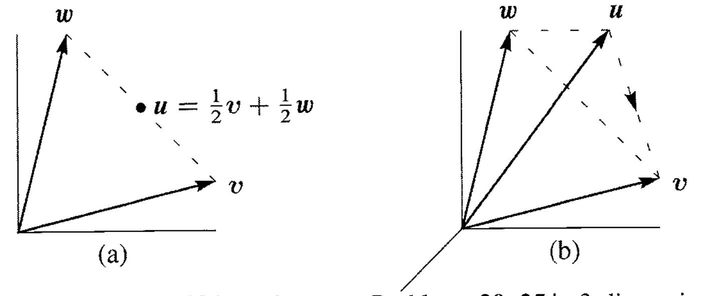

Figure 1.5: Problems **15–19** in a plane Problems **20–25** in 3-dimensional space