13. We write $\vec{r} = \vec{a} + \vec{b}$. When not explicitly displayed, the units here are assumed to be meters. Then $r_x = a_x + b_x = 4.0 - 13 = -9.0$ and $r_y = a_y + b_y = 3.0 + 7.0 = 10$. Thus $\vec{r} = (-9.0\,\text{m})\,\hat{\text{i}} + (10\,\text{m})\,\hat{\text{j}}$. The magnitude of the resultant is

$$r = \sqrt{r_x^2 + r_y^2} = \sqrt{(-9.0)^2 + (10)^2} = 13 \text{ m} .$$

The angle between the resultant and the $+x$ axis is given by $\tan^{-1}(r_y/r_x) = \tan^{-1} 10/(-9.0)$ which is either $-48°$ or $132°$. Since the x component of the resultant is negative and the y component is positive, characteristic of the second quadrant, we find the angle is $132°$ (measured counterclockwise from $+x$ axis).

21. It should be mentioned that an efficient way to work this vector addition problem is with the cosine law for general triangles (and since $\vec{a}$, $\vec{b}$ and $\vec{r}$ form an isosceles triangle, the angles are easy to figure). However, in the interest of reinforcing the usual systematic approach to vector addition, we note that the angle $\vec{b}$ makes with the $+x$ axis is 135° and apply Eq. 3-5 and Eq. 3-6 where appropriate.

(a) The x component of $\vec{r}$ is $10\cos 30° + 10\cos 135° = 1.59$ m.

(b) The y component of $\vec{r}$ is $10\sin 30° + 10\sin 135° = 12.1$ m.

(c) The magnitude of $\vec{r}$ is $\sqrt{1.59^2 + 12.1^2} = 12.2$ m.

(d) The angle between $\vec{r}$ and the $+x$ direction is $\tan^{-1}(12.1/1.59) = 82.5°$.

36. If a vector capable calculator is used, this makes a good exercise for getting familiar with those features. Here we briefly sketch the method. Eq. 3-30 leads to

$$2\vec{A} \times \vec{B} = 2\left(2\,\hat{\text{i}} + 3\,\hat{\text{j}} - 4\,\hat{\text{k}}\right) \times \left(-3\,\hat{\text{i}} + 4\,\hat{\text{j}} + 2\,\hat{\text{k}}\right) = 44\,\hat{\text{i}} + 16\,\hat{\text{j}} + 34\,\hat{\text{k}} \ .$$

We now apply Eq. 3-23 to evaluate $3\vec{C} \cdot \left(2\vec{A} \times \vec{B}\right)$:

$$3\left(7\,\hat{\text{i}} - 8\,\hat{\text{j}}\right) \cdot \left(44\,\hat{\text{i}} + 16\,\hat{\text{j}} + 34\,\hat{\text{k}}\right) = 3\left((7)(44) + (-8)(16) + (0)(34)\right) = 540 \ .$$