Exercise 11

For the following exercises, rewrite the quadratic functions in standard form and give the vertex.

$$k(x) = 3x^2 - 6x - 9$$

Solution

Begin by factoring the coefficient of x^2.

$$k(x) = 3(x^2 - 2x - 3)$$

In order to write this quadratic function in vertex form, it's necessary to complete the square, which makes use of the following algebraic identity.

$$(x + B)^2 = x^2 + 2xB + B^2$$

Notice that $2B = -2$, which means $B = -1$ and $B^2 = 1$. Add and subtract 1 on the right side within the parentheses and use the identity so that x appears in only one place.

$$\begin{aligned}
k(x) &= 3(x^2 - 2x - 3) \\
&= 3[(x^2 - 2x + 1) - 3 - 1] \\
&= 3[(x + (-1))^2 - 4] \\
&= 3[(x - 1)^2 - 4] \\
&= 3(x - 1)^2 - 12
\end{aligned}$$

Therefore, the vertex of the parabola is $(1, -12)$.