6. $r_+(a) = \dfrac{-1+\sqrt{1+a}}{a}$, $r_-(a) = \dfrac{-1-\sqrt{1+a}}{a}$.

a) $\lim_{a\to 0} r_-(a)$ does not exist. Observe that the right limit is $-\infty$ and the left limit is ∞.

b) From the following table it appears that $\lim_{a\to 0} r_+(a) = 1/2$, the solution of the linear equation $2x - 1 = 0$ which results from setting $a = 0$ in the quadratic equation $ax^2 + 2x - 1 = 0$.

a	$r_+(a)$
1	0.41421
0.1	0.48810
-0.1	0.51317
0.01	0.49876
-0.01	0.50126
0.001	0.49988
-0.001	0.50013

c)
$$\begin{aligned}\lim_{a\to 0} r_+(a) &= \lim_{a\to 0} \frac{\sqrt{1+a}-1}{a}\\ &= \lim_{a\to 0} \frac{(1+a)-1}{a(\sqrt{1+a}+1)}\\ &= \lim_{a\to 0} \frac{1}{\sqrt{1+a}+1} = \frac{1}{2}.\end{aligned}$$