

**Exercise 9**

Find the limit.

$$\lim_{r \rightarrow 9} \frac{\sqrt{r}}{(r-9)^4}$$

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**Solution**

Plugging in 9 right away for  $r$  gives 0 in the denominator, so simplify the function first or rewrite the limit. Make the substitution,  $u = r - 9$ . Then as  $r \rightarrow 9$ ,  $u \rightarrow 0$ .

$$\begin{aligned} \lim_{r \rightarrow 9} \frac{\sqrt{r}}{(r-9)^4} &= \lim_{u \rightarrow 0} \frac{\sqrt{u+9}}{(u)^4} \\ &= \lim_{u \rightarrow 0} \frac{1}{u^4} \sqrt{u+9} \\ &= \lim_{u \rightarrow 0} \sqrt{\frac{1}{u^8}(u+9)} \\ &= \lim_{u \rightarrow 0} \sqrt{\frac{1}{u^7} + \frac{9}{u^8}} \\ &= \sqrt{\infty + \infty} \\ &= \infty \end{aligned}$$