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We give necessary and sufficient conditions that determine when a vertex replacement rule given by exactly one replacement graph generates an infinite graph with exponential growth and when it generates an infinite graph with polynomial growth. We also compute the formula for the growth degree of infinite graphs with polynomial growth that are generated by vertex replacement rules given by exactly one replacement graph and show that it coincides with the Hausdorff dimension of the fractal generated by the same rule. (Received July 23, 2009)