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A rational elliptic surface with section is the blow up of  $\mathbb{P}^2$  at the 9 base points of a pencil of cubics and the elliptic fibration is given by the induced map to  $\mathbb{P}^1$  determined by this pencil. It is more useful to interpret it as a fibration over  $\mathbb{P}^1$  with generic fiber an elliptic curve. Singular fibers of elliptic surfaces with section had been classified by Kodaira. For rational elliptic surfaces with section all possible configurations of singular fibers have been listed by Persson. The automorphism group of a rational elliptic surface with section is closely related to the configuration of singular fibers on that surface. This configuration determines the Mordell-Weil group (group of sections) which can be seen as a subgroup of the automorphism group by translation in each smooth fiber, an elliptic curve. Another subgroup of automorphisms is the automorphisms which send the zero section to itself setwise. The configuration of singular fibers is again important to determine this second subgroup via the combinatorial information it gives. Finite groups of order up to 24 may arise as such subgroups. The whole automorphism group is then the semidirect product of these two subgroups. All elliptic surfaces are assumed relatively minimal. (Received February 16, 2010)