This article deals with mathematical aspects of *planar* $\mathcal{N} = 4$ super Yang-Mills theory in the context of the AdS/CFT correspondence in string theory. Recently, it is shown that the $\mathcal{N} = 4$ planar amplitudes in a strong coupling region can be calculated from the areas of minimal surfaces in the AdS space which are circumvented by light-like segments [1]. For eight-point gluon amplitudes, it is shown that the amplitudes are given by the minimal surfaces of octagons in an AdS_3 subspace of AdS_5. The relevant calculations can be reduced to a problem of solving a set of equations in certain integrable models such as a generalized sinh-Gordon model and an $SU(2)$ Hitchin system [2]. Since the planar $\mathcal{N} = 4$ super Yang-Mills theory is integrable, these results are not surprising. They are, however, technically useful and are expected to provide clues to quantum aspects of the loop amplitudes.

This article under review should be considered as a generalization of the above results. It shows that the planar amplitudes at strong coupling for arbitrary number of gluons can be calculated from minimal surfaces in AdS_5 space, rather than the AdS_3 subspace. Furthermore, it reveals that the relevant computations can be reduced to a problem of solving a set of functional equations given by the so-called thermodynamic Bethe ansatz (TBA) system [3]. Technical details are also provided in the appendices.

References

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