On the Proportions of Ships of least Skin Resistance for a given Speed and Displacement. By Prof. RANKINE.

From the London Athenaeum, Sept., 1863.

The author referred to a previous paper which he had read to the British Association in 1861, and in which he had stated the results of a theoretical investigation of the "skin-resistance" of ships, and verified those results by a comparison with those of experiments. In the course of that paper he had stated, that the theory gives, for the proportion of length to breadth which produces least skin-resistance with a given displacement and speed, that of *seven to one*, nearly. This is the case when the figures and proportions of the cross-sections are given, so that the draft of water bears a fixed proportion to the breadth. But, when the draft of water has a fixed absolute value, the theory gives a somewhat different result; for the proportion of length to breadth which produces the least skin-resistance is found to increase as the draft of water becomes shallower.

Proceedings British Association.

For the Journal of the Franklin Institute.

$$\text{On the Integral of } \frac{dz^2}{dx^2} = \frac{8w}{R} z^{\frac{3}{2}} + c.$$

By DE VOLSON WOOD. Prof. of Civ. Eng. Univ. of Mich.

In an article on "*Beams of Uniform Strength*," published in Vol. xlii, third series, page 110 of this *Journal*, will be found the equation at the head of this article in which c is the constant of integration. I raised the query whether it could be integrated in finite terms. Upon a recent examination of it, I find that it may be integrated by means of the higher transcendental, in the following way:

$$\text{We have } dx = \frac{dz}{\sqrt{c + \frac{8w}{R} z^{\frac{3}{2}}}} = \sqrt{\frac{R}{8w}} \frac{dz}{\sqrt{c_1^2 + z^{\frac{3}{2}}}} \quad (1)$$

$$\text{where } c_1^2 = \frac{RC}{8w}.$$

Let $z^{\frac{3}{2}} = -u^2$ and the equation becomes

$$dx = -\frac{2}{3c_1} \sqrt{\frac{R}{8w}} \frac{u^{\frac{1}{2}} du}{\sqrt{1 - \frac{u^2}{c_1^2}}} \quad (2)$$

$$\text{Now let } \frac{u}{c_1} = (1-y^2)^{\frac{3}{2}} \quad \therefore u^{\frac{1}{2}} = c_1^{\frac{1}{2}} (1-y^2)^{\frac{1}{4}}$$

$$du = \frac{3}{2}(1-y^2)^{\frac{1}{2}} dy$$

(This y is not the depth of the beam as used in the problem.)