$$\therefore \frac{h}{b+CD} = \frac{\frac{2h}{a+b+CD}}{1-\frac{h^2}{(a+b+CD)^2}}$$

$$\therefore CD = \sqrt{a^2-h^2}-b$$

$$\text{again } \frac{h}{\sqrt{a^2-h^2}+b} = \frac{\frac{h}{a+\sqrt{a^2-h^2}}+\frac{h}{\sqrt{a^2-h^2}}}{1-\frac{h^2}{a\sqrt{a^2-h^2}+a^2-h^2}}$$

$$= \tan. 3m$$

$$\therefore h = \frac{a}{2b}\sqrt{(3b-a)(b+a)}$$

MATHEMATICAL NOTES, SOLUTIONS, &c.

1. To shew that the series whose n^{th} terms is $\sqrt{n^2+1}-n$ is divergent.

The series is $1+\sqrt{2}-1+\sqrt{5}-1+$&c.

$$= 1+\frac{1}{\sqrt{2}+1}+\frac{1}{\sqrt{5}+1}+ \text{ &c.}$$

$> 1+\frac{1}{3}+\frac{1}{4}+\frac{1}{5}+$ &c., and is $\therefore$ divergent.

2. A farm is let for £96 and the value of a certain numbers of quarters of wheat. When wheat is 38 shillings a quarter, the whole rent is 15 per cent. lower than when wheat is 56 shillings a quarter. Find the number of quarters of wheat which are paid as part of the rent.

Reducing the value of the wheat by $\frac{18}{56}$ has the effect of reducing the whole rent 15 per cent.; hence it follows that the value of the wheat bears to the whole rent the ratio $\frac{150}{1000} : \frac{18}{56}$, *i. e.*, 7 : 15, and $\therefore$ bears to the cash part of the rent (£96) the ratio 7 : 8, and hence the value of the wheat at 56 shillings a quarter is £84, $\therefore$ number of quarters is 30.

PROBLEMS.

[We commence in this number a series of Problems which will be continued in subsequent numbers of the Magazine. Solutions to the Problems will be given the month after they appear.]

1. Having only a plane ruler with parallel straight edges, construct an isosceles triangle.

2. With the same, bisect a given finite straight line.

3. With the same, bisect a given rectilineal angle.

4. Also, find the centre of a given circle.

5. A body moves from rest with an acceleration which remains constant during certain successive equal intervals of time, but is changed at the expiration of each such interval, so that the space described in the n^{th} interval is always $2^{1-n}(2^{n+1}-3)$ times the space described in the first of them. If the velocity acquired at the end of the first interval be v, show that after a long lapse of time the velocity approaches a uniform velocity $2v$.

6. An engine, whose power is sufficient to generate in one second a velocity of 150 feet a second in a mass M (which is its own mass), is attached to a carriage, whose mass is $\frac{1}{2}$ M by means of an inelastic weightless chain 3 ft. long; this carriage is attached in the same way to another whose mass is $\frac{1}{3}$ M; this to a third whose mass is $\frac{1}{5}$ M. The engine and carriages are successively in contact when the train starts; show that the last carriage will begin to move with a velocity of 33 ft. per second nearly.

7. A number of equal heavy particles are fastened at equal distances, a, on an inelastic string and placed in contact in a vertical line; show that if the lowest be then allowed to fall freely the velocity with which the n^{th} begins to move is

$$\sqrt{\left\{ag\frac{(n-1)(2n-1)}{3n}\right\}}$$

8. If $\frac{a+b}{1-ab} = \frac{c+d}{cd-1}$

Prove that $\frac{a+b+c+d}{\frac{1}{a}+\frac{1}{b}+\frac{1}{c}+\frac{1}{d}} = abcd.$