CA at F. $BD^2 = BA^2 + AD^2 + 2FA \cdot AD = BA^2 + AD^2 + CA \cdot AD = BA^2 + CD \cdot DA = 2AC^2$.

158. Let BAD be a $\triangle$ having vertical $<$ A a rt. $<$ draw AC $\perp$ to BD. $AD^2 = AB^2 + BD^2 - 2BC \cdot CD$. $AC^2 + CD^2 = AC^2 + BC^2 + AB^2 + AD^2 - 2BC \cdot BD$. $CD^2 = 2BC^2 + 2AC^2 + CD^2 - 2BC \cdot BD$. $BC \cdot BD = BC^2 + AC^2$. $BC.CD = AC^2$.

159. Construct same as preceding, then $BC \cdot CD = AC^2$; $BC \cdot BD = AB^2$.

160. $BC^2 = BA^2 + AC^2 + 2CA \cdot AE = BA^2 + EC\ CA + CA \cdot AE = BA^2 + BA \cdot AF + EC \cdot CA = FB \cdot BA + EC \cdot CA$.

161. Let AB be the larger str. line and C the smaller, through B draw BD = to C at rt. $<$s to AB, bisect AB at E and from E at the distance EB describe the circle ABF. Through D draw DF $\parallel$ to AB and meeting the circle at F and from F draw FG $\perp$ to AB; $AG \cdot GB = BD^2 = G^2$ by Prop 14.

MATHEMATICAL NOTES.

In solving such questions as the following :—If A can do a piece of work in 5 days, B in 6 days, and C in 8 days; in what time can all three working together do the work ? A simpler solution than the ordinary one may be given, and this class of questions placed under L. C. M. instead of under Fractions as is usually done. Thus,

If A can do the work once in 5 days he could do it 24 times in 120 days.
B " " 20 " " "
C " " 15 " " "

A, B and C together could do the work 59 times in 120 days, or once in $1\frac{5}{59}$ days. It will be seen that 120 is L. C. M. of 5, 6, 8; and so in all similar cases.

FIRST CLASS PROVINCIAL CERTIFICATES, COMMENCING 26th DECEMBER, 1873.

ALGEBRA.

TIME—TWO-HOURS-AND-THREE-QUARTERS.

1. Three clocks, A, B and C, the first of which is gaining uniformly, and the last losing uniformly, while the second keeps correct time, are all right at noon. The rates at which they go are in geometrical progression. When C indicates midnight, A is $2\frac{1}{18}$ minutes ahead of true time. Find how many seconds A gains, and how many C loses, in the hour.

2. A hare is a certain distance ahead of a greyhound. It takes 12 leaps in m seconds, the greyhound taking 9 leaps in the same time; and 2 of the greyhound's leaps are equal to 3 of the hare's. After having taken half as many leaps as are necessary to catch the hare, the greyhound increases by one the number of leaps it takes in n seconds, the length of its leaps remaining unchanged. In consequence of this, it catches the hare t seconds sooner than it would otherwise have done. Find by how many of its own leaps the hare was ahead of the greyhound at starting.

3. Given $(m + n)\, pq = p + q$, and $(p + q)\, mn = m + n$. Prove that, if m and n be the roots of the equation, $2x^2 + ax + 3 = 0$, p and q shall be the roots