

to establish and maintain schools in which the principle of parental authority is in force. This right is not a so-called right, but a real and most sacred right, granted to them by their Protestant fellow-citizens of Ontario, and guaranteed to them by the Parliament of England in the British North America Act of Confederation. Roman Catholics, as such, have no corporate existence in Ontario any more than the members of the other denominations of its citizens; consequently what is denied to them in that capacity by the *Journal* is not a privation in any sense. In Ontario, every denomination is on a footing of the most perfect equality before the law. Until now, I was not aware that the Catholics existed in a "corporate capacity" in the United States.

It is not correct to call the Roman Catholic Separate Schools *private schools*. They are established by law; supported, taught, and inspected according to law; and in every way conducted like the Public Schools, and, like them, receive Government recognition and aid in proportion to the work they do; the only difference being the one already indicated. The Roman Catholic Schools in Ontario are as much and as perfectly a portion of the educational machinery of the country as are the Public Schools of the majority. Not only in Ontario, but in general throughout every part of the British Empire, parents enjoy the right to educate their children according to the dictates of their conscience and the teachings of their religion. And we American Catholics here in Canada cannot help regretting the absence of a similar privilege for our co-religionists in your great Republic, which we all so much admire in all respects save this one.

The *Journal* says:—"The right to establish Separate Schools was conceded *thoughtlessly* by the conquerors of Quebec, and cannot be accredited to the liberality of the Ontario Government, which, had it been left to itself, would have nobly refused to disfigure its educational system with Separate Schools."

To these assertions I may be permitted to say the certain things are brought together here and mixed up a little which must be kept apart. The Treaty of Quebec, subsequently ratified in Paris, secured to the French Canadian inhabitants of Canada all the rights and privileges—social, civil, and religious—then enjoyed by them in as far as compatible with British law. Nothing was then said or done, asked for or conceded, thoughtlessly or otherwise, in reference to Roman Catholic Separate Schools in Ontario. As a matter of fact, our first Catholic Schools in Ontario (then Upper Canada) were opened somewhere about the year 1830, under the Right Rev. and Right Honorable Bishop McDonald, first Roman Catholic Bishop in Upper Canada, and member of the Privy Council. He brought over a few Catholic teachers from Scotland, and at first supported them largely at his own expense. But it was in the year 1842 that Separate Schools were first legally established in Ontario (Upper Canada). The provisions in their favor have, from time to time, been extended, and at the time of Confederation were placed under the shield of British protection, with the consent and through the liberality of the Protestant majority of Ontario. And in doing so they have not at all *disfigured their own educational system*; on the contrary, they have done right nobly, and wisely, and well, in acceding to the conscientious demands of their Roman Catholic fellow-citizens, and allowing them to educate their children as they think proper. Not to the State, but to the parent, was it said:—"Train up a child in the way he should go, and when he is old he will not depart from it."

Further evidence of the enlightened liberality of the Protestants of Ontario towards their Roman Catholic fellow-citizens is to be found in the School Bill now on its way through our House of Assembly, in which further improvements are being made to our Separate School Law, bringing its provisions into more complete harmony with the Public School Law, and rendering it more efficient and more acceptable to the supporters of Separate Schools. This fresh concession has been made to us by the unanimous voice of our Legislative Assembly of Ontario, and must not be accredited to what was thoughtlessly done by the conquerors of Quebec.

In conclusion, I beg to enquire: 1st. Does the *Journal* think the Protestant majority in Ontario would do well now to force its school system on the Catholic minority? If so, would the Catholic majority of Quebec do right to force its system on the Protestant minority? 2nd. In France, in Bavaria, in the Catholic Cantons of Switzerland, in Belgium, in Wurtemberg, and in those parts of Prussia where Catholics are a majority, would they do nobly to force the Protestant minority into their schools?

A satisfactory reply to these questions will be found interesting

to educationists on both sides of the line, and to the friends of true liberty everywhere.

I am, sir, your obedient servant,

M. STAFFORD, Pt.

Lindsay, Ont., March 6th, 1879.

## Mathematical Department.

Communications intended for this part of the *JOURNAL* should be on separate sheets, written on only one side, and properly pagged to prevent mistakes. They must be received on or before the 20th of the month to secure notice in the succeeding issue.

ALFRED BAKER, M.A., EDITOR.

### RELATIONS BETWEEN THE ROOTS AND THE COEFFICIENTS OF EQUATIONS.

It will be remembered that if  $a, b$  be the roots of  $x^2 + px + q = 0$ , then  $a + b = -p$ ;  $ab = q$ ; or if  $\alpha, \beta$  be the roots of  $ax^2 + bx + c = 0$ , then  $\alpha + \beta = -\frac{b}{a}$ ,  $\alpha\beta = \frac{c}{a}$ . These relations may be made use of to obtain the values of various symmetrical functions of the roots in terms of the coefficients, and to form equations whose roots are symmetrical functions of the roots of given equations, without actually solving the equations. We proceed to give some examples.

Ex. 1. If  $a, b$  be the roots of  $x^2 - px + q = 0$ , find the value of  $\frac{a}{b} + \frac{b}{a}$  and of  $a^3 + b^3$ .

Here  $a + b = p$ ,  $ab = q$ .

$$\text{Also } \frac{a}{b} + \frac{b}{a} = \frac{a^2 + b^2}{ab} = \frac{(a + b)^2 - 2ab}{ab} = \frac{p^2 - 2q}{q}.$$

$$\text{And } a^3 + b^3 = (a + b)(a^2 + b^2 - ab) = (a + b)\{(a + b)^2 - 3ab\} = p(p^2 - 3q).$$

Ex. 2. If the roots of  $x^2 + px + q = 0$ , and  $x^2 + qx + p = 0$  differ by the same quantity, show that  $p + q + 4 = 0$ .

Let  $k$  be this quantity, so that the roots of the first equation are  $a, a + k$ , and those of the second  $b, b + k$ .

Then  $a + a + k = -p$  (1),  $a(a + k) = q$  (2).

Also,  $b + b + k = -q$  (3),  $b(b + k) = p$  (4).

$$(1) - (3) \text{ gives } 2(a - b) = q - p,$$

$$(2) - (4) \text{ gives } a^2 - b^2 + k(a - b) = q - p;$$

$$\therefore a^2 - b^2 + k(a - b) = 2(a - b),$$

$$\text{or } a + b + k = 2.$$

$$\text{Again, } (1) + (3) \text{ gives } 2(a + b) + 2k = -(p + q);$$

$$\therefore 4 = -(p + q),$$

$$\text{or } p + q + 4 = 0.$$

Ex. 3. If  $a, b$  be the roots of  $px^2 + qx + r = 0$ , form the equation whose roots are  $a^2 + b^2$ ,  $a^{-2} + b^{-2}$ .

$$\text{Here } a + b = -\frac{q}{p}, ab = \frac{r}{p}.$$

$$\text{The required equation is } \left\{x - (a^2 + b^2)\right\} \left\{x - \frac{a^2 + b^2}{a^2 b^2}\right\} = 0,$$

$$\text{or } x^2 - (a^2 + b^2 + \frac{a^2 + b^2}{a^2 b^2})x + \frac{(a^2 + b^2)^2}{a^2 b^2} = 0.$$

$$\text{Now } a^2 + b^2 = (a + b)^2 - 2ab = \frac{q^2}{p^2} - \frac{2r}{p}.$$

Hence the required equation becomes

$$x^2 - \left(\frac{q^2 - 2pr}{p^2} + \frac{p^2}{r^2}\right)x + \frac{\left(\frac{q^2 - 2pr}{p^2}\right)^2}{\frac{r^2}{p^2}} = 0,$$

$$\text{or } p^2 x^2 - (q^2 - 2pr)(p^2 + r^2)x + (q^2 - 2pr)^2 = 0.$$

Our readers may work the following:

1. If  $a, b$  be the roots of the equation  $px^2 + qx + r = 0$ , form the