SELECTED QUESTIONS,

From Science and Arts Department, December. 1882 (England).

6. Show that $w^3+x^3+y^3+z^3=(w-x)^3+(w-y)^3+(w-z)^3+6xyz$, if $w=x+y+z$.

7. Solve the equations

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

$$(b)\ x+y=a^3\left(\frac{1}{x^3}+\frac{1}{y^3}\right)$$

$$\frac{1}{x^2}+\frac{1}{y^2}=\frac{1}{b^2}+\frac{b}{xy}.$$

8. A and B are two points on the bank of a river, which flows down from A to B at the rate of $2\frac{1}{2}$ miles an hour. A boat whose crew would row it in still water at the rate of $8\frac{1}{2}$ miles an hour starts from B for A at the same instant that a steam-launch starts from A for B. If the steam-launch (moving under a constant pressure) on reaching B returns without loss of time and arrives at A along with the boat, with what velocity would the launch move in still water under the constant pressure?

9. Given $\alpha+\beta=a$ and $\alpha\beta=b^2$, find the value of $\alpha^4+\alpha^3\beta^2+\alpha^2\beta^3+\beta^4$.

10. Show that the sum of the squares of the first n natural numbers is

$$n(n+1)(2n+1)\div 6.$$

Find an expression for the sum of the squares of the first n odd numbers.

11. Show that the convergents of a continued fraction taken in order are alternately greater and less than the fraction itself.

Show that the fraction

$$\frac{1}{2+}\ \frac{1}{3+}\ \frac{1}{100+}\ \frac{1}{a+}\ \frac{1}{b+}$$

etc., differs from $\frac{3}{7}$ by less than $\frac{1}{4914}$.

EDUCATION DEPARTMENT, ONTARIO.

DECEMBER, 1882.—SPECIAL EXAMINATION.

Intermediate.

ARITHMETIC.

1. There is a rectangle whose length is $1\frac{1}{2}$ times its width, and which may be planked with boards of lengths 5, 8 or 9 feet, all running parallel to any (the same) side. What is the least size of the rectangle?

2. If an ounce of pure gold be worth £3 18*s.*; and $\frac{1}{9}$ in weight of a guinea be pure gold, and the remainder an alloy 50 times less valuable; what is the weight of the pure gold in a guinea?

3. How much money must be invested in stock at 97½, which pays an annual dividend of 6 per cent., to realize a income of $600 per annum?

4. A person invests $4,500 in purchasing stock at 90 (par value 100). In three months he sells 30 shares at 95, and in three months thereafter the remainder at 87. If his money be worth 8 per cent., what does he gain or lose by the transaction, no dividend having been paid on the stock in the interval?

5. Shew that the following is approximately a correct method of calculating interest at 6 per cent. for a given number of days: "Divide the number of days by 6; multiply the quotient by the number of dollars on which interest is required; and the result is the interest expressed in mills."

6. A bill due 4 months hence is discounted at 7 per cent. per annum (true discount), and $1,267 is received for it. What is its face value?

7. At what rate per cent. will $100 in 3 years amount to as much as $120 in 2 years at 7 per cent.?

8. A mortgage which is redeemed, principal and interest, by 3 equal annual payments of $250 each, is to be sold. What justly should now (a year before the first payment) be paid for it; interest 7 per cent. per annum?

9. A grocer has teas at 5*s.* and 3*s.* 6*d.* per lb. He mixes them in equal quantities, and sells the mixture at such a price that he gains as much per cent. on one kind as he loses per cent. on the other. What was the selling price, and what does he gain or lose per cent.?

10. The volume of a solid whose faces are rectangles is 786 cubic feet, and its edges are as the numbers 1, 2, 3. Find lengths of these edges.