8. For each of three succeeding months the population of a North of the base equal to one another, and also those terminated in the west town rose 50 per cent; and at the end of the third month was 2,700. What was the population at the beginning of the time ?

9. Loap year is omitted once in every century, except those cen-turies whose number is divisible by 4. What is the average length of a year l

10. A cube is formed of a cortain number of pounds avoirdupois of a substance, and the same number of pounds Troy of the same substance. What proportion will a side of the cube bear to a side of a cube formed of the same number of pounds as before, but all avoirdupois? (175 lbs. Troy = 144 lbs. avoirdupois.)

Values-1, 10; 2, 6; 3, 8; 4, 10; 5, 10: 6, 10; 7, 12; 8, 12; 9, 10; 10, 12.

ALGEBRA.

TIME-Two Hours.

(Eighty per cent. of this paper will be considered a maximum.)

1. Divide (1). $(a-b)c^{3} + (b-c)a^{3} + (c-a)b^{3}$ by (a-b)(b-c)(c-a).

(2).
$$\frac{x^2+y^2}{x^3y^3} - \frac{x^2+y^2}{x^3y^3}$$
 by $\frac{1}{x} - \frac{1}{y^2}$.

2. What must be the values of a, b, and c that $x^3 + ax^2 + bx + c$ may have x - 1, x - 2, and x - 3, all as factors? 3. Find the H.C.F. of— (1). $3x^4 - 4x^3 + 1$ and $4x^4 - 5x^3 - x^2 + x + 1$. (2). $3x^3 - y^3 + 27x^3 + 18xyz$ and $4x^2 + 12xx + 9z^2 - y^2$.

4. Simplify-

(1).
$$\left(\frac{4x^{3}}{y^{3}}-1\right)\left(\frac{2x}{2x-y}-1\right)+\left(\frac{8x^{3}}{y^{3}}-1\right)\left(\frac{4x^{2}+2xy}{4x^{3}+2xy+y^{6}}-1\right)$$

(2). $\frac{x^{3}+(a+b)x^{2}+(ab+1)x+b}{bx^{3}+(ab+1)x^{2}+(a+b)x+1}$.

5. Find a value of r that will make $\frac{ac+bd+ad+bc}{x-3c+2d}$ independent

of c and d.

ter de la composición de la composición

- 6. (1). If a+b+c=0, then $\frac{1}{a^2}+\frac{1}{b^2}+\frac{1}{c^2}=\left\{\frac{1}{a}+\frac{1}{b}+\frac{1}{c}\right\}^2$.
 - (2). If $x = a^2 + b^2 + c^2$ and y = ab + bc + cx, then $x^3 + 2y^3 3xy^2$
 - (2) If $x=a+b+c^{2}$ and $y=abc^{2}$, $=(a^{2}+b^{3}+c^{3}-3abc)^{3}$. (3) If 2a=y+z, 2b=z+x, 2c=x+y, express $(a+b+c)^{3}$ $-2(a+b+c)(a^{2}+b^{3}+c^{3})$ in terms of x, y, and z.
- 7. Find a value of α which will make the quantities
 - $\frac{(a+b)(a+c)}{a+b+c}$ and $\frac{(a+c)(a+d)}{a+o+d}$ equal to one another.

8. Solve the equations-

(1). $\sqrt{x+3} + \sqrt{x+3} = 5$.

(2),
$$\frac{5-x}{3} + \frac{5-2x}{4} + \frac{x+1}{3} - \frac{2+5x}{2} = 0.$$

(3). (x+a+b)(c+d)=(x+o+d)(a+b), where c+d is not equal

to u+b. 9 One side of a right angled triangle exceeds the other by 3 ft., no ther being the hypothonuse, and its area is 18 sq. fest. What art the sides ?

1). A cistern with vortical sides is h feet deep. Water is carried away from it by one pipe § as fast as it is supplied by another. Find at what point in the side the former pipe must be inserted that the cistern may fill in twice the time it would did water not flow from it atall.

 ∇ alues-1 (1) 6, (2) 4; 2, 6; 3 (1) 5, (2) 7; 4 (1) 5, (2) 6; 6 (1) 6, (2) 7, (3) 5; 7, 6; 8 (1) 6, (2) 5, (3) 5; 9, 7; 10, 8.

EUCLID.

TIME-TWO HOURS.

Algebraical proofs will be allowed for 6, 7, and 8.

1. State the differences between a square, an oblong, a rhombus, ard a rhomboid.

What name employed in Euclid will apply to all of them ? What to the first two only?

not be two triangles having their sides terminated in one extremity whole work slone?

. . . .

other extremity.

3. Equal triangles upon the same base and upon the same side of it are between the same parallels.

4. To find a point within a triangle such that if lines be drawn from it to the angular points the three triangles thus formed shall be equal.

5. The straight lines drawn through the points of bisection of two sides of a triangle is parallel to the third side.

6. If a straight line be divided equally and also unequally, the rectangle contained by the unequal parts is less than the square upon one of the equal parts, by the square upon the line between the points of division.

7. Show that the proposition of question 6 includes the following, viz :- The rectangle under the tum and difference of two lines is equal to the difference of the squares upon the lines.

8. Of all rectangles with the same perimeter the square has the greatest area.

Values-1, 8+2+2; 2, 14; 3, 12; 4, 12; 5, 12; 6, 14; 7, 12; 8, 12.

NATURAL PHILOSOPHY.

TIME-Two Hours.

1. How are forces measured? What is the unit of force com monly adopted in statics ? What general relation is there between the latitude of any place and the magnitude of the statical unit of force for that place ?

2. What is meant by saying that two or more given forces exactly balance each other ?

If a body moving with constant velocity in a straight line be brought under the action of two forces which exactly balance each other, what will be the result with regard to the motion of the body i

3. Explain how a force may be completely represented by a straight line.

Draw a diagram to represent the frame and the forces acting thereon in the following :-- A square frame ABCD, whose sides are each 3 ft. long, is under the action of four forces ; 1st, a force of 3 lbs. acting at A, and from A towards C; 2nd, a force of 3 lbs. acting at B, in the direction from D to B; 3rd, a force of 6 lbs. acting at C, and from C towards D; 4th, a force of 5 lbs. acting at D, in a ine parallel to CA, and in the direction from C to A.

4. State the parallelogram of forces.

Two forces of 10 units each act in lines which meet in a point, and the angle between their directions is 120°. Show that they may be balanced by two forces of 5 units each, and determine the directions in which these must act.

5. State the principle of the lever.

Two boys playing & see-saw find they balance each other standing on the ends of a uniform plank laid across a log, when the arms of their see-saw are 7 ft. and 8 ft. respectively. Find the weight of the plank, the weights of the boys being 75 lbs. and 90 lbs. respectively.

6. What is meant by the specific gravity of a body ?

A cubic foot of anthracite coal which weighs IO3 lbs. in the air is found to weigh only 45 lbs. 2 oz. in a certain specimen of petroleu.n. Find the specific gravity of the petroleum, assuming that a cubic foot of water weighs 1,000 oz.

7. Describe the common mercury barometer and state the principles of its action.

Find the greatest height to which water will rise in a common suction pump when the mercury in the barometer stands at 30 in., the specific gravity of moroury being 13.6.

Values-1, 10; 2, 10; 3, 20; 4, 15; 5, 15; 6, 25; 7, 15.

MENTAL ARITHMETIC:

TIME-THIBTY MINUTES.

1. A hall-way is 90 inches wide, and takes 25 sq. yds. of oil-cloth to cover it. How long is it?

2. A gentleman travels from Toronto to Montroal and back. He goes at an average rate of 83 miles per hour and returns at an average of 30 miles per hour, and he finds that he occupied one hour longer in returning than in going. Find the distance from

Toronto to Montreal. 3. A can do a piece of work in 7 days, and B ... do it in 8 days. A works at it for 21 days, and B works at it for 3 days. O then 2. Upon the same base, and upon the same side of it, there can-finishes it in 32 days. In how many days could O have done the

<u>.</u>