Area of doors &c=13713 sq. ft.; ∴area to be papered= 77533 sq. ft. 77533 sq. ft. Area of 1 piece = 72 sg ft. \therefore number of rolls=77533÷72=102393. 13. *A's* income=40 × 182 × 5=\$192 3013. *A's* proceeds=4000 × 182=\$3923 07 rg. *B's* income=40 × 320=\$161 61 7g. *B's* proceeds=4000 × 82=\$4307 69 3. B's proceeds=4000 × §§=\$4307'0573. 14. 9 mos.=3yr., 3 mos.=1yr. Int. for 9 mos. @ 8%=35 discount=33, and P. W.=§§. Int. for 3 "" = $\frac{1}{50}$ discount=37, and P. W.=§§. ... gain= $80(\frac{50}{51}-\frac{50}{53})=4000(\frac{1}{51}-\frac{1}{53})=\frac{8000}{53\times51}$... gain %= $\frac{8000\times100}{53\times51\times80}=\frac{1000}{2703}=37$ nearly=almost §%

15. If 75 shares represent the property, the farms will be represorted by 33, 24, 18 shares respectively; each son should therefore get 25 shares. Hence A must pay Bone and C seven shares i.e. $\frac{1}{75}$ and $\frac{1}{75}$ of \$2000 respectively, or \$26.665 to B and \$186.665 to C.

. ARITHMETIC.

Examiner-J. B. SOMERSET, ESO.

TIME-THREE HOURS-THIRD CLASS.

1. Simplify $\frac{3}{5} \times \frac{5}{6} - \frac{2}{3} \circ t \frac{7\frac{1}{2} - 5\frac{1}{4}}{1 \cdot 625} \times 0.64743589$. 2. Bought 6 cwt. 3 qrs. 21 lbs. of sugar, at £2 16s. per cwt., for

which I am to pay two-thirds cash and the balance in soap at 41d. per 1b. What do I pay in money and how many lbs of soap?

3. At what time after half past 3 o'clock will the two hands meet for the first time?

4. A person performs 2 of a piece of work in 11 days, he then receives assistance from another person and they finish it in 4 days. In what time could each do it by himself?

5. Simplify $\frac{1234 \times 4321 - 01}{00481 346}$ and $\frac{83 + 0416}{0025}$ 6. If brass be composed of 63 parts of copper and 31 parts of zinc,

what quantity of brass contains 4 lls more of copper than of zine? 7. 2 acres of land are contained sfield whose width is 2 chains 80 links. What is the length of the field?

8. A man left $\frac{2}{3}$ of his property to his eldest son, $\frac{2}{3}$ of the remainder to the younger son and the rest t. A his wife. Upon dividing it was found that the eldest son had \$750 more than the younger. Find the share of each.

9. What sum must I lend for 10 months at $6\frac{1}{2}$ per cent. per annum, so that I may receive interest to the amount of \$237.50?

10. If 509 men can excavate a basin 800 yards long, 500 yards wide and 40 yards deep in 4 months, how many men will be required to excavate a basin 1,000 yds. long, 400 yds. wide and 50 yds. deep in 5 months?

HINTS AND RESULTS.

- 1. 213646050. 2. £12 " 19 " 1025 ; 34634 lbs. 3. 2147 min. after four.
- 4. 17¹/₂ dys., and 27¹/₁₃ dys. 5. 9 ; 350. 6. 11²/₄ lbs.

- 7. 7 chains 143 links.
- 8. \$1200, \$450, \$270.
- 9. \$4384.61₁₃.
- 10. $800 \times 500 \times 10 = 1000 \times 400 \times 10$: same number, 500.

ALGEBRA.

Examiner-A. DAWSON, M.A.

TIME-THREE HOURS. -FIRST CLASS.

1. Investigate a rule for finding the G.C.M. of two algebraical expressions, explaining when and why a factor can be introduced or suppressed.

Find the G.C.M. of
$$\begin{cases} a^4 + a^2x^2 + x^4 \\ a^4 + a^3x - ax^3 - a$$

2. Find the sum of the product of the roots of the equation +px+=0.When will the roots be real and different, real and equal, or im-

possible ?

Form the equation whose roots are

$$\frac{p+\sqrt{q}}{pq}$$
 and $\frac{p+\sqrt{q}}{pq}$

3. A triangular piece of ground contains 210 square feet and two of the sides are 18 and 25 feet respectively. Find the remaining side.

4. If
$$\frac{a}{b} = \frac{c}{d} = \frac{e}{f}$$
 prove $\frac{a}{b} \frac{c}{df} = \frac{a^3 + c^3}{b^3 + d^3}$.
Find the square root of $33 \pm 12\sqrt{6}$

5. Define the Harmonical mean between two quantities. The sum of three numbers in Harmonical Progression is 33 and their continued product is 972. Find the numbers. 6. Prove that the Arithmetical, Geometrical and Harmonical

means between a and b are in order of magnitude, the arithmetical mean being the greatest.

Show that
$$p = \frac{p^2}{2} + \frac{p}{2} - (p^2 - p + 1) + (p^2 - p + 2) + (p^2 - p + 3) + to p$$

torms.

7. If \$600 pay 10 men for 10 weeks' work, for how many weeks will \$540 pay 6 men ?

8. If $a_1x + b_1 y + c_1 z = 0$ $a_2x + b_2 y + c_2 z = 0$ Show that $\frac{x}{b_1 c_2 - b_1 c_1} = \frac{y}{c_1 a_2 - c_2 a_1} = \frac{z}{a_1 b_2 - a_2 b_1}$ Eliminate x and y from x + 2 y - c = 0

$$2x - y + b = 0$$

9. The number of combinations of *i* things taken n-r together is equal to the number of them taken r together.

Find the number of combinations that can be made out of the letters in the word binomial taken 3 together.

10. Extract the square root of
$$1+x^3+2(1-x^3)\sqrt{x}+3x-x^3$$
.

Show that $\sqrt[5]{5=1+4-\sqrt{6}+\sqrt{5}+\sqrt{6}+\sqrt{6}+\sqrt{6}}+\infty c$.

SOLUTIONS.

1. The ordinary process of finding the G.C.M. of two expressions consists in continuously taking the difference between multiples of the given quantities. It depends on the fact that every measure of x and y will measure $mx \pm ny$ where m and n are any multiples whatever. In practice however it saves labor to restrict m and n to whole numbers. For the nearest method of conducting the operation see McLellan's "TEACHERS' HANDBOOK OF ALGEBRA."

Ans. $a^2 + ax + x^3$.

2. Sum = -p, product = q. Roots are real and different, real and equal, or impossible accord-

ing as $p^2 >$, =, or <4q. Ans. $p^2q^2x^2 - 2p^2qx + p^2 = 0$. 3. $210^2 = s(s-a)(s-b)(s-c)$, where s=a+b+c, and a, b and c are the sides. Given a=18, b=25, whence by substitution we get c.

- 4. Book-work. Ans $\sqrt{3}(2\sqrt{2}\pm\sqrt{3})$.
- Book-work. Ans voir --...
 Book-work. Let a, ^{2ab}/_{a+b}. and b be the numbers,
 : $(a+b) + \frac{2ab}{a+b} = 33 \text{ and } \frac{2a^2b^2}{a+b} = 972$ whence a=6, b=18, and $\frac{2ab}{a+b}=9$.

An A. P. First term = $(p^q - p + 1)$ com. difference = 1, number of $torms = p : sum = [2(p^{q}-p+1)+(p-1)(1)]_{0}^{p}$

$$\frac{n}{2} = \frac{n^2}{2} \frac{n}{2}$$

$$=p^{q+1}-\frac{p}{2}+\frac{p}{2}$$
.

7. Ans. 15 weeks. 8. Multiply (1) by a_2 , (2) by a_1 , subtract, transpose, and divide U x an¢

$$\frac{d}{a_{2}c_{1}-a_{1}c_{2}} = \frac{d}{a_{1}b_{2}-a_{2}b_{1}} = (by \ symmetry) \frac{d}{b_{1}c_{2}-b_{2}c_{1}} + (b) \frac{d}{b_{1}c_{2}-b_{2}c_{2}} + (b) \frac{d}{b_{1}c_{2}-b_{2}-b_{2}c_{2}} + (b) \frac{d}{b_{1}c_{2}-b_{2}-b_$$

Subtract (3) from (1) and y = c-a. 9. Whenever a set of r things is selected from n things, there is left a set of n-r things.

We have 8 letters of which 2 are alike. The 6 different letters. may be combined two and two in $\frac{5\times9}{2}$ different ways = 15 and be-