To encourage the study of Music and drawing an examination may be passed on either or both of the subjects, and the number of marks obtained by the candidate will be added as a bonus to his total. The value of each of these is fixed at 75 marks.

The total value of the obligatory subjects is 1,400, and in addition to the prescribed minimum on each, the candidate is to make 700 marks on the aggregate.

The presiding examiner in the subject of Reading shall be selected by the County Board of Examiners, the result to be reported to the Department. He shall hear each of the candidates read a passage selected by examiners from an authorized Fifth Reader. The paper in Writing will also be considered by the Central Committee.

* Those who have already passed the Intermediate Examination are not required to pass again in the same subjects for Third-Class. A female candidate may, at either the Second or Third Class Examination, substitute for Algebra one of the subjects of French, German, Music, or Botany, in which she has not been examined for the Intermediate. The bonus for Music will not be allowed where Music is taken as a substitute for Algebra.

EXAMINATION TIME-TABLE.

FIRST-CLASS, 1884.		NON-PROFESSIONAL, THIRD, AND SECOND-CLASS, 1884.		
DAYS AND HOURS.	SUBJECTS.	DAYS AND HOURS.	SUBJECTS.	CLASS.
Non-Professional Examination.		Monday, July 7.		
GRADE C.		A.M. 9—9.20	Reading Regulations	3
		9.25—11.25	English Literature.	3
Tuesday, July 15.		P.M. 1—2.30	Algebra	3
P.M. 2—3.....	Composition	2.35—4.05	Geography	3
3.5—5.5..	Geography.	4.10—5.40	Chemistry	3
		Tuesday, July 8.		
Wed'sday, July 16.		A.M. 9.00—11.00	English Grammar	3
A.M. 9—12...	Nat. Philosophy	11.05—12.35	History	3
P.M. 2—5.....	History.	P.M. 1.30—3.30	Euclid	3
		3.35—5.05	Natural Philosophy	3
Thursday, July 17.		Wednesday, July 9		
A.M. 9—12 ..	Arithmetic.	A.M. 9.00—11.00	Arithmetic	3
P.M. 3—4.30 .	Eng. Lit & Lang.	11.05—11.25	Reading Regulations	2
		11.30—12.00	Mental Arithmetic	3 and 2
Friday, July 18.		P.M. 1.0—2.00	Composition	3 " 2
A.M. 9—12....	Euclid.	2.05—2.35	Dictation	3 " 2
P.M. 2—5.....	Grammar.	2.40—3.40	Drawing	3 " 2
		3.45—5.30	Reading	3 " 2
Saturday, July 19		Thursday, July 10		
A.M. 9—12....	Algebra.	A.M. 8.30—8.55	Writing	3 and 2
P.M. 2—4.30 .	Hydros. & Heat.	9.00—11.30	Latin Authors	3 " 2
		11.35—12.35	Botany	3 " 2
Monday, July 21.		P.M. 1.30—3.30	French	3 " 2
A.M. 9—11....	Chemistry.	3.35—4.30	Music	3 " 2
		Friday, July 11.		
Professional Examination.		A.M. 8.30—10.00	Latin Gram. & Prose	3 and 2
		10.05—12.05	German	3 " 2
		P.M. 1.30—3.30	English Literature	2
Monday, July 21.		3.35—5.05	Chemistry	2
A.M. 11.5—12.35	Edu.—1st Paper	Saturday, July 12.		
P.M. 2—4.....	" 2nd Paper	A.M. 9.00—11.00	English Grammar	2
		11.05—12.35	Geography	2
Tuesday, July 22.	Music. Drawing. Drill. Reading.	P.M. 2.00—3.45	Algebra	2
		Monday, July 14.		
GRADES A & B.		A.M. 8.30—10.30	Arithmetic	2
		10.35—12.05	History	2
Wednesday, July 7 & 3 following days.		P.M. 1.15—3.15	Euclid	2
		3.20—5.20	Natural Philosophy	2

A worthy Quaker thus wrote: I expect to pass through this world but once; if, therefore, there be any kindness I can show, or any good thing I can do, any fellow human being, let me do it now. Let me not defer or neglect it, *for I shall not pass this way again.* Let this be my epitaph:

What I spent, I had;
What I saved, I left behind;
What I gave away I took with me.

Mathematical Department.

SELECTED PROBLEMS,

SUITABLE FOR FIRST AND SECOND-CLASS TEACHERS' EXAMINATIONS, WITH

SOLUTIONS.

1. What must be the rate of interest so that a sum of money may double itself in 20 years at compound interest?

Given Log 2 = ·301030; log 20705 = 4·3160752 and log 20106 = 4·3160962.—*Intermediate Arts, London, 1882.*

Let M = amount, P = principal, R = amount of £1 for 1 year, and n = number of years. Then $M = PR^n$, but $M = 2P$, $n = 20$.

$\therefore\ 2P = PR^{20}$; *i.e.* $2 = R^{20}$, $\therefore\ \log 2 = 20 \log R = \cdot 301030$

$\therefore\ \log R = \cdot 0150515$, whence $\log 2\ R = \cdot 3160815$

But $\log 2{\cdot}0705 = \cdot 3160752$

Difference $= \cdot 0000063$

Now, log 20706 − log 20805 = ·0000210, which is the difference for unity.

$\therefore$ ·0000063 is the difference for $\frac{63}{210} = \cdot 3$

$\therefore\ 2\ R = 2{\cdot}07053$ and $R = 1{\cdot}035265$, $\therefore$ rate per cent. $= 3{\cdot}5265$.

2. If n be a whole number, what is the least value of n for which $(\frac{11}{12})^n$ is less than $\frac{1}{8}$? *London Matriculation, 1882.*

Given $(\frac{11}{12})^n < \frac{1}{8}$; $\therefore\ n \log (\frac{11}{12}) < \log (\frac{1}{2^3})$

$\therefore\ n(\log 2 - \log 3) < (-3) \log 2$

or, $n(\log 3 - \log 2) < 3 \log 2$

$$\therefore\ n < \frac{3 \log 2}{\log 2 - \log 2},\ \textit{i.e.},\ < \frac{\cdot 90309}{\cdot 1760913},\ \textit{i.e.},\ < 5{\cdot}1$$

Now since n is to be a whole number, n must = 6.

3. Find the condition that $x^2 + ax + b$ and $x^3 + a_1x + b_1$ may have a common divisor $x + c$. Prove that this common divisor will also divide $ax^2 + (b - a_1)x - b_1$.—*London 1st B.A., 1882.*

Divide $x^3 + ax + b$ by $x + c$, remainder $= c^2 - ac + b$, which must $= 0$ since $a + c$ is a divisor; $\therefore\ b = c(a - c)$. (A.)

Again, divide $x^3 + a_1x + b_1$ by $x + c$, remainder $= -c^3 - x_1x + b_1 = 0$, as before; $\therefore\ b_1 = c(a_1 + c^2)$. (B.)

Lastly, divide $ax^2 + (b - a_1)x - b_1$ by $x + c$, and the remainder $= ac^2 - c(b - a_1) - b_1$.

[NOTE.—These remainders are found by substituting $-c$ for x in the expressions. See *Teachers' Handbook.*—ED.]

Now, if this last remainder $= 0$, the third expression is exactly divisible by $x + c$. Substitute the values of b and b_1 found above, and we have $ac^2 - c\{(b - a_1) - b_1 = ac^2 - c\{c(a - c) - a_1\} - c(a_1 + c^2)$

$= ac^2 - ac^2 + c^3 + a_1c - a_1c - c^3 = 0$.

Hence the expression is divisible, and the conditions are (A) and (B).

4. Find r and s in terms of a and b, p and q, so that $x^4 + px^3 + qx^2 + rx + s$ may be divisible by $x^2 + ax + b$, whatever x may be.—*London Matriculation, 1880.*

Find the remainder when expression is divided by $x^2 + ax + b$ and put this remainder $= 0$, thus:—

	1	1	+	p	+	q	+	r	+	s
−	a		−	a		$-(ap - a^2)$		$-(aq - ab - a^2p - a^3$		
−	b				−	b		$-(bp - ab) - b(q - b - ap + a^2)$		
		$1 + (p - a) + (q - b - ap + a^2)$								

Now we must have each column of the remainder $= 0$,

i.e., $\therefore\ r - bp + 2ab - aq + a^2p - a^3 = 0$, $\therefore\ r = bp - 2ab +$ &c.;

also $s - b(q - b - ap + a^2) = 0$, $\therefore\ s = b(q - b - ap + a^2)$.

If $x = 0$, dividend $= s$, and divisor $= b$

$\therefore$ For division to succeed, we must have $s = nb$, where n = a whole number.

5. Find the side of a square inscribed in a semi-circle whose radius is 5 feet.—*Pupil Teachers' Examination, 1879.*

Let FG be the diameter, A and E the corners on the circumference, and B and D the corners of the square $AEDB$ on FG. Join O, the centre, with A and E.

Then (I. 47) $OA^2 = AB^2 + OB^2$

$= 5OB^2$, (see cor. II. 4).

$$\therefore\ OB^2 = \frac{OA^2}{5} = 5,\ \textit{i.e.},\ OB = \sqrt{5}$$

Now side of square $= 2OB = 2\sqrt{5} = 4{\cdot}472136\ldots$