12. "Take any circle with diameter $AB$; divide $AB$ into 5 equal parts; now, with $A$ as centre and a radius $AB$, describe arcs at $D$ and $C$; from $D$ draw lines through the divisions in $AB$ to the circumference of the circle, and do the same from $C$. The 10 points so joined will be the vertices of a regular polygon of 10 sides." (*Scientific American* supplement, May 17, 1884.)

Is this true? Give reasons for your answer.

TRIGONOMETRY—HONOURS.

*Examiner*—T. W. Wright, B.A.

1. Find the value of

(1) $(a+b)\cos 180^\circ + (a-b)\sin 90^\circ + 2b\tan 45^\circ$

(2) log cos 60°, log tan 45°, log cosec 30.

2. Find the expressions for the trigonometric functions of $90^\circ + a$ in terms of the functions of $a$.

3. Show from a figure that $\sin 2a < 2\sin a$.

4. Prove the formulas

(1) $(\cos a - \cos \beta)^2 + (\sin a - \sin \beta)^2 = 4\sin^2 \frac{a-\beta}{2}$.

(2) $\cos 60^\circ = \cos 36^\circ - \cos 72^\circ$.

(3) $\frac{\cos a - \cos \beta}{\cos a + \cos \beta} + \tan \frac{1}{2}(a+\beta)\tan \frac{1}{2}(a-\beta) = 0$.

(4) $\sin(A-B)\sin C + \sin(B-C)\sin A + \sin(C-A)\sin B = 0$.

5. Solve the equations ($a < 360^\circ$).

(1) $\sin a = \frac{1}{2}$.

(2) $3\tan^2 a + \sec^2 a = 5$.

6. $A\,B\,C$ is a triangular field, $B$ is 100 feet S. of $A$, and 200 feet S. S. W. of $B$, find the length of fence that will enclose the field.

7. In a scalene triangle the angle $A$ is 60°, show that $b + c = \sqrt{a^2 + 3bc}$.

8. When the altitude of the sun is 22° 30', find the length of the longest shadow that can be cast by a straight rod 12 feet in length.

9. Find the formula for the area of a parallelogram in terms of

(1) Two adjacent sides and their included angle.

(2) The diagonals and their included angle.

10. Each diagonal of a regular pentagon is 10 in., find the area of the pentagon.

11. Solve the triangles

$a = 177{\cdot}01$, $b = 216{\cdot}45$ $A = 35^\circ\ 36'\ 20''$.

$a = \quad 748$, $b = \quad 375$ $C = 63^\circ\ 35'\ 30''$.

| NUMBER | LOG. | ANGLE. | LOG |
|---|---|---|---|
| 17701 | 24800 | 35°36'20" | L. sin 9·76507 |
| 21645 | 33536 | 45°23'28" | L. sin 9·85213 |
| 30024 | 47755 | 63°35'30" | L. sin 9·95214 |
| 51674 | 71327 | 58°12'15" | L. tan 0·20766 |
| 11230 | 05039 | 28°10'52" | L. tan 9·72808 |
| 37300 | 57171 | 30° 1'23" | L. sin 9·60027 |
| 37500 | 57403 | 99° 0'12" | L. sin 9·99462 |
| 67127 | 82690 | 9° 7'48" | L. sin 9·23034 |
| 20000 | 30103 | | |

## EDUCATION DEPARTMENT, ONTARIO.

### JULY EXAMINATIONS, 1884.

*First Class Teachers—Grade C.*

ALGEBRA.

*Examiner*—J. A. McLellan, LL.D.

NOTE.—Ten questions will constitute a full paper.

1. Divide $x^3 - 5qx + 4r$ by $(x - m)^2$.

Find the relation between $q$ and $r$, in order that the remainder may vanish.

1. Quotient is $x^2 + 2mx + 3m^2$, remainder $-\frac{5m^3x + 5qx - 4r - 4m^4}{(x-m)^2}$,

∴ in order that remainder may vanish $5(m^3 - q)x + 4(r - m^4) = 0$, for all values of $x$.

$\therefore \left.\begin{matrix} m^3 - q = 0 \\ r - m^4 = 0 \end{matrix}\right\}$ and $\sqrt[3]{r} = \sqrt[4]{q}$.

2. When is any expression symmetrical with respect to two or more of the letters it involves?

(1) Find the square root of $3\{(a+b+c+d)^2 + (b+c+d+e)^2 + (c+d+e+a)^2 + (d+e+a+b)^2 + (e+a+b+c)^2 - (a^2+b^2+c^2+d^2+e^2)\}$.

(2) Simplify $\frac{(a-b)^2 - (b-c)^2}{a^2 + ab - bc - c^2} + \frac{(b-c)^2 \cdot (c-a)^2}{b^2 + bc - ca - a^2} + \frac{(c-a)^2 - (a-b)^2}{c^2 + ca - ab - b^2}$.