

4. "Thought fond man  
Of these, and all the thousand nameless ills  
That one incessant struggle render life,  
One scene of toil, of suffering, and of fate,  
Vice in his high career would stand appalled,  
And needless rambling Impulse learn to think;  
The conscious heart of Charity would warm,  
And her wide wish Benevolence dilate."

What kind of sentence is the above? Give a general analysis of it.

#### ARITHMETIC.

1. State the principles on which is based the rule for finding the Highest Common Factor of two numbers. Apply them to find that of 3621 and 1581.
2. Determine the order of magnitude of  $\frac{31}{91}$ ,  $\frac{41}{115}$ ,  $\frac{51}{143}$  and express the difference of the two less in terms of the difference of the two greater.
3. A sold goods which cost \$4,000 to B at a certain loss per cent., and B sold them to C for \$2.50 less than A paid, gaining at the same rate per cent. at which A lost. How much did A lose and B gain per cent.?
4. A tradesman professes to retail his goods at 10 per cent. profit, but adulterates them by adding one quarter of their weight of an inferior article, which costs him four-fifths of the price of the better. How much per cent. profit does he make, and in what proportion should he mix the two kinds so as to gain 20 per cent.?
5. A train 88 yds. in length overtook a person walking along the line at the rate of 4 miles an hour, and passed him in 10 seconds. Twenty minutes after it had passed him, the train overtook another person and passed him in 9 seconds. When will the former person overtake the latter?
6. The amount of my capital for a certain time at 4 p. c. is \$360, and for the same time at 7 p. c., is \$405; required the principal and the time.
7. Give the English equivalents of a kilometre and kilogram. Name the prefixes employed with the metric-denominations, distinguishing those used as multiples from those used as divisors.

#### PRACTICAL MATHEMATICS.

1. Construct a scale of chords for angles at intervals of  $10^\circ$ , and explain how an angle may be plotted with it.
2. Demonstrate a rule for finding the area of a quadrilateral inscriptible in a circle.
3. On opposite sides of a base, 120 yards long, two isosceles triangles are constructed. The altitude of one triangle is double that of the other, and the triangle that has the least altitude is right angled; find the area of the quadrilateral thus formed, and express the result in acres, rods, &c.
4. Three hemispherical bowls, of equal thickness and of the same material, are made to fit one inside of another, and the interior diameter of the smallest is twice the thickness of each: compare their weights.
5. A hollow paper cone, whose vertical angle is  $60^\circ$ , is held with its vertex downwards, and in it there is placed a sphere of 2 inches radius, the portion of the cone remote from the apex is then cut away along the line where the paper touches the sphere: find the exterior surface of the body thus formed.
6. Explain fully what is meant by *Resolving a Traverse*. Explain the log line, and show to what errors it is liable. If the distance run by log is 315, and the length of the log-line is 47 feet, and the glass runs out in 32 seconds, what is the true distance run?
7. Show by a diagram that the spaces passed through in successive seconds by a point moving from rest under the action of a force producing a uniform acceleration are as the odd numbers 1, 3, 5, 7, etc. A body is thrown directly upward with a velocity of 11256 feet per second; (a) what velocity will it have at the end of the fourth second, and (b) in what direction is it now moving?

#### ALGEBRA.

1. The effect of adding the same quantity to both terms of a ratio is to bring the value of the ratio nearer to unity. Give general proof.
2. Find values  $x$  and  $y$  in the equations,  
 $ax^{-1} + b^{-1}y = 2$   
 $xy - ab = bx - ay.$
3. Find an Arithmetical Progression whose first term is 2, and whose 1st, 4th, and 10th terms form a Geometrical Progression.
4. If  $a$  and  $b$  are the roots of the equation  $6x^2 + 5x = 7$ , find the equation whose roots are  $\frac{2a}{b}$  and  $\frac{2b}{a}$ .

5. If  $a$ ,  $2a$ , and  $b$ , and also  $2a$ ,  $b$ , and  $2c$  are in continued proportion, show that  $b - 2a$  is a mean proportional between  $a$  and  $2c - b$ .

6. A crew can row a certain course up stream in 84 minutes; if there were no downward current they could row the same course in 7 minutes less than it takes them to drift down with the stream. How long would they take to row down with the current?

7. If the expression  $ax^2 + bx + c$  be a perfect square, show that  $b^2 = 4ac$ .

#### GEOMETRY.

1. The three circles having the three sides of a triangle as diameters have all their intersections lying on the sides of the triangle.
2. If, from any point without a circle, two straight lines be drawn, one of which cuts the circle, and the other touches it; the rectangle contained by the whole line which cuts the circle, and the part of it without the circle must be equal to the square on the line which touches it.
3. An equilateral triangle and a regular hexagon are inscribed in a given circle; show (1) that the area of the triangle is half that of the hexagon, and (2) the square on the side of the triangle is three times the square on the side of the hexagon.
4. About a given circle to describe a triangle equiangular to a given triangle.
5. If two straight lines be given, show how to produce one of them so that the rectangle contained by it and the produced part may be equal to the square on the other.
6. To draw a tangent to a circle from a given external point.

NOTE.—Additional value will be given if, instead of the text method, the solution of this problem be derived from Book III, Prop. XXXI.—"The angle in a semi-circle, &c."

7. To draw a common tangent to two unequal circles external to one another.

#### SCHOOL SYSTEM AND SCHOOL MANAGEMENT.

1. State the objects for which money may be voted by the School Meeting, and the principles which regulate the assessment of the sum voted.
2. If the ratepayers at the School Meeting fail to make provision for the maintenance of the School, what course is legally open to the Trustees for securing the necessary funds?
3. As Principal of a Graded School, what steps would you take to ascertain the methods and influence of the teachers, and the progress of the pupils, in the lower departments.
4. Mention the chief conditions on which the power to govern a school depends.
5. Discuss the general principles by which you would be guided in administering punishment, and specify thereunder improper methods.

#### TEACHING.

1. "There is perhaps no part of intellectual training which requires so much careful attention as the control of the child's use of words." Explain the methods by which you would give this needed attention.
2. Explain as to a class the rule for converting a common into a decimal fraction.
3. A modern writer on education classifies studies, as respects their aims, into *practical*, *disciplinary* and *culture-producing*. Group under these heads the subjects embraced in our Common School Course.
4. State what you conceive to be the value and proper use of written examinations.
5. Is "learning by heart" always to be condemned? Give an answer that will fully set forth your views and practice.

#### PHYSIOLOGY.

1. Give the name, situations and functions of the salivary glands.
2. Describe the structure of the skin. State the difference between it and mucous membrane. In what respect are the lungs, kidneys, and skin alike?
3. What is the cause of near-sightedness? Of far-sightedness? How may these defects be remedied?
4. Describe briefly the spinal cord.
5. Write a note on the beverages,—tea, coffee, and cocoa, giving their composition, mode of preparation, and their action upon the human system.
6. Discuss the effects of the use of impure water as exemplified in some forms of disease.

(Candidates are at liberty as per Syllabus of Examination to write on such two of the three subjects given below as they may choose. No credit will be given to papers on all subjects from the same candidate.)