(All work must be purely Arithmetical.)

1. Explain fully why you double the quotient for a new divisor in extracting the square root of a number; and, what is the meaning of the numbers 30 and 300 which appear in the common method of extracting the cube root.

2. A wine merchant buys a barrel of wine (32 gals.) for $25 and sells it at $1.50 per gallon. The leakage amounts to two-fifths of a gill per day; and his living expenses to $510 per year. How many barrels per year must pass through his hands in order to cover the whole expense of his business?

3. A person buys a horse upon borrowed money for which he pays 6 per cent. per annum. The horse earns 70 cents daily and costs ½ per cent. upon his purchase price for daily keeping. The owner sells him at the end of a year for $50, and realizes $132.40 upon his whole transaction. What did the horse cost?

4. A mortgage drawn March 1st, 1878, for $4000 is to be paid in 8 annual instalments of $500 each, with interest at 4 per cent. per annum. It, having made the payments regularly, is offered for sale on Sept 15th, 1881. What should it bring, money being worth 6 per cent. per annum.

5. Given that 772 pounds raised 1 foot represents the amount of heat required to warm 1 pound of water through 1°F., and that 1°F. is equal to ⅝°C., and that 39.37 inches is equal to 1 metre, and that a cube of water one-hundredth of a metre upon the edge weighs 1 gram, how many grams raised 1 metre will represent 1 gram of water warmed through 1°C.?

6. A specimen of galena yields 82 per cent. of its weight in lead, and a cube of the lead one-fifth of an inch upon its edge yields a sphere of silver .027 inches in diameter. If the density of the lead be 11.3 and of silver 10.5, and if silver be worth 84 cents per ounce, what value of silver is contained in one ton of galena?

7. A flume is two feet wide at the bottom, 3 feet at the top and 4 feet deep, and it is filled to a height of 2½ feet with water. It supplies a turbine from which the water issues through 12 circular orifices each 1 inch in diameter with a velocity of 12 feet per second. Find the mean velocity per second with which the water moves along the flume.

8. A piece of lead in the form of a prismoid is 3 inches by 4 upon one base and 5 inches by 6 upon the other, and 10 inches high. If it is pressed into the form of a sphere what will be its radius?