

# Algebra

Algorithms

Problems sorted by topic

Interest problems: compound interest

## Algorithms

**VIS 230.** by Artemas Martin

Give an expeditious method of approximating the cube root of a quantity, and find by it the cube root of 2 to at least 100 decimal places.

**VIS 110.** by Artemas Martin

Give an expeditious method of approximating the square root of a quantity, and find by it the square root of 2 to at least 150 decimal places.

## Calendar problems

**VIS 159.** by William Hoover

August 1879 had five Fridays, five Saturdays, and five Sundays. When will the month of August have five of each of these days again?

## Combinatorics

**VIS 118.** by Winfield V. Jeffries

How many different combinations, each composed of  $n$  letters, can be formed from  $m$  letters, of which  $a$  are one letter,  $b$  are another, and  $c$  are another?

## Continued fractions

**VIS 276.** by Artemas Martin

If  $p_n/q_n$  is the last convergent in the first period of  $\sqrt{A}$  expanded as a continued fraction, and  $r$  is the integral part of  $\sqrt{A}$ , show that

$$p_n = r q_n + q_{n-1}.$$

## Determinants

**VIS 146.** by W. J. Wright

Let  $S_{ik}$  be the coefficient of  $a_{ik}$  in the determinant  $D = \sum \pm a_{11} a_{22} \dots a_{nn}$ , and let  $\Delta$  denote the determinant  $\sum \pm S_{11} S_{22} \dots S_{nn}$ . Prove that  $\Delta = D^{n-1}$ .

## Factorization

**VIS 193.** by William Woolsey Johnson

If  $(x - iy)^n = A + Bi$ , ( $i = \sqrt{-1}$ ), show that the expression  $A + Bq$ , where  $q$  is any real numerical quantity, is the product of  $n$  real factors linear in  $x$  and  $y$ , and find these factors.

## Functions

**VIS 64.** by J. J. Sylvester

If there are two equations in  $x$  of the same degree  $n$ , and  $M$  is a rational integral function of the coefficients of these equations such that  $Mx, Mx^2, \dots, Mx^{n-1}$  are each also rational functions of the same, find the most general form of  $M$ .

## Geometric progressions

**VIS 100.** by Daniel Kirkwood

Find a number that when added to 15, 27, and 45 give rise to three numbers that are in geometric progression.

## Inequalities

**VIS 57.** by Oscar H. Merrill

Prove that the cube of any given number is greater than the product of any other three numbers whose sum is three times the given number.

**VIS 261.** by A. E. Haynes

If  $a, b$ , and  $c$  are distinct positive real numbers, prove that

$$a^3 + b^3 + c^3 > 3abc.$$

## Interest problems: bonds

**VIS 163.** by Theo. L. DeLand

In 1861 a 6%, 20-year coin bond of the US, interest payable semiannually, sold on the market for \$0.891 on the dollar. On this basis, what would have been the market value of a US 4%, 28-year coin bond, interest payable quarterly?

**VIS 267.** by Theodore L. DeLand

US 4% bonds with 26 years to run, interest payable quarterly, are worth 112 on the market. Consider this the measure of the National Credit. The Secretary of the Treasury wishes to place on the market a new loan to refund maturing bonds — the 6's; the loan is to run 40 years, interest payable triennially. Find the rate the new bonds must draw in order to sell at par.

**VIS 258.** by D. L. Wright

What percent of income do US  $4\frac{1}{2}\%$  bonds at 108 yield on currency when gold is 105?

## Interest problems: compound interest

**VIS 175.** by W. L. Harvey

A man buys a farm for \$4,000 and agrees to pay for it in 4 equal annual installments, interest at 5% per year, compounded at every instant. What is the annual payment?

**VIS 262.** by L. P. Shidy

A man deposits  $D$  dollars in a bank every year which gives him compound interest at the rate of  $r\%$  per year. What sum will the bank owe him at the end of  $n$  years?

**VIS 92.** by James Q. Brigham

What is the percent rate of interest when a sum of money amounts to ten times itself in 21 years, compounded annually? What would be the rate for the same time if compounded semiannually?