

100. A gentleman's income in Dominion six per cent. stock is \$1,260. He sells out when the stock is at 92, and invests the proceeds in railway shares, 105 bringing five per cent. Find the alteration in his income, and thus his new income.

101. Two cisterns of equal volume are filled with water, and the taps of both being opened at once, it is found that one is emptied in four hours and the other in five. When will the contents of the second cistern be twice those of the first?

102. Which of the following areas has the longest perimeter—an equilateral triangle whose area is $2500\sqrt{3}$ square feet, a square whose area is 2500 square feet, a regular hexagon whose area is $2500\sqrt{3}$ square feet, or a circle whose area is $795\frac{1}{4}$ square feet?

103. Compare the weight of a cylinder of copper 3 feet high and 2 feet in diameter, and of a sphere of lead 4 feet in diameter, it being given that a cubic foot of copper weighs 8,788 ounces, and a cubic foot of lead 11,350 ounces.

104. Resolve into elementary factors the expression

$$(x^2 + xy + y^2)^2 - (x^2 + xy + y^2)(x^2 + y^2) + x^2y^2.$$

105. If $ax^n = by^n = cz^n$,
and if $x^{-1} + y^{-1} + z^{-1} = k^{-1}$, then

$$(ax^{n-1} + by^{n-1} + cz^{n-1})^n = (a^n + b^n + c^n) \frac{n-1}{k^n}.$$

$$\begin{aligned} 107. \text{ If } & x + y - axy = 0 \\ & y + z - byz = 0, \\ & z + x - czx = 0 \end{aligned}$$

and if $ax^2 + by^2 + cz^2 = 0$, then

$$\frac{a}{b^2 - (a-c)^2} + \frac{b}{c^2 - (b-a)^2} + \frac{c}{a^2 - (c-b)^2} = 0.$$

108. Shew that

$$\begin{aligned} & \frac{2n(2n+1)(2n+2)\dots(2n+r-1)}{r} \\ & + \frac{2n(2n+1)(2n+2)\dots(2n+r-2)}{r-1} \cdot \frac{n}{1} \\ & + \frac{2n(2n+1)(2n+2)\dots(2n+r-3)}{r-2} \end{aligned}$$

$$\begin{aligned} & \frac{n(n+1)}{2} + \dots + \frac{2n(2n+1)}{2} \\ & \frac{n(n+1)(n+2)\dots(n+r-3)}{r-2} \\ & + \frac{2n}{1} \cdot \frac{n(n+1)(n+2)\dots(n+r-2)}{r-1} \\ & + \frac{n(n+1)(n+2)\dots(n+r-1)}{r} \\ & = \frac{3n(3n+1)(3n+2)\dots(3n+r-1)}{r} \end{aligned}$$

109. If x be the circular measure of any arc, then

$$1 - \frac{x^2}{2} + \frac{x^4}{4} - \dots = \left\{ 1 - \frac{2x^2}{2} + \frac{8x^4}{4} - \dots \right\}^{\frac{1}{2}}$$

both sides being infinite.

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110. Factor

$$l(m+nx)^2 - (l+ln)(l+nx)(m+nx) + n(l+nx)^2.$$

111. Divide without expansion

$$(x^2 - \frac{1}{2}yz)^3 + \frac{27}{8}y^3z^3 \text{ by } x^2 + yz.$$

112. Two equal circles intersect in A and B through D any point in the line AB ; DEC is drawn at right angles to AB , meeting the circles in E and C respectively; join BE and AE and produce them to meet AC in F , and BC in G respectively. Shew that triangles ACG and BCF are similar.

113. In Fig. of number 112 shew that a circle may be described passing through the four points A, B, G, F .

114. The town of Berlin having issued six per cent. debentures to the amount of \$20,000 payable, principal and interest, in twenty equal annual payments, find amount of each annual payment, and the amount of principal that should be paid off at the end of ten years from date of issue.

115. In question 114 find what a Loan Company should offer for the debentures that will mature during the last five years in