PROBLEMS.

(FROM NOVEMBER NUMBER.)

1. If three circles touch each other in any manner, the tangents at the points of contact pass through the same point.

1. Join the centres of the circle A, B, C, let D, E, F be the points of contact opposite to the angles A, B, C, respectively; then, since the two tangents drawn to each circle from the same point are equal, it follows that the three tangents are equal; that is the tangents at D and E will cut off each the same length from the tangent at E, or the three tangents will meet in the same point P, which is the centre of the circumscribing circle of the triangle ABC, for the angles A, B and C are bisected by the lines AP, BP, CP.

14. If $f(x)=ex-1$ and $\phi(x)=e^x+1$, show

$$f(x)\log\tfrac{1}{2}\left[+f\left\{\phi(x)\right\}+\phi\left\{\phi(x)\right\}\right]=$$
$$\phi(x)\log\tfrac{1}{2}\left[\phi\left\{f(x)\right\}+f\left\{f(x)\right\}\right]$$

that is substituting

$$(e^x-1)\log\tfrac{1}{2}\left[e^{e^{x+1}}-1+e^{e^{x+1}}+1\right]=$$
$$(e^x+1)\log\tfrac{1}{2}\left[e^{e^{x-1}}+1+e^{e^{x-1}}-1\right]$$

$$\text{that is } (e^x-1)\log e^{e^{x+1}}=(e^{2x}-1)$$
$$=(e^x+1)\log e^{e_x-1}.$$

Q.E.D.

(CONTRIBUTED.)

1. To show that $12n+5$ cannot be a perfect square.

2. Given the perimeters A and B of two regular polygons inscribed in a circle, one of n sides and the other of $2n$ sides, to find the perimeter of a regular inscribed polygon of $4n$ sides.

Result $B\sqrt{\dfrac{2B}{A+B}}$.

(SELECTED.)

3. Show how to find the least number of terms of a geometrical progression, of which the first term and the common ratio are given, whose sum exceeds a given quantity. In what case is the solution impossible?

4. Two men, A and B, play together, A having the liberty to name the stakes. Whenever A loses a game, he increases the last stake by a shilling for the next game, and diminishes it by a shilling after gain. When they leave off playing A has gained £13, and had each won the same number of games, A would still, by following the above principle in regulating his stakes, have gained 10*s.* If the first stake be 30*s.*, show that A won 15 and lost 5 games.

5. Solve the equation

$$\frac{x^2}{a-y}+\frac{y^2}{a-x}=a$$
$$\frac{x}{a^2-y^2}+\frac{y}{a^2-y^2}=\frac{1}{a}.$$

MODERN LANGUAGES.

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SOME TEST QUESTIONS ON THE CONJUGATION OF FRENCH VERBS.

1. Name the distinctive infinitive endings of the four regular conjugations, and trace each ending to its Latin origin.

2. Which of the conjugations contain the largest number of verbs? Assign a reason for your answer.

3. Draw up a table of the endings of the pres. indic. of the four conjugations, showing wherein they are identical.

4. The "s" of some of these endings is said to be contrary to etymology. Explain.

5. Account etymologically for the so-called euphonic "t" used in certain parts of the first conjugation interrogatively.

6. Tabulate the impf. endings of the four conjugations and show wherein they are identical.

7. Trace the impf. endings of the first and second conjugations respectively to their Latin origin.

8. What points of identity may be noted in the endings of the preterite in the four conjugations.

9. The future of all verbs is formed by affixing to the infinitive of the verb, the pres.