

the condition that this should be possible; and, if it is, and the angles of the new triangle are α, β, γ , shew that—

$$1 + \frac{\cos \alpha}{\cos A} + \frac{\cos \beta}{\cos B} + \frac{\cos \gamma}{\cos C} = \frac{1}{2} \sec A \sec B \sec C.$$

12. Find the radii of the inscribed, the circumscribed, and the nine-point circles of a given triangle.

If O be the centre of the first, O' of the second, and P the centre of perpendiculars, shew that the area of the triangle $OO'P$ is

$$-2R^2 \sin \frac{B-C}{2} \sin \frac{C-A}{2} \sin \frac{A-B}{2}$$

where R is the radius of the circle circumscribing ABC .

UNIVERSITY OF LONDON.

MATHEMATICAL EXAMINATION, JANUARY, 1881.

ARITHMETIC AND ALGEBRA.

1. Express $\sqrt{\frac{0.00456 \times 0.987}{6.54}}$ as an ordinary decimal fraction, correctly to three significant figures.

2. Express $\sqrt{1.27 \times 1.571428}$ as a vulgar fraction, reducing it to its simplest form.

3. What is one shilling and sixpence a gallon in francs per litre? Express the result decimally correct to four significant figures.

[A gallon of water weighs 10 pounds; a litre is a cubic decimetre; a gramme is the weight of a cubic centimetre of water; and you may assume that a kilogramme is 2½ lbs., and that £1 is equal to 25 francs.]

4. Assume that 4 English navvies can do as much work in a day as 5 French navvies, that 4 French navvies can do as much as 7 negroes. It is found that 13 English and 12 French do a piece of work in 3 days. How long will it take 10 negroes? Express your result decimally to three significant figures, and use none but arithmetical symbols in your work.

5. A milk dealer buys pure milk at 11½d. per gallon. How much water must he add that he may sell at 5d. a quart and obtain a gross profit of 100 per cent.?

6. Find a geometric progression of which the first term is 4 and the fifth 100.

7. The army of an enemy consists of infantry, cavalry, and artillery. It is known that his cavalry have 105 horses to every 100 men, that in the artillery there are twice as many men as horses, and that in the infantry there is one horse to every fifty men. It is ascertained that the army consists of 10,000 men with 2,740 horses; also that the infantry are as numerous as twice the cavalry and three times the artillery together. How many are there of each arm?

8. A reduction of 10 per cent. in the price of iron would enable a purchaser to obtain one hundredweight more for a sovereign. What may the present price be?

9. Find the greatest common measure of the expressions.

$$\begin{cases} x^6 + 6x^2 + 9x + 4, \\ x^4 + 9x^3 + 28x^2 + 36x + 16, \\ x^4 + 8x^3 + 21x^2 + 22x + 8. \end{cases}$$

10. A tobacconist pays 4s., 3s. 6d., and 2s. 6d. per pound for three kinds of tobacco. He mixes them, and by selling at 4s. per pound obtains a gross profit of 25 per cent. *on his receipts*. If he omitted the most expensive tobacco from his mixture, keeping the others in the same proportion, his profit would be 45½ per cent. *on his outlay*; whereas if he omitted the cheapest his profit would be only 2½d. per pound. What was his mixture?

GEOMETRY.

1. A number of equal triangles stand on the same base and at the same side of it; prove that their vertices are all situated on the same right line, which is parallel to their common base.

2. By aid of the preceding, or otherwise, find a point such that the two triangles having it for a common vertex, and standing on two given right lines as bases, shall be each of a given area.