

where the lines bisecting the angle meet the opposite sides, as $(a+b)(b+c)(c+a) : 2abc$.

13. Let CD, AF, BG bisect the angles, then $BD : DA = BG : CA$,

$$\therefore BD = \frac{ac}{a+b} \text{ and } BF = \frac{ac}{b+c},$$

$$\therefore BDF = \frac{1}{2} \cdot \frac{ac}{a+b} \cdot \frac{ac}{b+c} \sin B$$

$$= \frac{acS}{(a+b)(b+c)}.$$

$$\therefore \text{area of } ABC : DGF :: S : S - S$$

$$\left\{ \frac{ac}{(b+c)(a+b)} + \frac{bc}{(c+a)(a+b)} + \frac{ab}{(a+b)(b+c)} \right\}$$

$$:: 1 : \frac{2abc}{(b+c)(c+a)(a+b)} \quad \text{Q.E.D.}$$

14. Show how to solve a triangle having given the radii of the circumscribed and inscribed circles, and the perpendicular, from one of the angles on the opposite side.

$$14 \text{ Let } p \text{ cut } AB \text{ in } D. \quad (1) R = \frac{abc}{4S};$$

$$(2) r = \frac{S}{a}; \text{ and } (3) \frac{1}{2} p c = S; \text{ from } (2) a + b$$

$$= 2S \frac{(p+r)}{pr}; \text{ from } (1) \text{ and } (3) 2pR = ab.$$

$$\text{Now } \frac{2S}{ab} = \sin C = \sin (BCD + ACD)$$

$$= \frac{p}{ab} (\sqrt{a^2 - p^2} + \sqrt{b^2 - p^2})$$

$$\therefore \frac{r(a+b)}{p-r} \sqrt{a^2 - p^2} + \sqrt{b^2 - p^2} \text{ and } ab =$$

$2pR$. Solve for a and b , and hence the other parts.

15. Eliminate θ between the equations $\cos(\phi - \theta + a) \cos(\theta - a) = \cos(\phi - \theta - a) \cos(\theta + a) = c$, $\cos(\phi - \theta + a) \cos \theta - a = c$; $\therefore \cos(\phi - 2\theta - 2a) = 2c - \cos \phi$; from 2nd equation $\cos(\phi - 2\theta + 2a) = 2c - \cos \phi$.

Expand and subtract

$$\therefore \sin 2\theta = \cos 2\theta \frac{\sin \phi}{\cos \phi}$$

by adding $\cos \phi \cos 2\theta \cos 2a$

$$+ \sin \phi \sin 2\theta \sin 2a = 2c - \cos \phi;$$

$$\therefore \cos 2\theta = \frac{(2c - \cos \phi) \cos \phi}{\cos^2 \phi \cos 2a + \sin^2 \phi \sin 2a},$$

similarly for $\sin 2\theta$ square and add

$$\therefore \frac{(2c - \cos \phi)}{\cos^2 \phi \cos 2a + \sin^2 \phi \sin 2a} = 1.$$

CLASSICS.

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BRADLEY'S ARNOLD.

BY M. A.

Exercise 27.

1. Barbari summum jugum ascendentis exercitus, eadem qua antea ferocia, latera adoriebantur. 2. Fratrem tuum, ne quid patrem vestrum, hominem optimum celaret sæpissime monui. 3. Primus mortem optetere debuisti, et fortissimi patris fortem te filium prestitisse, non levissimum periculum primus perhorruisse. 4. Cæsar si copias Rhenum traduxerit, per totam Germaniam trepidabitur. 5. Multa nos speculatores nostri de situ arcis et magnitudine docuerunt; quantum sit ac quale præsidium celatos nos videntur velle. 6. Quum de summa re actum esse intellexisset dux, funestas paludes fuga præcipiti prætervectus in arcem incolumis pervenit. 7. Ut reipublicæ procuratorem, rem laboriosissimam defugeret ætatem ac corporis infirmitatem excusavit. 8. Multi terras longinquas prætervecti sunt; orbem ille terrarum primus circumnavigasse creditur. 9. De itinere meo te celatum nolim; hoc autem a te posco ne absentis mei obliviscare. 10. Consilii sui de parte omnia me docuit, cetera fratrem ipsum celavit.

Exercise 54.

1. Quæ cum ita se haberent, excedere urbe noluit, et id se facturum esse, ipso præsentē præfecto, negavit. 2. Quum e via languerem, totum diem domi manere et nihil agere decrevi. 3. Ubi primum, edito ex summa arce signo, primum hostium agmen adventare sensit, nocte ac tenebris usus, patefacta repente porta, ferox in medios erupit. 4. Ubi primum expositas hostium copias accepit, quum domi securis manere posset, arma sumere decrevit et quantum in se esset illatum bellum propulsare. 5. Quum videret nihil apud regem valere preces suas et obsecrationes finem dicendi fecit; ubi primum conticuit, patefactis subito foribus, duo introducti sunt milites, uterque cum