12.—PRACTICAL MATHEMATICS, B.

(Any *five* questions make a full paper.)

1.   Deduce the formula $\dfrac{c + a}{c - a} = \dfrac{tan\ \frac{1}{2}\ (C + A)}{tan\ \frac{1}{2}\ (C - A)}$.

2.   Given $log\ 2 = .30103$, and $log\ 3 = .47712$, find, without tables, the logarithms of 3.6 and of $\dfrac{1}{12}$.

3.   A flagstaff on a cliff is known to be 20 feet high.   From a boat which is moored the flagstaff subtends an angle of 1° 30′, and the elevation at the top of the cliff is 18°. Find the height of the cliff, and the distance of the boat from the foot of the cliff, both to the nearest foot.   [Given, Sin 1° 30′ = .0261769; Cos 19° 30′ = .9426415. Sin 18° = .3090170.]

4.   (*a*) A ship is steering by compass N. W ¾ W., the variation of the compass is 2¼ points W., the wind is S. E , leeway ¼ point, deviation 5⅜° W. ; find the true course.

(*b*) How is the distance run by ship at sea found ?   What is the chronometer used for ? What is the sextant used for ?

5.   A horse is hitched by a long rope to one corner of an equilateral triangular field. How long must the rope be that he may feed off half an acre ?

6.   (*a*) A rifle is fired horizontally 32 feet above a level plain ; what is the velocity of the bullet (neglecting the friction of the air), when it strikes the plain 1600 feet away ?

(*b*)   Describe the system of pulleys whose equation of equilibrium is $\dfrac{P}{W} = \dfrac{1}{2n}$.

7.   What is " Parallelogram of Forces ? " Show how the " triangle " and " Polygon of Forces " may be deduced from it.

13.—ALGEBRA, B.

1.   If $x + a$ be a common factor of $x^2 + px + q$ and $x^2 + lx + m$, show that $a = \dfrac{m - q}{l - p}$.

OR, find two numbers the sum of whose squares is 74, and whose sum is 12.

2.   Prove that the square root of a rational quantity cannot be partly rational and partly a quadratic surd.

OR,   given $\dfrac{2x - 3}{\sqrt{x - 2} + 1} = 2\sqrt{x - 2} - 1$, find x.

3.   Form an equation whose roots shall be the arithmetic and harmonic means between the roots of $x^2 - px + q = 0$.

OR, if $^nC_3 : ^{n-1}C_4 = 8 : 5$, find n.

4.   Expand $log\ \sqrt{1 + x}$ in ascending powers of x.

OR, given $3^x = 9^{y-1}$ and $10^{3-x} = 8^{y-2}$, find x and y.

5.   In what scale is 647 the square of 25 ?

OR, evaluate the following expression : when $a = 4$, $b = -3$, $x = \frac{2}{3}$, $y = -\frac{1}{2}$ (taking only + sign in $\sqrt{\ }$).

$$\left\{ \dfrac{\left[\sqrt[4]{\dfrac{bx}{2}} \left\{ (a - b)^2 + 1 \right\}\ y + a \left(\dfrac{x^{-1}}{2} - y \right)^0 \right]^{-\frac{1}{4}}}{\sqrt[4]{\dfrac{abxy\ \sqrt{a}\ (ab^2x^3y^5 - \frac{2}{3})^{-3}}{\left\{ -b\ (2a^0 - y^p)\ x - 3bx \right\}^{-\frac{3}{2}}}}} \right\}^{-2}$$