

Trigonometry.—For Senior Civil Service. Time allowed : 3 hours.

1. Prove that the circumference of a circle varies as its radius.
If the radius of a circle is 10 ft., find the length of an arc of 45° in the circle, and the area of the corresponding sector.
2. Show that $\sec(180^\circ - A) = -\sec A = \operatorname{cosec}(270^\circ \pm A)$; and find the general expression for all angles having the same secant.
If $\sec A - \cos A = \frac{3}{2}$, find the general value of A .
3. Show that $\frac{\sin A}{1 + \cos A} = \tan \frac{1}{2}A = \frac{1 - \cos A}{\sin A}$; and find expressions for $\tan 2A$ and $\tan 4A$ in terms of $\tan A$.
4. Prove the following relations:—
 - (a.) $\sin 3A = 3 \sin A - 4 \sin^3 A$;
 - (b.) $\sin A(1 + \sin A)\left(1 - \tan \frac{A}{2}\right) = \cos A(1 - \cos A)\left(1 + \cot \frac{A}{2}\right)$;
 - (c.) $\frac{\cos 3A + \sin 3A}{\cos A - \sin A} + \frac{\cos 3A - \sin 3A}{\cos A + \sin A} = 2$.
5. Show that, if $\cos A = \cos B \cos C$, then $\tan \frac{1}{2}(A+B) \tan \frac{1}{2}(A-B) = \tan^2 \frac{C}{2}$.
6. Show that in any triangle, adopting the usual notation,—

$$(a.) \quad \sin \frac{1}{2}B = \sqrt{\frac{(s-a)(s-c)}{ac}};$$

$$(b.) \quad \frac{\cot \frac{1}{2}B + \cot \frac{1}{2}C}{\cot \frac{1}{2}A} = \frac{a}{s-a};$$

$$(c.) \quad \cos A + \cos B + \cos C = 4 \sin \frac{A}{2} \sin \frac{B}{2} \sin \frac{C}{2} + 1;$$

$$(d.) \quad \frac{1}{2}(a^2 - b^2) \frac{\sin A \sin B}{\sin(A-B)} = \text{area}.$$

7. The angles of a triangle are as the numbers 1, 2, 3, and the perpendicular from the greatest angle upon the opposite side is 10 ft.: find the area of the triangle.

8. In a triangle ABC, given $b = 251$, $c = 372$, $A = 40^\circ 32'$, find B and C .

[$\log 121 = 2.0827854$, $\log 623 = 2.7944880$, $L \cot 20^\circ 16' = 10.4326795$, $L \tan 27^\circ 44' = 9.7207827$, $L \tan 27^\circ 45' = 9.7210893$]

9. Two rocks A and B were observed from a ship to be in a line bearing E. 30° N. After the ship had sailed N. 30° E. for ten miles A bore S. and B bore S.E.: find the distance between the rocks.

Shorthand.—For Senior Civil Service. Time allowed : 3 hours.

INSTRUCTIONS TO SUPERVISORS.

1. Inform candidates before the time for taking up this subject that they may use pen or pencil as they please for taking notes, which should be written on ruled paper, but that they must transcribe those notes into longhand with pen and ink.

2. Inform candidates that when once you have commenced to dictate you cannot stop until the passage is finished.

3. Dictate the passages at the following rates of speed:—

(a.) 80 words a minute.

(b.) 120 " "

(c.) 150 " "

N.B.—It will be well to practise reading these aloud some time beforehand, looking at a watch or clock, so as to accustom yourself to reading at the exact rate indicated. The matter to be read is marked off into sections, each of which is to occupy a minute. The Supervisor will perhaps find it advisable to mark it off into smaller sections, each containing the number of words to be read in fifteen seconds, and to read one section in every quarter of a minute. As the candidates hear the passage read only once, the reader's articulation ought to be very clear, and the candidates ought to be so placed as to be able to hear well.

4. Candidates are at liberty to take down one, two, or three passages, as they choose. All the passages required by candidates are to be dictated before any one begins to transcribe; and there should be as little delay as possible between the readings.

5. Inform candidates that rapidity in transcribing notes into longhand is essential, and note carefully on the transcribed copy the exact time taken in the transcription of each passage. Candidates must not look at their notes while a passage that does not concern them is being read.

6. Inform them also that the clearness and accuracy of the shorthand notes (which must in every case be sent in attached to the transcript) will be taken account of by the examiner; and that they must not alter the shorthand notes after the dictation is finished.

PASSAGES FOR DICTATION.

(a.) At the rate of 80 words a minute. Takes 10 minutes.

It is seldom even in the history of an empire like ours that a measure of such magnitude and of such far-reaching importance as the Australian Commonwealth Bill is submitted to the Legislature for sanction. The colonies to which it applies to-day are great and powerful States, but their resources are so vast, their natural advantages so exceptional, and their poli-