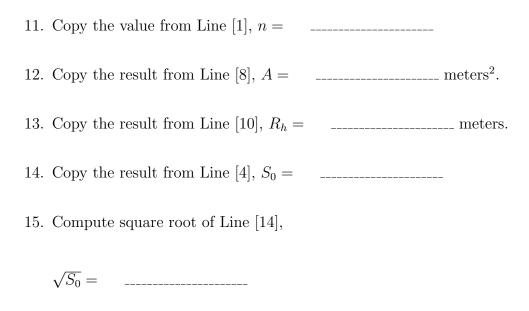
ID-10-T-SI Circular	
Purpose:	Compute discharge in a circular section using Manning's equation as- suming normal (uniform) flow
Required Tools:	Calculator/Slide-Rule, or Logarithmic and Trigonometric Tables
Input Data:	Manning's $n$ ; Conduit Slope, $S_0$ , (dimensionless); Flow Depth, $d$ , (in meters); and Conduit Diameter, $D$ , (in meters)
Output Values:	Discharge, $Q$ , (in cubic meters per second)
Use:	When on-line tools or spreadsheet tools are unavailable.
1. Manning's $n =$	
2. Flow Depth $d =$ meters.	
3. Conduit Diameter $D = \dots$ meters.	
4. Conduit Slope $S_0 =$	
5. Compute ratio of flow depth to diameter; $\frac{d}{D} =$	
6. Compute $cos(\alpha) = 1 - 2 \times \frac{d}{D} =$	
7. Compute the inverse cosine of the result in line [6] in <b>radians</b> . Enter the result below.	
$\cos^{-1}(1-2\times 1)$	$(\frac{d}{D}) = \alpha =$
8. Compute the flow area using	
$A = \frac{D^2}{4} \times (\alpha - \sin(\alpha)\cos(\alpha)) = \qquad \text{meters}^2.$	
9. Compute the wetted perimeter	
$P_w = \alpha \times D =$ meters.	
10. Compute the hydraulic radius, $R_h = \frac{A}{P_w} =$ meters.	

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16. Compute Line [13] raised to the 2/3-rds power;



17. Multiply Line [16], Line [15], and Line [12];

$$R_h^{2/3} \times \sqrt{S_0} \times A = \qquad \dots$$

18. Multiply Line [17] by 1.0;

 $1.0 \times R_h^{2/3} \times \sqrt{S_0} \times A =$ 

19. Divide Line [18] by Line [11], result is discharge, Q.

 $Q = \frac{1.0}{n} \times R_h^{2/3} \times \sqrt{S_0} \times A =$  cubic meters per second.