Answer Key: Civil Engineering Licensure Exam – Mock Exam (Day 11: Triangulation and Trilateration)

February 24, 2025

Answer Key

Section A: Multiple Choice Solutions

1. Advantage of triangulation: **(a) Higher accuracy in rough terrain**

2. Sum of angles in a triangulation network: **(c)** $180°$

3. Trilateration measures: **(b) Distances only**

4. Common instrument for angle measurement: **(a) Theodolite**

5. Ideal triangulation network: **(c) Equilateral triangles**

Section B: Problem-Solving Solutions

1. Missing angle in a triangle:

$$\sum \text{angles} = 180°$$

$$x = 180° - (40° + 65°) = 75°$$

2. Area using Heron's formula:

$$s = \frac{200 + 250 + 300}{2} = 375$$

$$A = \sqrt{s(s-a)(s-b)(s-c)}$$

$$A = \sqrt{375(375-200)(375-250)(375-300)}$$

$$A = \sqrt{375 \times 175 \times 125 \times 75} = 24,495.78 \text{ m}^2$$

3. Smallest angle using cosine rule:

$$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$$

$$\cos A = \frac{60^2 + 80^2 - 50^2}{2(60)(80)}$$

$$\cos A = \frac{3600 + 6400 - 2500}{9600} = 0.75$$

$$A = \cos^{-1}(0.75) = 41.41°$$

4. Third side using Law of Cosines:

$$c^2 = a^2 + b^2 - 2ab\cos C$$

$$c^2 = 150^2 + 150^2 - 2(150)(150)\cos 60°$$

$$c^2 = 45000 - 22500$$

$$c = \sqrt{22500} = 150 \text{ m}$$

5. Finding the remaining side using Law of Sines:

$$\frac{a}{\sin A} = \frac{b}{\sin B}$$

$$\frac{250}{\sin 45°} = \frac{x}{\sin 75°}$$

$$x = \frac{250\sin 75°}{\sin 45°} = 323.61 \text{ m}$$