

SOLUTIONS MANUAL

to accompany

SURVEYING

Tenth Edition

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University of California, Berkeley



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CHAPTER 1

- 1-1. 6.9323 ha. 1-2. 17.130 acres. 1-3. 746,180 sq.ft. 1-4. 2,641.32 ft. 1-5. 805.07 m. 1-6. 90,361.978 ft. 1-7. 90,361.797 ft.
- 1-8. (a) $26^{\circ}54'$; (b) $196^{\circ}13'$; (c) $63^{\circ}27'50''$; (d) $312^{\circ}09'16.6''$; (e) $19^{\circ}31'29.86''$
- 1-9. (a) 29.9^g ; (b) 218.03^g ; (c) 70.516^g ; (d) 346.8384^g ; (e) 21.69440^g
- 1-10. (a) 16.62° ; (b) 254.2783° ; (c) 96.87064° ; (d) 35.78801° ; (e) 174.821342° .
- 1-11. (a) 18.47^g ; (b) 282.5314^g ; (c) 107.63404^g ; (d) 39.76446^g ; (e) 194.245936^g
- 1-12. (a) 14° ; (b) 23.6° ; (c) 247.10° ; (d) 354.747° ; (e) 25.1500° ; (f) 33.71585°
- 1-13. (a) 14° ; (b) $23^{\circ}36'$; (c) $247^{\circ}06'$; (d) $357^{\circ}44'50''$; (e) $25^{\circ}25'00''$ (f) $33^{\circ}42'57.06''$
- 1-14. (a) $11,434 \text{ m}^3$; (b) 99079 m^3 ; (c) $1,946.3 \text{ m}^3$; (d) $13,909.29 \text{ m}^3$
- 1-15. (a) 714 yd^3 ; (b) $3,727.9 \text{ yd}^3$; (c) $1,943.17 \text{ yd}^3$; (d) $55,529 \text{ yd}^3$
- 1-16. 36.7767^g ; 114.5701^g ; 48.6531^g
- 1-17. $10^{\circ}09'38''$; $81^{\circ}29'32''$; $88^{\circ}20'50''$
- 1-18. 66.7740 ha
- 1-19. 165.002 acres
- 1-20. 963.985 m ; 104.7145^g ; 59.6493^g
- 1-21. 882.127 m ; $9^{\circ}26'00''$; $155^{\circ}11'14''$
- 1-22. 70.3136 ha ; 173.748 acres
- 1-23. 10.0906 ha ; 24.9342 acres
- 1-24. 179.289 ft ; 311.073 ft
- 1-25. 689.781 m
- 1-26. $12.82''$
- 1-27. 0.00396^g

CHAPTER 2

$$2-1. \quad \text{Avg pace} = 34.78. \quad \frac{34.78}{100} = \frac{x}{20 \times 66} ; x = 459 \text{ paces}$$

$$2-2. \quad \text{Avg pace} = 57.00. \quad \frac{57.00}{50} = \frac{x}{450} ; x = 513 \text{ paces}$$

$$2-3. \quad H = 962.21 \cos 3^{\circ}16' = 960.65 \text{ ft}$$

$$2-4. \quad dH = -962.21 \sin 3^{\circ}16' \times 2/(60 \times 57.2958) = 0.03 \text{ ft}$$

$$2-5. \quad s = 850.00/\cos 2^{\circ}58' = 851.14 \text{ ft}$$

$$2-6. \quad H = (16.264^2 + 343.516^2)^{\frac{1}{2}} = 343.901 \text{ m}$$

$$2-7. \quad H = 148.264 \cos 4^{\circ}16' = 147.853 \text{ m}$$

$$2-8. \quad dC = \frac{16.264 \times 0.022}{343.516} = 0.001 \text{ m}$$

$$\begin{aligned} 2-9. \quad H_1 &= (30.000^2 - 1.792^2)^{\frac{1}{2}} = 29.946 \\ H_2 &= (30.000^2 - 0.930^2)^{\frac{1}{2}} = 29.986 \\ H_3 &= (18.520^2 - 0.966^2)^{\frac{1}{2}} = 18.495 \\ H_4 &= (30.000^2 - 3.075^2)^{\frac{1}{2}} = 29.842 \\ H_5 &= (12.422^2 - 0.660^2)^{\frac{1}{2}} = \underline{12.404} \\ &\qquad\qquad\qquad 120.673 \\ H &= 120.67 \text{ m} \end{aligned}$$

$$\begin{aligned} 2-10. \quad C_a &= 0.04 \text{ ft} \\ 0.04 \times 2.80 &= 0.11 \text{ ft} \\ 0.04 \times 5.60 &= 0.22 \text{ ft} \\ \text{Lay out } 280.11 \text{ ft by } 560.22 \text{ ft} \end{aligned}$$

$$2-11. \quad 0.04 \times 6.8225 = 0.27 \text{ ft. Lay off } 681.98 \text{ ft}$$

$$\begin{aligned} 2-12. \quad \text{Slope distance} &= \left[(430.000^2 + (0.05 \times 430.000)^2 \right]^{\frac{1}{2}} = 430.537 \text{ m} \\ C_a &= 0.010 \text{ m/tape}; C_a = 0.010 \times \frac{430.537}{30} = 0.144 \text{ m} \\ \text{Lay off } 430.537 - 0.144 &= 430.393 \text{ m} \end{aligned}$$

$$\begin{aligned} 2-13. \quad C_t &= 748.25 \times 0.0000065 (84-72) = +0.058 \text{ ft} \\ C_p &= \frac{(18 - 10) \times 748.25}{0.006 \times 28,000,000} = +0.036 \text{ ft} \end{aligned}$$

Continued

$$C_s \text{ for } 700 \text{ ft} = 7 \left(\frac{2.00^2 \times 100}{24 \times 182} \right) = -0.360$$

$$C_s \text{ for } 48.25 = \frac{0.02^2 \times 48.25^3}{24 \times 18^2} = -0.006$$

$$C_{\text{total}} = -0.272 \text{ ft}$$

$$\text{Length of line is } 748.25 - 0.27 = 747.98 \text{ ft}$$

$$2-14. \quad C_t = 30 \times 0.000015 \times (13.5 - 20) = -0.0023 \text{ m}$$

$$C_s = \frac{0.012^2 \times 30^3}{24 \times 8.5^2} = -0.0022 \text{ m}$$

$$-0.0045 \text{ m}$$

$$\text{Distance } 0-30 \text{ m} = 29.9955 \text{ m}$$

$$2-15. \quad C_a = 5.15 \times (-0.010) = -0.052 \text{ ft}$$

$$C_t = 515.68 \times 0.0000065 \times (42-68) = -0.087 \text{ ft}$$

$$-0.139 \text{ ft}$$

$$\text{Correct distance} = 515.68 - 0.139 = 515.54 \text{ ft}$$

$$2-16. \quad 0.204 \text{ w } \sqrt{AE} = 0.204 \times 1.80 \times \sqrt{0.0056 \times 28,000,000} = 145.40$$

$$\text{Try } 20 \text{ lb } P_n = \frac{145.40}{\sqrt{20 - 10}} = 45.98$$

$$\text{Try } 40 \text{ lb } P_n = \frac{145.40}{\sqrt{40 - 10}} = 26.55$$

$$\text{Try } 32 \text{ lb } P_n = \frac{145.40}{\sqrt{32 - 10}} = 31.00$$

$$\text{Try } 31.5 \text{ lb } P_n = \frac{145.40}{\sqrt{31.5 - 10}} = 31.36 \text{ or } P_n = 31 \frac{1}{2} \text{ lbs}$$

$$2-17. \quad C_s = \frac{0.024^2 \times 50^3}{24 \times 2.2^2} = + 0.6198 \text{ m}$$

$$C_p = \frac{50 (6-2.20)}{0,038 \times 2,100.000} = + 0.0024 \text{ m}$$

$$C_a = - 0.0138 \text{ m}$$

$$\text{Tape measures } 50.6084 \text{ m } C_{\text{TOTAL}} = + 0.6084 \text{ m}$$

$$2-18. \quad \frac{9.20 \text{ dh}}{100^2} = \frac{1}{10,000}; \text{ dh} = \frac{1}{9.20} = 0.109 \text{ ft}$$

$$2-19. \quad \frac{2.840 \text{ dh}}{30^2} = \frac{1}{25,000}; \text{ dh} = \frac{900}{25,000 \times 2.840} = 0.0127 \text{ m}$$

$$2-20. \quad dV'' = \frac{206,265}{20000 \tan 3^{\circ}54'} = 151'' = 2'31''$$

$$2-21. \quad dV'' = \frac{0.005 \times 206,265}{342.535 \sin 2^{\circ}24'} = 72'' = 1'12''$$

$$2-22. \quad n_g = 1 + \left(287.604 + \frac{4.8864}{0.5500^2} + \frac{0.068}{0.5500^4} \right) 10^{-6} = 1.0003045$$

$$n_a = 1 + \frac{0.359474 (1.0003045 - 1) \times 29.00 \times 25.4}{273.2 + (88 - 32) 5/9} = 1.00026496$$

$$2-23. \quad n_g = \left(1 + 287.604 + \frac{4.8864}{0.6328^2} + \frac{0.068}{0.6328^4} \right) 10^{-6} = 1.0003002$$

$$n_a = 1 + \frac{0.359474 (1.0003002 - 1) \times 725}{273.2 + 20} = 1.0002668$$

$$2-24. \quad (n_r - 1) 10^6 = \frac{103.48}{273.2 + 18.9} (29.2 - 0.51) \times 25.4 + \frac{86.26}{273.2 + 18.9} \times$$

$$\left(1 + \frac{5748}{273.2 + 18.9} \right) 0.51 \times 25.4$$

$$n_r = 1.0003373; \quad v_r = \frac{299,792.5}{1.0003373} = 299,691.4 \text{ km/sec.}$$

$$\lambda = 299,691.4 / 30 \times 10^6 = 0.009989714 \text{ km} = 9.98714 \text{ m}$$

$$2-25. \quad v_a = \frac{299,792.5}{1.00026495} = 299,713.1 \text{ km/sec}$$

$$\lambda = 299,713.1 / 30 \times 10^6 = 0.00999043637 \text{ km} = 9.99043637 \text{ m}$$

$$2-26. \quad v_a = \frac{299,792.5}{(1.0002668)} = 299,712.5 \text{ km/sec}$$

$$\lambda = 299,712.5 / 30 \times 10^6 = 0.0099904167 \text{ km} = 9.9904167 \text{ m}$$

$$2-27. \quad (n_r - 1) 10^6 = \frac{103.49}{289.2} (749 - 7.2) + \frac{86.26}{289.2} \left(1 + \frac{5748}{289.2} \right) 7.2$$

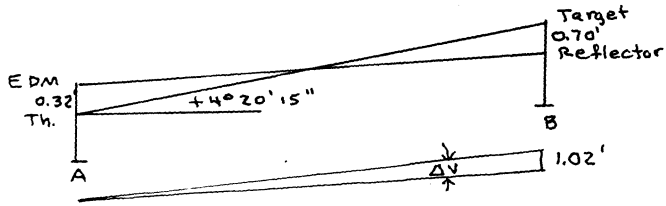
$$n_r = 1.0003103; \quad v_r = \frac{299,792.5}{1.0003103} = 299,699.50 \text{ km/sec}$$

$$\lambda = 299,699.5 / 75 \times 10^6 = 0.00399599338 \text{ km} = 3.99599338 \text{ m}$$

$$2-28. \quad C_L = 1219.28 - (796.16 + 423.25) = -0.13 \text{ ft}$$

$$\text{Length of line is } 2946.22 - 0.13 = 2946.09 \text{ ft}$$

2-29.

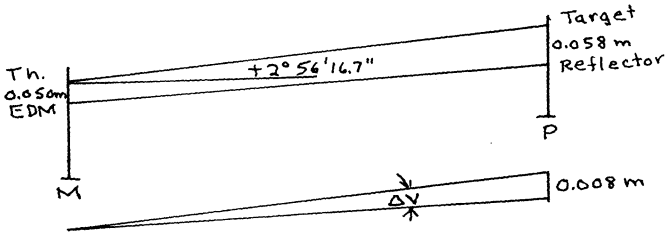


$$\Delta v'' = \frac{1.02 \cos 4^{\circ} 20' 15''}{3451.55 \times 0.000004848} = 61'' = 1' 01''$$

$$v' = 4^{\circ} 20' 15'' - 1' 01'' = 4^{\circ} 19' 14''$$

$$H = 3451.55 \cos 4^{\circ} 19' 14'' = 3441.74'$$

2-30.



$$3.2644^{\circ} = 2^{\circ} 56' 16.7''$$

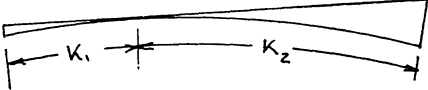
$$\Delta v'' = \frac{0.008 \cos 2^{\circ} 56' 16.7''}{975.26 \times 0.000004848} = 1.7''$$

$$v' = 2^{\circ} 56' 16.7'' - 1.7'' = 2^{\circ} 56' 15''$$

$$H = 975.26 \cos 2^{\circ} 56' 15'' = 973.98 \text{ m}$$

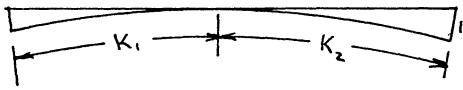
CHAPTER 3

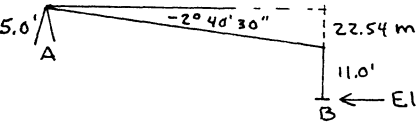
3-1. $C_{BS} = 0.0785 \times 0.060^2 = 0.0003 \text{ m}$; Correct BS = 3.0452 m
 $C_{FS} = 0.0785 \times 0.220^2 = 0.0038 \text{ m}$; Correct FS = $\frac{1.1470 \text{ m}}{DE = +1.8982 \text{ m}}$

3-2.  $K_1 = \sqrt{\frac{5.5}{0.574}} = 3.02 \text{ mi}$
 $K_2 = 13 - 3.02 = 9.98 \text{ mi}$

Ht. of shortest tree = $0.574 \times 9.98^2 = 57 \text{ ft}$

3-3. $C_{BS} = 0.667 \left(\frac{20}{5280}\right)^2 = 0$; Correct BS = 3.865 ft
 $C_{FS} = 0.667 \left(\frac{220}{5280}\right)^2 = 0.0013 \text{ ft}$; Correct FS = $\frac{2.679 \text{ ft}}{DE = +1.1860 \text{ ft}}$

3-4.  $K_1 = \sqrt{\frac{120}{0.574}} = 14.46 \text{ mi}$
 $K_2 = \sqrt{\frac{150}{0.574}} = 16.17 \text{ mi}$
 Between ships 30.63 mi

3-5.  Elev. = 345.46 m

Elev A = $345.46 + 11 \times 0.3048 + 482.5 \tan 2^\circ 40' 30'' - 50 \times 0.3048 = 506.91 \text{ mi}$

3-6. At P, DE = $45,580.50 \sin 2^\circ 12' 15'' = 1753.05 \text{ ft}$
 At Q, DE = $45,580.50 \sin 2^\circ 19' 15'' = 1845.79 \text{ ft}$
 $DE_{PQ} = +1799.42 \text{ ft}$

Elev. of Q = $1542.85 + 1799.42 = 3342.27 \text{ ft}$

3-7. At Q, DE = $45,580.50 \sin 2^\circ 19' 15'' - 0.0206[(45,580.5/1000) \cos 2^\circ 19' 15'']^2$
 DE = 1803.06 ft.

3-8. DE = $5.20 + 2250 \tan 12^\circ 52' 25'' + 0.0206 \frac{2,250^2}{5000} - 12.28 = 507.25 \text{ ft}$
 Elev hilltop = $322.64 + 507.25 = 829.89 \text{ ft}$