CLASS TEST

S.No.: 01SKCE_JKL_23072025

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SURVEYING

CIVIL ENGINEERING

Date of Test : 23/07/2025

ANSWER KEY

1.	(c)	7.	(b)	13.	(c)	19.	(b)	25.	(d)
2.	(a)	8.	(d)	14.	(b)	20.	(b)	26.	(d)
3.	(d)	9.	(d)	15.	(c)	21.	(d)	27.	(b)
4.	(d)	10.	(a)	16.	(c)	22.	(d)	28.	(c)
5.	(d)	11.	(d)	17.	(c)	23.	(b)	29.	(a)
6.	(a)	12.	(b)	18.	(a)	24.	(b)	30.	(c)

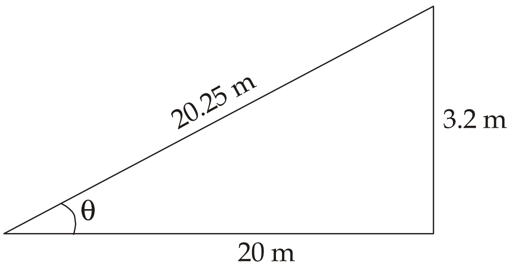
DETAILED EXPLANATIONS

1. (c)

$$\text{Correction for sag} = \frac{W^2 l_1}{24P^2} = \left[\frac{(30)^2 \times 100}{24 \times (200)^2}\right] = 0.09375 \text{ m}$$

$$\text{Horizontal distance} = 100 - 0.09375 = 99.90625 \text{ m}$$

2. (a)



$$\text{Hypotenusal allowance} = l(\sec\theta - 1)$$

$$= 20\left(\frac{20.25}{20} - 1\right) = 0.25\text{m} = 25 \text{ cm}$$

3. (d)

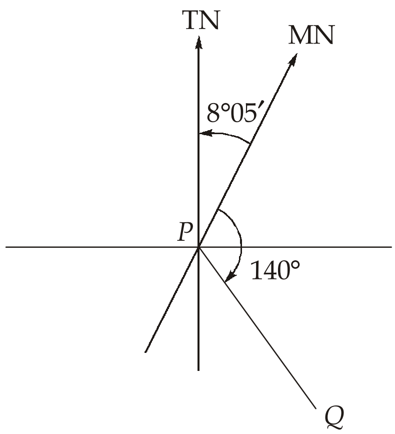
Isogonic lies: It is the line passing through points on the earth surface at which declination is same at a given point.

Agonic lines: These are special isogonic lines which pass through points having zero declination.

Isoclinic lines: The imaginary line joining the points having same dip on the surface of the earth.

Aclinic lines: The imaginary line joining the points with no dip.

4. (d)



$$\text{True bearing of } PQ = \text{Magnetic bearing} \pm \text{magnetic declination E/W}$$

$$= 140° + 8°05′$$

$$= 148°05′$$

5. (d)

A theodolite is a precise instrument for measuring horizontal angels, angles of elevation and depression i.e., vertical angles, bearing and azimuth of a line.

- Theodolite is also used for prolongation of survey lines, finding difference in elevations and setting out engineering works requiring higher precision i.e., ranging the highway and railway curves, aligning tunnels etc.; measuring distances indirectly and levelling.

6. (a)

$$L \times l = L_1 \times l_1$$

$$L = 940.5 \text{ m}, \; l = 20.1 \text{ m}, \; l_1 = 20 \text{ m}$$

$$\therefore \quad L_1 = \frac{940.5 \times 20.1}{20} = 945.2 \text{ m}$$

7. (b)

Let the length of line measured on plan be L.

Actual area, $A = (4000\,L)^2$

Measured area, $A_m = (5000\,L)^2$

$$\text{Percentage error in area} = \frac{(5000\,L)^2 - (4000\,L)^2}{(4000\,L)^2} \times 100 = 56.25\%$$

8. (d)

Multiplying constant = k

Additive constant = 0, for anallactic lens

$\therefore \quad D = ks$

$\Rightarrow \quad D \;\alpha\; s$

10. (a)

$$\text{The height of rise} = 0.0673\,D^2 = 0.0673 \times (50)^2 = 168.25 \text{ m}$$

11. (d)

Displacement due to angular error on ground = $l \sin\alpha = 15 \sin\alpha$

Displacement due to linear error on ground = $\frac{l}{r} = \frac{15}{20} = 0.75$

$$\text{Combined error on ground} = \sqrt{(15\sin\alpha)^2 + (0.75)^2}$$

Combined error in plotting on plan = $\frac{1}{30}\sqrt{(15\sin\alpha)^2 + (0.75)^2}$

Hence, $\frac{1}{30}\sqrt{(15\sin\alpha)^2 + (0.75)^2} = 0.025$

$\Rightarrow \quad \alpha = 0°$

So, no angular error can be permitted.

12. (b)

$$\alpha = \frac{S}{nD} \times 206265''$$

$$\therefore \quad S = \frac{\alpha n D}{206265} = \frac{30 \times 2 \times 150}{206265} = 0.0436 \text{ m}$$

13. (c)

$$L = (1 - P_l)\, Sl$$

$$W = (1 - P_w)\, Sw$$

$$\therefore \quad L = (1 - 0.65) \times 250 \times 20 \text{ m} = 1.75 \text{ km}$$

$$W = (1 - 0.30) \times 250 \times 20 \text{ m} = 3.5 \text{ km}$$

Area covered by one photograph

$$= LW$$

$$= 1.75 \times 3.5$$

$$= 6.125 \text{ km}^2$$

14. (b)

$$V = h\left[\frac{A_1 + A_n}{2} + A_2 + A_3 + A_4\right]$$

$$= 5\left[\frac{20 + 1100}{2} + 100 + 400 + 900\right] \times 10^4$$

$$= 9800 \times 10^4 \text{ m}^3$$

15. (c)

In a closed traverse with no local attraction,

$$FB - BB = 180°$$

Since station 'X' is free from local attraction and therefore FB_{XY} and BB_{ZY} are correct.

$\therefore$ $FB_{XY} = 35°$ and $BB_{XY} = 216°$

But $BB_{XY} - FB_{XY} = 216 - 35° = 181° \neq 180°$

$\therefore$ A correction of –1° is to be applied at station Y,

$\therefore$ $FB_{YZ} = 116° - 1° = 115°$

But $BB_{YZ} - FB_{YZ} = 293° - 115° = 178° \neq 180°$

$\therefore$ A correction of +2° is to be applied at Z

$\therefore$ The correct FB of ZY $= 293° + 2° = 295°$

16. (c)

Using reciprocal levelling,

$$h = \frac{(Q_1 - P_1) + (Q_2 - P_2)}{2}$$

$$= \frac{(2.305 - 1.575) + (2.150 - 1.540)}{2}$$

$$= 0.67 \text{ m}$$

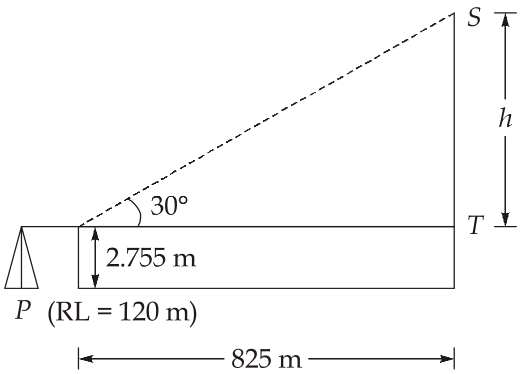
If instrument is kept at P, reading at Q will be erroneous by 'e'

$$h = (2.305 - e) - 1.575$$

$$\Rightarrow \quad 0.67 = 2.305 - e - 1.575$$

$$\Rightarrow \quad e = 0.06 \text{ m}$$

17. (c)



$$\text{RL of top of tower} = \text{Height of instrument at } P + h$$

$$= (120 + 2.755) + 825 \tan 30° = 599.07 \text{ m}$$

18. (a)

Combined correction due to curvature and refraction

$$C = -0.0673\, d^2 \qquad \text{(where } d \text{ is in km)}$$

$$= -0.0673\, (0.425)^2$$

$$= -0.012156 \text{ m}$$

$\therefore$ Corrected staff reading at B $= 1.950 - 0.012156 = 1.938$ m

[RL] of B $=$ [RL] of A + HI – Staff reading at B

$= 160 + 1.2 - 1.938 = 159.262$ m

$\therefore$ Level difference $= (\text{RL})_A - (\text{RL})_B = 160 - 159.262 = 0.738$ m

19. (b)

GMT time = 00:00 – 0.5:30 = 18:30 GMT on 31st December.

Branch	City	GMT offset	Local time
A	Dubai	GMT +4:00	18:30 + 4:00 = 22:30 on 31st December
B	Seoul	GMT +9:00	18:30 + 9:00 = 03:30 on 1st January
C	Cape Town	GMT +2:00	18:30 + 2:00 = 20:30 on 31st December
D	Auckland	GMT +13:00	18:30 + 13:00 = 07:30 on 1st January

20. (b)

- Bowditch method also called compass rule, is used to balance a traverse where linear and angular measurements are of equal precision.
- Transit method employed where angular measurements are more precise than the linear measurements.

21. (d)

Chainage of point of commencement

= Chainage of point of intersection
– Tangent length intersection with the curve

$$\text{Tangent length} = R\tan\frac{\delta}{2}$$

$$\delta = 80°$$

$$\text{Tangent length} = 600\tan\left(\frac{80}{2}\right) = 503.5 \text{ m}$$

∴ Chainage of point of commencement

$$= 2053 - 503.5 = 1549.5 \text{ m} \simeq 1550 \text{ m (say)}$$

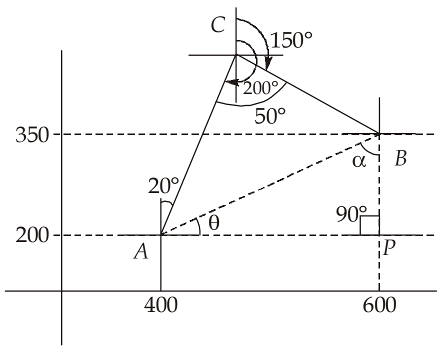
22. (d)

BS	IS	FS	Rise	Fall	RL	Comment
1.135	–	–	–	–	90.000	–
1.08	–	0.368	0.767	–	90.767	–
1.155	–	1.844	–	0.764	90.003	–
–	2.632	–	–	1.477	88.526	–
–	1.196	–	1.436	–	89.962	–
–	–	0.976	0.22	–	90.182	–

(All values in m)

So, the value of Y = 89.962 m.

23. (b)



$$\angle C = 200° - 150° = 50°$$

$$BP = 350 - 200 = 150 \text{ m}$$

$$AP = 600 - 400 = 200 \text{ m}$$

$\therefore$ $AB = \sqrt{BP^2 + AP^2} = \sqrt{150^2 + 200^2} = 250 \text{ m}$ ...(i)

Now, $\tan\theta = \dfrac{BP}{AP} = \dfrac{150}{200}$

$\therefore$ $\theta = 36.87°$

$\therefore$ $\alpha = 180° - (90° + 36.87) = 53.13°$

$\therefore$ FB of BA $= 180 + \alpha = 180° + 53.13° = 233.13°$

FB of CB $= 150°$ (Given)

FB of AC $= 200° - 180° = 20°$ (Alternate angle)

For a closed transverse,

$\because$ $\Sigma L = 0$

$\Rightarrow$ $L_{AC}\cos 20° + L_{CB}\cos 150° + L_{BA}\cos 233.13° = 0$

$\Rightarrow$ $0.94\, L_{AC} - 0.86\, L_{CB} + 250\,(-0.60) = 0$

$\Rightarrow$ $0.94\, L_{AC} - 0.86 L_{CB} = 150$ ... (ii)

$\because$ $\Sigma D = 0$

$\Rightarrow$ $L_{AC}\sin 20° + L_{CB}\sin 150° + L_{BA}\sin 233.13° = 0$

$\Rightarrow$ $0.34\, L_{AC} + 0.5\, L_{CB} - 0.8(250) = 0$

$\Rightarrow$ $0.3\, L_{AC} + 0.5 L_{CB} = 200$ ... (iii)

By solving equations (ii) and (iii)

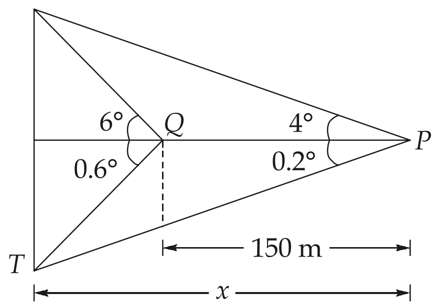
$L_{AC} = 339.286 \text{ m}$

$L_{CB} = 196.428 \text{ m}$

and $L_{AB} = 250 \text{ m}$ [From eq. (i)]

$\therefore$ Perimeter of transverse $= 339.286 + 196.428 + 250 = 785.714 \text{ m}$

24. (b)



$x(\tan 4° + \tan 0.2°) = (x - 150)(\tan 6° + \tan 0.6°)$

$\Rightarrow$ $0.0734\, x = (x - 150)(0.11558)$

$\Rightarrow$ $0.04218\, x = 17.337$

$\Rightarrow$ $x = 411.024 \text{ m}$

$\therefore$ Height of tower $= 411.024(\tan 4° + \tan 0.2°)$

$= 30.176 \text{ m}$

25. (d)

Height of instrument, HI = RL of floor + Staff reading from floor

= 45.65 + 0.60

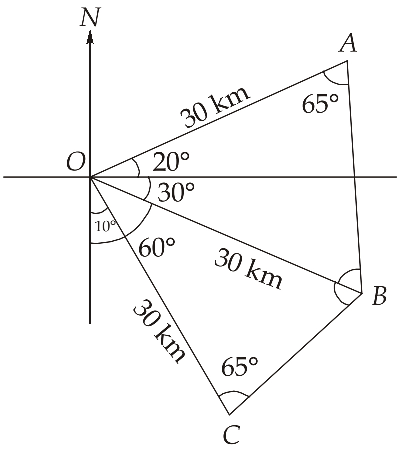
= 46.250 m

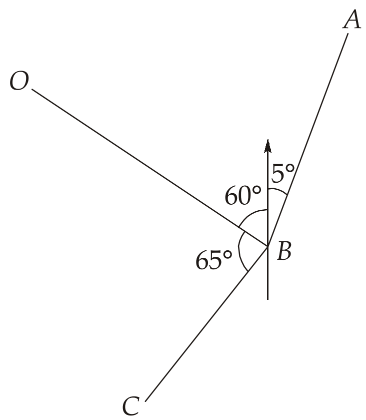
RL of bottom of beam, = HI + Inverted staff reading taken from bottom of beam

= 46.250 + 3.242

= 49.492 m

26. (d)





Since speed of ships is same, the distance travelled by them will be same after an hour.

Distance travelled = 30 km

$\angle AOB$ = 50°

$\angle BOC$ = 50°

Using cosine formula, $AB = \sqrt{OA^2 + OB^2 - 2OA \times OB\cos(\angle AOB)}$

$= \sqrt{30^2 + 30^2 - 2 \times 30 \times 30 \times \cos 50°}$

= 25.36 km

Since ΔAOB and ΔBOC are congruent,

AB = BC = 25.36 km

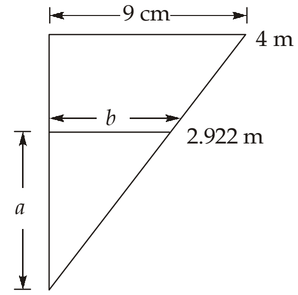
FB of BA = 65° – 60° = 5°

So, Bearing of A = N 5°E

Bearing of C = S 55°W

So, (a), (b) and (c) are correct.

27. **(b)**



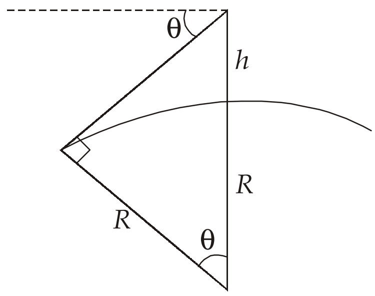
$$\frac{b}{9} = \frac{2.922}{4}$$

$\Rightarrow$ $b = 6.5745$ cm

$\therefore$ Correct reading $(a) = \sqrt{2.922^2 - (0.065745)^2}$

$= 2.92126 \text{ m} \simeq 2.9213 \text{ m}$

28. **(c)**



$$\text{Dip} = \theta = \cos^{-1}\left(\frac{R}{R+h}\right)$$

$\Rightarrow$ $\theta = \cos^{-1}\left(\frac{6370}{6370 + 0.082}\right)$

$\Rightarrow$ $\theta = 0.2907° = 17.44$ minutes

29. **(a)**

For a simple circular curve,

$$\text{Length of curve} = \frac{\pi R \Delta}{180} = \frac{\pi \times 300 \times 60}{180} = 314.16 \text{ m}$$

$$\text{Length of long chord} = 2R\sin\frac{\Delta}{2} = 2(300)\sin\left(\frac{60°}{2}\right) = 300 \text{ m}$$

$$\text{Apex distance} = R\left(\sec\frac{\Delta}{2} - 1\right) = 300\left[\frac{1}{\cos 30°} - 1\right] = 46.41 \text{ m}$$

$$\text{Mid ordinate} = R\left(1 - \cos\frac{\Delta}{2}\right) = 300[1 - \cos 30°] = 40.19 \text{ m}$$

30. **(c)**

Average scale of photograph

$$= \frac{f}{H - h_{avg}}$$

$$h_{\text{avg}} = \frac{1}{4}(1250 + 1650 + 1486 + 1501) = 1471.75 \text{ m}$$

$$\text{Average scale} = \frac{0.160}{3200 - 1471.75} = \frac{0.16}{1728.25}$$

$$= \frac{1}{10801.56} \simeq \frac{1}{10802}$$

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