CLASS TEST

S.No. : 01IGCE_DEF_17042024

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SURVEYING

CIVIL ENGINEERING

Date of Test : 17/04/2024

ANSWER KEY

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

DETAILED EXPLANATIONS

1. (d)

2. (a)

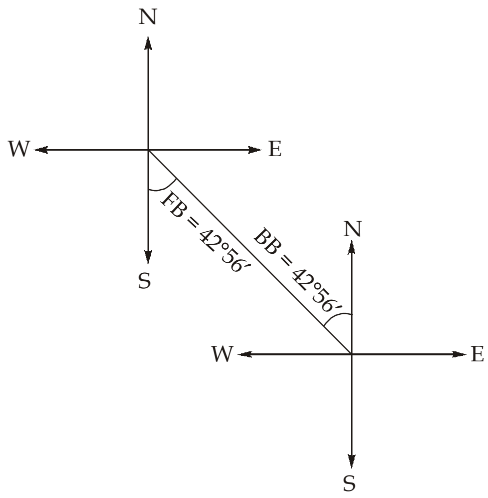
$$\text{Correct volume} = \left(\frac{l'}{l}\right)^3 \times \text{Computed volume}$$

$$= \left(\frac{20.15}{20}\right)^3 \times 10000 = 10226.69 \text{ m}^3$$

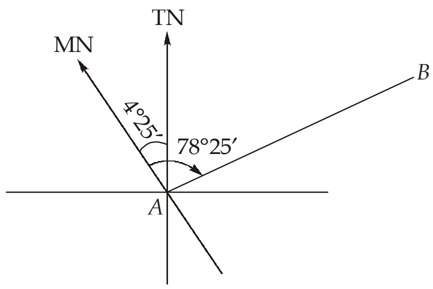
3. (c)

Check lines are provided to check the accuracy of the field work.

4. (c)



5. (a)



$$\begin{aligned}\text{True bearing} &= \text{Magnetic bearing} - \text{Declination}\\ &= 78°25' - 4°25'\\ &= 74°00'\end{aligned}$$

6. (a)

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

$\Rightarrow$ $L = 841.5$ m, $l = 20.1$ m, $l_1 = 20$ m

$$\Rightarrow \qquad L_1 = \frac{841.5 \times 20.1}{20} = 845.7 \text{ m}$$

7. (b)

Chain surveying is used for securing data for exact description and marking of the boundaries of a piece of land or for preparing the maps of the area to show various details. It is generally used for plans of estates, fields, etc. on a large scale when the area is small in extent and the ground is fairly level and open.

The cross-staff survey is a special type of chain survey conducted to locate the boundaries of a field for the purpose of determining the area of the field.

8. (d)

Photomaps are the aerial photographs which are used as a suitable for maps. The photomap may consist of one photograph, but usually photomaps are obtained by assembling two or more photographs to form a large map.

The large photomaps from two or more photographs are called mosaics. To varying degree of accuracy, a mosaic is a map substitute.

The mosaic has an overall average scale comparable to the scale of a planimetric map.

9. (a)

The magnetic needle is attached to a graduated aluminium ring. The ring is graduated from 0° to 360°. Further, Degrees are subdivided into half degrees.

10. (d)

Resection is a method of plane table surveying in which location of station occupied by plane table is unknown and it is determined by sighting any two or three known points or plotted points. It is also called method of orientation and it can be conducted by two field conditions as follows:

- The three point problem
- The two-point problem

11. (b)

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

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

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

$$= 9800 \text{ ha-m}$$

12. (a)

$$\text{Number of full chord} = \frac{1435}{20} = 71.75 \simeq 71$$

$$\text{Length of last chord } C_n = (1435 - 71 \times 20) = 1435 - 1420 = 15 \text{ m}$$

Now, offset for last chord

$$O_n = \frac{C_n}{2R}(C_n + C_{n-1})$$

$$O_{72} = \frac{15}{2 \times 400}(15 + 20) = 0.656$$

$$\simeq 0.66 \text{ m}$$

13. (b)

$$\text{Scale} = \frac{1}{5000}, \quad S = 5000,$$

Area, $A = 100 \text{ km}^2$

Length recorded by 1 photo $= ls(1 - p_s)$

$= 150 \times 5000 \times (1 - 0.7) \times 10^{-6}$

$= 0.225$ km

Width recorded by 1 photo $= bs(1 - p_s)$

$= 150 \times 5000 \times (1 - 0.4) \times 10^{-6}$

$= 0.45$ km

Area recorded by 1 photo $= (0.225 \times 0.45) = 0.10125 \text{ km}^2$

No. of photos required,

$$N = \frac{A}{a'} = \frac{100}{0.10125} = 987.654 \text{ photos}$$

14. (a)

$$\text{Scale} = \frac{\text{Map distance}}{\text{Ground distance}}$$

$$\Rightarrow \quad \frac{1}{25000} = \frac{3.6}{\text{Ground distance}}$$

$\Rightarrow$ Ground distance $= (3.6 \times 25000)$ cm $= 900$ m

Now, $$S_{\text{photo}} = \frac{f}{H - h}$$

$$\Rightarrow \quad \frac{5}{900} = \frac{12}{H - 200}$$

$\Rightarrow$ $H = 2360$ m

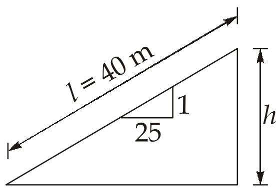
$\therefore$ Height of aircraft above ground

$= H - h$

$= 2360 - 200$

$= 2160$ m $= 2.16$ km

15. (c)



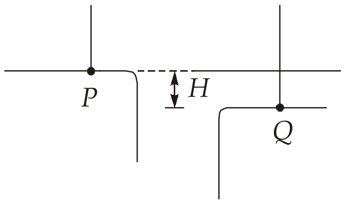
$$\text{Slope correction} = \frac{h^2}{2l}$$

Difference in elevation between points,

$$h = \frac{1}{\sqrt{25^2+1^2}} \times 40 = 1.598 \simeq 1.6 \text{ m}$$

$$\therefore \text{ Slope correction} = \frac{(1.6)^2}{2\times 40} = 0.032 \text{ m} = 3.2 \text{ cm}$$

16. (a)



Using reciprocal levelling,
$$H = \frac{(Q_1 - P_1)+(Q_2 - P_2)}{2}$$

$$= \frac{(2.205-1.475)+(2.060-1.44)}{2}$$

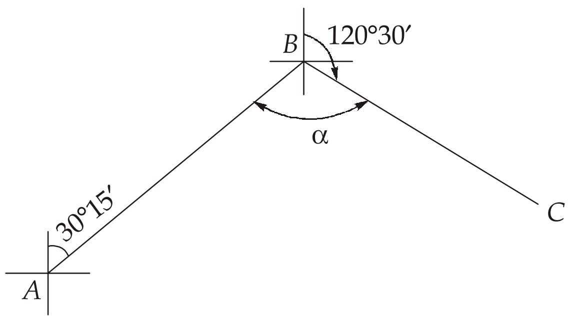
$$= 0.675 \text{ m}$$

If instrument is at P then true reading at Q will be

$$Q_1^T = P_1 + H = 1.475 + 0.675 = 2.15 \text{ m}$$

So, $$\text{Collimation error} = \text{Measured value} - \text{True value}$$
$$= 2.205 - 2.15 = 0.055$$

17. (b)



The interior angle,
$$\alpha = BB \text{ of } AB - FB \text{ of } BC$$
$$= (30°15' + 180°) - 120°30'$$
$$= 89°45'$$

18. (c)

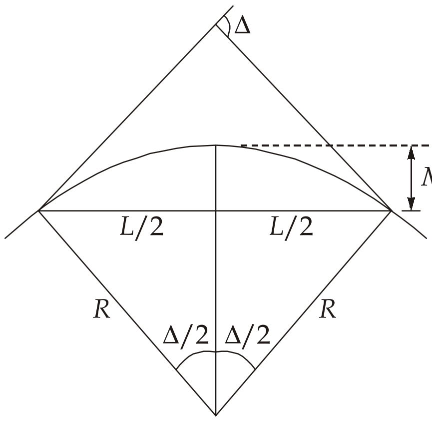
Temporal resolution refers to the precision of a measurement with respect to time in which, observations are made over the same area on different datas. This is useful during crop growth, deforestation, floods etc.

19. (a)

A theodolite is a precision instrument used for measuring angles both horizontally and vertically theodolites can rotate along their horizontal axis as well as their vertical axis. A transit is a surveying instrument that also takes accurate angular measurements. Transits use vernier scales and external graduated metal circles for angular readings.

A double readings theodolite is one in which images of diametrically opposite parts of the graduated circle are brought into the field of view by a suitable optical arrangement and are read and averaged in one stroke.

20. (a)



$$\text{Mid ordinate, } M = R - \sqrt{R^2 - \left(\frac{L}{2}\right)^2}$$

$$= 30 - \sqrt{30^2 - 25^2}$$

$$= 13.42 \text{ m}$$

21. (a)

22. (c)

We have, $$\Delta h = \frac{H \times \Delta p}{b + \Delta p}$$

where, H = Height of datum

Δp = Parallax difference between two points

Δh = Elevation difference between two points

b = Photograph base

But here, Δp = +0.75 mm

b = 94.25 mm

Δh = 100 m

$$H = \frac{\Delta h(b + \Delta p)}{\Delta p} = \frac{100(94.25 + 0.75)}{0.75}$$

$$= 12666.67 \text{ m}$$

23. (b)

24. (d)

$$\text{First RL} = 51.45 \text{ m}$$
$$\text{Last RL} = 63.5 \text{ m}$$
$$\Sigma BS = 87.755 \text{ m}$$
$$\Sigma FS = 73.725 \text{ m}$$

where there is no error, then

$$\Sigma BS - \Sigma FS = \text{Last RL} - \text{First RL}$$

The difference between LHS and RHS is the closing error of the work.

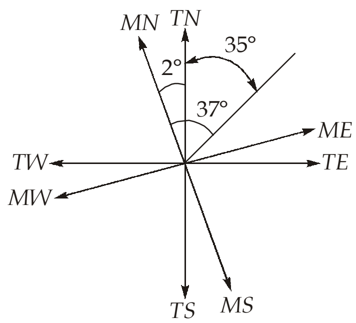
$$\Sigma BS - \Sigma FS = 87.755 - 73.725 = 14.03 \text{ m}$$
$$\text{Last RL} - \text{First RL} = 63.5 - 51.45 = 12.05 \text{ m}$$
$$\text{Closing error} = 14.03 - 12.05 = 1.98 \text{ m}$$

25. (a)

$$\text{H.I. at point 5} = \text{R.L. of } C + \text{Foresight at point } C = 197.82 \text{ m}$$
$$\text{R.L. of point 5} = \text{H.I. at point 5} - \text{Backsight at point 5} = 193.49 \text{ m}$$
$$\text{H.I. at point 2} = \text{R.L. of point 3} + 5.39 = 197.01 \text{ m}$$
$$\text{R.L. of point 2} = \text{H.I. at point 2} - 3.91 = 193.1$$
$$\text{R.L. of point 4} = \text{H.I. at point 2} - 4.73 = 192.28 \text{ m}$$
$$\text{R.L. of } B = \text{H.I. at point 2} - (-6.29) = 203.30 \text{ m}$$
$$\text{H.I. at } A = \text{R.L. of point 2} + 6.52 = 199.62$$
$$\text{R.L. of } A = \text{H.I. at } A - 4.39 = 195.23 \text{ m}$$

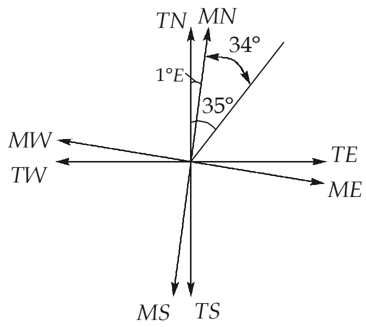
26. (b)

In December 1985



Now rate of annual magnetic declination is 5′E, so in 36 years i.e. 1985 to 2021 magnetic meridian got shifted by 5 × 36 i.e. 180′ means 3° in east ward side. So net declination in 2021 is 1°E.

$$\therefore \quad TB = MB - \delta_W$$
$$= 37° - 2° = 35°$$



$$TB = MB + \delta_E$$

$\Rightarrow$ $$35° = MB + 1°$$

$\Rightarrow$ $$MB = 34°$$

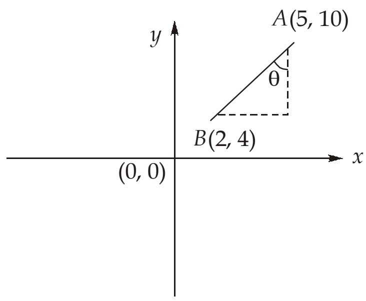
27. (d)

Length of line AB, $$L_{AB} = \sqrt{(y_2 - y_1)^2 + (x_2 - x_1)^2}$$

$$= \sqrt{(4-10)^2 + (2-5)^2}$$

$$= \sqrt{36+9}$$

$$= 6.71$$



$\Rightarrow$ $$\tan\theta = \frac{3}{6}$$

$\Rightarrow$ $$\theta = 26.56°$$

Bearing of line AB with the north,

$$\alpha = \theta + 180 = 206.56°$$

Latitude of line, $$AB = L_{AB} \cos\alpha$$

$$= 6.71 \times \cos(206.56°)$$

$$= -6.00$$

28. (b)

Length of curve, $$l = PT - PC$$

$\Rightarrow$ $$l = 2999.4 - 2658.3$$

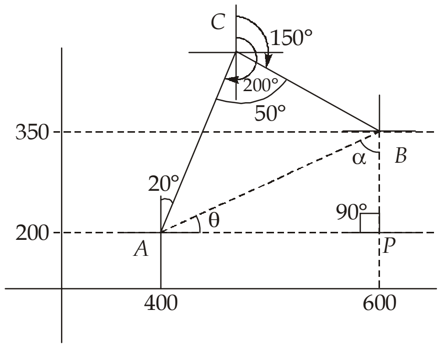
$\Rightarrow$ $$l = 341.1 \text{ m}$$

We know, $$\frac{l}{\Delta} = \frac{2\pi R}{360°}$$

$$\Rightarrow \quad \frac{341.1}{50°} = \frac{2\pi R}{360°}$$

$$\Rightarrow \quad R = 390.87 \text{ m} \simeq 391 \text{ m}$$

29. **(a)**



$$\angle C = 200° - 150° = 50°$$

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

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

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

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

$\therefore \quad \theta = 36.87°$

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

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

FB of CB $= 150°$ (Given)

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

Now, $\angle BAC = 90° - (20° + \theta) = 90° - (20° + 36.87°) = 33.13°$

30. **(b)**

For a closed transverse,

$\because \quad \Sigma L = 0$

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

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

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

$\because \quad \Sigma D = 0$

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

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

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

By solving equations (i) and (ii)

$L_{AC} = 339.286$ m

$L_{CB} = 196.428$ m

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

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

■■■■