CLASS TEST

S.No. : 01IGCE_AB_07012024

MADE EASY

India's Best Institute for IES, GATE & PSUs

Delhi | Bhopal | Hyderabad | Jaipur | Pune | Kolkata

Web: www.madeeasy.in | E-mail: info@madeeasy.in | Ph: 011-45124612

SURVEYING

CIVIL ENGINEERING

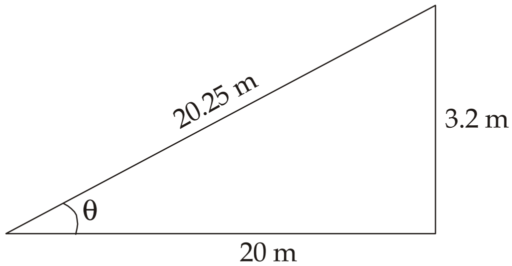
Date of Test : 07/01/2024

ANSWER KEY

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

DETAILED EXPLANATIONS

3. (a)



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

$$= 20\left(\frac{20.25}{20} - 1\right)$$

$$= 0.25\text{m}$$

$$= 25\text{ cm}$$

4. (d)

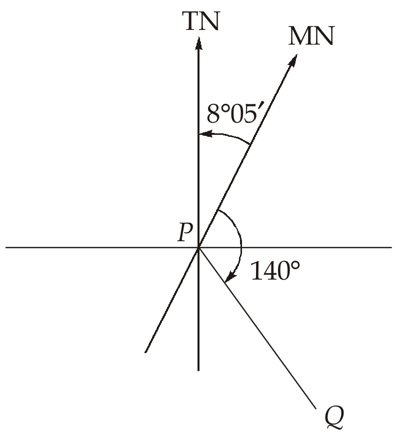
Isogonic lies: It is the line passing through points on the earth surface at which declination is same at a given point.

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.

5. (d)



$$\text{True bearing of } PQ = \text{Magnetic bearing + Magnetic declination (E)}$$

$$= 140° + 8°05'$$

$$= 148°05'$$

6. (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.

7. (c)

$$\text{Most probable angle} = \frac{2 \times 30°00'00'' + 4 \times 30°00'20''}{6}$$

$$= 30°00'13.33''$$

Hence option (c) is correct.

8. (a)

$$R = \frac{l}{\alpha}$$

Now, $l = 2 \text{ mm} = 0.002 \text{ m}$

$$\alpha = \frac{30}{206265} \text{ radians}$$

$$\Rightarrow \quad R = \frac{l}{\alpha} = \frac{0.002 \times 206265}{30} = 13.75 \text{ m}$$

9. (c)

- Reciprocal levelling is used to determine the correct difference in elevations of two points which are quite a large distance apart and it is not possible to set up the instrument mid-way between these two points to balance the foresight and backsight.
- Reciprocal levelling eliminates the need of applying
  (a) correction due to curvature
  (b) correction due to refraction
  (c) collimation error
  It does not eliminates parallax error.

10. (a)

Intersection: It is a method of locating a point on the drawing sheet by the intersection of two rays drawn from two different station.

This method is most commonly used for plotting details. It is preferred when the distance between the stations is too large, the stations are inaccessible, or ground is undulating.

Note:

Resection: This method of orientation is employed when the plane table occupies a position not yet plotted on the drawing sheet.

Radiation: In this method, instrument is set up at a station and rays are drawn to various stations which should be visible and accessible from the plane table station.

11. (d)

True bearing = Magnetic bearing – Declination (west)

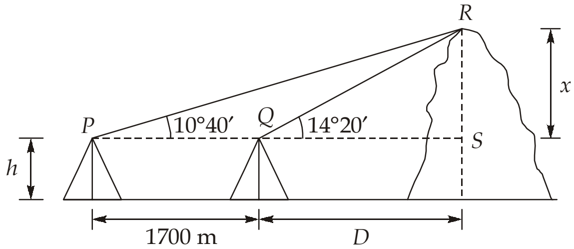
$= 320°30' - 3°30' = 317°0'$

As the true bearing of a line is constant, so the present true bearing of line is also 317°0′.

$\therefore$ Present magnetic bearing = True bearing – Declination (East)

$= 317°0' - 4°15' = 312°45'$

12. (c)



In ΔPRS,

$$\tan 10°40' = \frac{x}{1700 + D}$$

$$\Rightarrow \quad x - 0.188D = 320.194 \quad \text{...(1)}$$

In ΔQRS, $$\tan 14°20' = \frac{x}{D}$$

$$\Rightarrow \quad x - 0.256\,D = 0 \quad \text{...(2)}$$

From (1) and (2) $x = 1205.44$ m and $D = 4708.74$ m

$\therefore$ Elevation of top of hill $= x + h$

$= 1205.44 + 436.50 = 1641.94$ m

13. (b)

Longitude of the place = 94°20′E

Longitude of the standard meridian = 78°30′E

$\therefore$ Difference in longitude $= 94°20' - 78°30' = 15°50'$

= 1 h 3m 20 s

The place is east of standard meridian

$\therefore$ Standard time = LMT – Difference in longitude = LMT – 1 h 3 m 20 s

$\Rightarrow$ LMT = 10 h 06 m 18 s + 1 h 3 m 20 s = 11 h 09 m 38 s

14. (b)

In surveyor's compass:

- The graduated card or scale ring is directly fixed to the box, which governs the size of compass.
- Used for measurement of quadrantal bearings.

15. (b)

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

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

16. (b)

RL of instrument station = 102.680 m

Height of trunnion axis = 1.560 m

Hence, RL of line of collimation = 102.680 + 1.560 = 104.24 m

Now, RL of staff station = 104.24 – 1.285 = 102.955 m

Hence option (b) is correct.

17. (b)

Let $2L = 6$ m

$\Rightarrow$ $L = 3$ m

$A_1 = 5 \times 4 = 20$ m^2

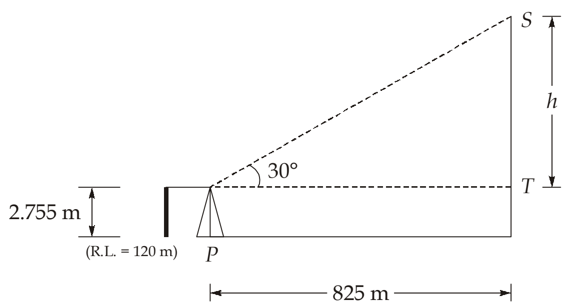
$A_2 = 4 \times 2 = 8$ m^2

$$A_m = \left(\frac{5+4}{2}\right) \times \left(\frac{4+2}{2}\right) = 13.5 \text{ m}^2$$

$$\therefore \quad V = \frac{L}{3} \times (A_1 + 4A_m + A_2)$$

$$= \frac{3}{3}(20 + 4 \times 13.5 + 8) = 82 \text{ m}^3$$

18. (c)

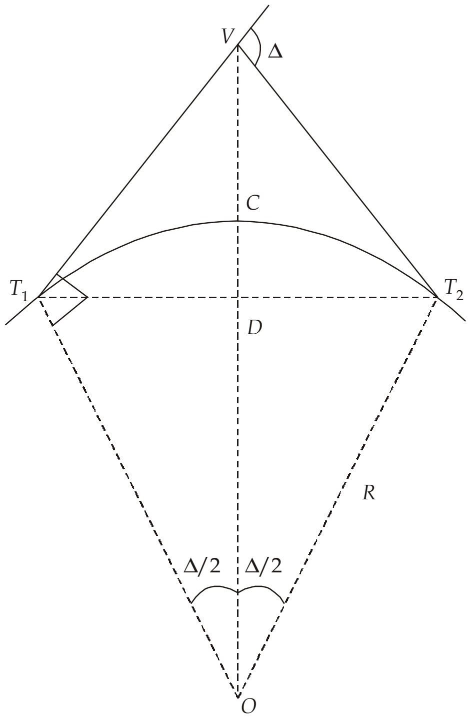


RL of top of tower = Height of instrument at $P + h$

= (120 + 2.755) + 825 tan 30°

= 599.07 m

19. (d)



- Tangent length (VT_1) = $R\tan\frac{\Delta}{2}$
- Apex distance (VC) = $R\left(\sec\frac{\Delta}{2}-1\right)$
- Length of long chord (T_1DT_2) = $2R\sin\frac{\Delta}{2}$
- Mid-ordinate (CD)= $R\left(1-\cos\frac{\Delta}{2}\right) = R\,\text{versine}\frac{\Delta}{2}$

20. (c)

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

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

$$\Rightarrow \quad \text{Ground distance} = 90{,}000 \text{ cm} = 900 \text{ m}$$

Now,

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

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

$$\Rightarrow \quad H = 2360 \text{ m}$$

∴ Height of aircraft above ground

$$= H - h$$
$$= 2360 - 200$$
$$= 2160 \text{ m} = 2.16 \text{ km}$$

21. (a)

$$h_A = 1.35 \text{ m}, \qquad h_A' = 1.65 \text{ m}$$
$$h_B = 0.7 \text{ m}, \qquad h_B' = 0.45 \text{ m}$$

$$H = \frac{(h_B - h_A) + (h_B' - h_A')}{2}$$

$$= \frac{(0.7 - 1.35) + (0.45 - 1.65)}{2} = -0.925$$

$$\text{RL}_A = 100 \text{ m}$$

Station B is at a rise with respect to station A.

$$\text{RL}_B = \text{RL}_A + \text{H} = 100 + 0.925 = 100.925 \text{ m}$$

22. (b)

$$\tan\theta = \frac{\Sigma D}{\Sigma L}$$

$$\Rightarrow \qquad \tan\theta = \frac{2.50}{1.40}$$

$$\therefore \qquad \theta = \tan^{-1}\left(\frac{-2.50}{1.40}\right)$$

$$\Rightarrow \qquad \theta = -60° \; 45' \; 4.23''$$

$\therefore$ ΣD is negative, means it is in west.

ΣL is positive, means it is in North.

$$\therefore \qquad \theta = 360° - 60°45' \; 4.23''$$
$$= 299° \; 14' \; 55.77''$$

23. (d)

Let, the length of plan on map be L

Then, Actual length = 3000 L

Measured length = 3500 L

$$\therefore \text{Percentage error in volume} = \frac{(3500L)^3 - (3000L)^3}{(3000L)^3} \times 100$$

$$= 58.8\%$$

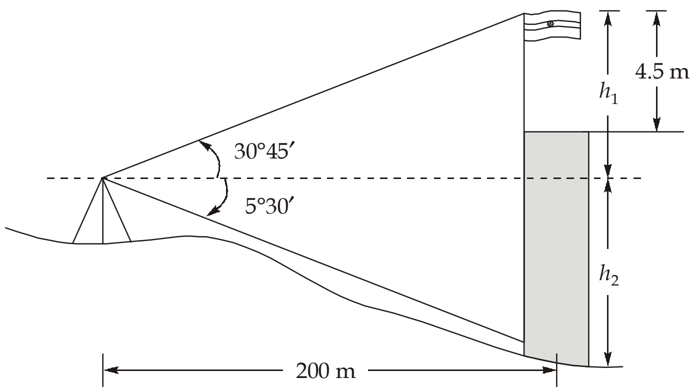
24. (d)

The deviation of staff in 3.800 m height

$$= \frac{3.8}{4} \times 8 = 7.6 \text{ cm}$$

$$\therefore \text{Correct reading of staff at point } A = \sqrt{(3.800)^2 - \left(\frac{7.600}{100}\right)^2} = 3.7992 \text{ m}$$

25. (c)



From fig. $\quad \frac{h_1}{200} = \tan 30°\,45'$ and $\frac{h_2}{200} = \tan 5°\,30'$

$$\begin{aligned} \text{Height of building} &= h_1 + h_2 - 4.5 \\ &= 200\tan 30°45' + 200\tan 5°30' - 4.5 \\ &= 133.745 \text{ m} \end{aligned}$$

26. (a)

$$\begin{aligned} \text{Scale: } 1 \text{ cm} &= 8000 \text{ cm} \quad \text{i.e. } 1 \text{ cm} = 80 \text{ m} \\ \text{Longitudinal visibility} &= 25 \times (1 - 0.7) \times 80 \times 10^{-3} = 0.6 \text{ km} \\ \text{Side visibility} &= 25 \times (1 - 0.4) \times 80 \times 10^{-3} = 1.2 \text{ km} \end{aligned}$$

$$\text{Number of photographs per strip} = \frac{25}{0.6} + 1 \simeq 43$$

$$\text{Number of strip} = \frac{20}{1.2} + 1 \simeq 18$$

Total number of photographs = 43 × 18 = 774

27. (b)

$$r_1 - r_2 = \frac{r_1 h}{H}$$

$$r_1 = 110 \text{ mm},\ r_2 = 80 \text{ mm}$$

$$H = 1800 - 400 = 1400 \text{ m}$$

Hence, $$0.110 - 0.080 = 0.110 \times \frac{h}{1400}$$

$\Rightarrow$ $$h = 381.82 \text{ m}$$

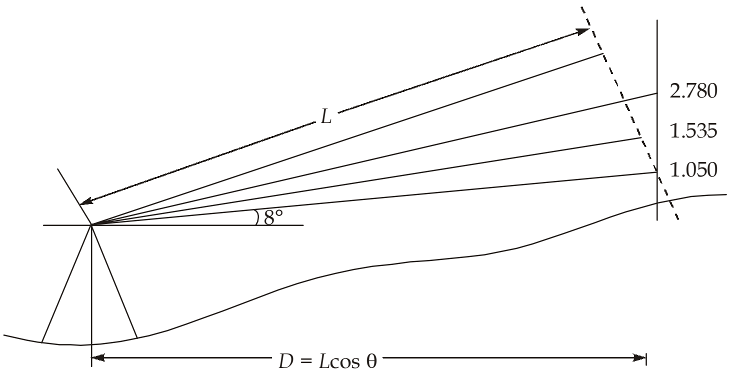
28. (b)

$$D = kS + C \qquad D_1 = 100 \text{ m} \qquad S_1 = 1 \text{ m}$$

$$D_2 = 200 \text{ m} \qquad S_2 = 2.0 \text{ m}$$

$\therefore$ $$100 = k(1) + C$$

$$200 = k(2.0) + C \qquad (\therefore\ k = 100,\ C = 0)$$



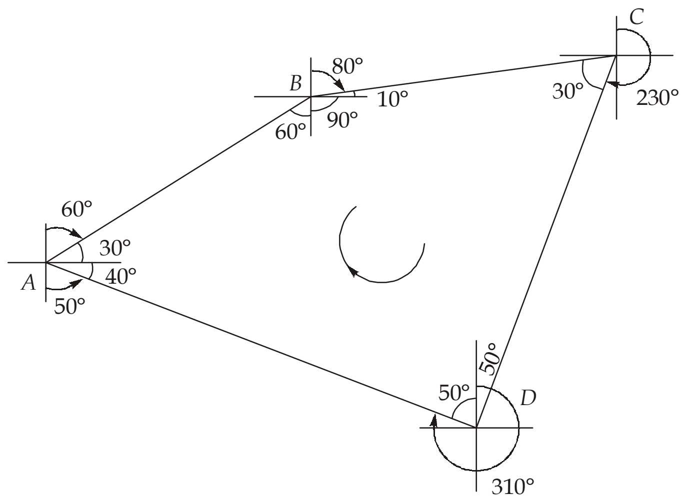
$\Rightarrow$ $D = (ks \cos\theta + C)\cos\theta$

$$D = ks \cos^2\theta$$

$\Rightarrow$ $$D = 100\ (2.780 - 1.050)\ \cos^2 8°$$

$\Rightarrow$ $$D = 169.65 \text{ m}$$

29. (c)



Since, traverse is running clockwise.

∴ Included angles are external angles

External angle $A = 360° - (30° + 40°) = 290°$

External angle $B = 360° - (10° + 60° + 90°) = 200°$

External angle $C = 360° - 30° = 330°$

External angle $D = 360° - (50 + 50) = 260°$

∴Sum of included (External) angles = 290° + 200° + 330° + 260° = 1080°

30. (b)

Value	Mean	$x - \bar{x}$	$(x - \bar{x})^2$
160° 20′ 00″	160° 20′ 43.75″	– 43.75″	31′ 54.06″
160° 20′ 30″		– 13.75″	3′ 9.06″
160° 21′ 05″		+ 21.25″	7′ 31.56″
160° 21′ 20″		+ 36.25″	21′ 54.06″

Σ = 1° 4′ 28.74″

$$E_s = \pm 0.6745 \times \sqrt{\frac{\Sigma(x-\bar{x})^2}{n-1}}$$

$$= \pm 0.6745 \times \sqrt{\frac{1°4'28.74''}{(4-1)}} \quad \pm 24.22''$$

Probables error of mean = $\dfrac{E_s}{\sqrt{n}} = \dfrac{24.22''}{\sqrt{4}} = 12.11''$

■■■■