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SURVEYING

CIVIL ENGINEERING

Date of Test : 31/05/2023

ANSWER KEY ➤

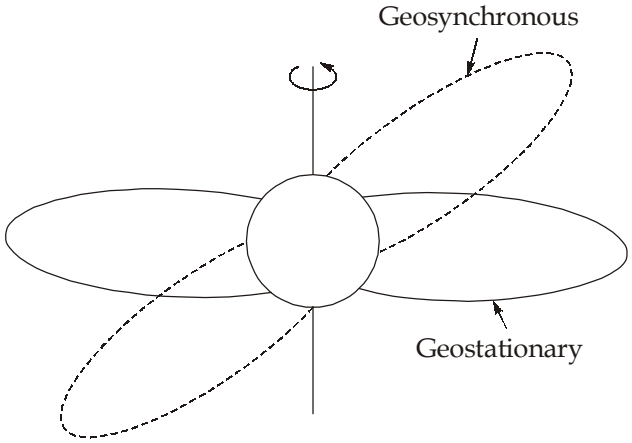
1.	(d)	7.	(b)	13.	(b)	19.	(d)	25.	(b)
2.	(b)	8.	(b)	14.	(d)	20.	(b)	26.	(d)
3.	(a)	9.	(b)	15.	(d)	21.	(b)	27.	(d)
4.	(b)	10.	(c)	16.	(b)	22.	(a)	28.	(a)
5.	(c)	11.	(b)	17.	(d)	23.	(c)	29.	(a)
6.	(c)	12.	(c)	18.	(b)	24.	(a)	30.	(d)

DETAILED EXPLANATIONS

1. (d)

Geostationary satellites: These are kept at some point above the equator and they follow equatorial path of the earth.

A object is geostationary orbit revolve around the earth at the same speed as the earth rotates.



2. (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

3. (a)

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

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

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

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

4. (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.

5. (c)

$$\text{Most probable angle} = \frac{2 \times 30° \times 00' \times 30'' + 4 \times 30°00'20''}{6} = 30°00'23.33''$$

6. (c)

Scale, $$S = \frac{f}{H-h} = \frac{20\times10^{-2}}{2000-750} = \frac{0.20}{1250} = \frac{1}{6250}$$

7. (b)

Remote sensing is defined as the process or technique of obtaining information about an object, area or phenomenon through the analysis of data acquired by a device without being in contact with the object and the phenomenon being studied.

Application of remote sensing: Agriculture, forestry, land use and solids, geology, urban land use, water resources, coastal environment, ocean resources, watershed, environment, digital elevation models, disasters, facilities managements.

8. (b)

Parallax bar: It is a instrument used to determine the apparent displacement of a point with respect to a reference point or a system.

Pantagraph: It is a instrument used of enlarging and reducing a plan already drawn.

9. (b)

10. (c)

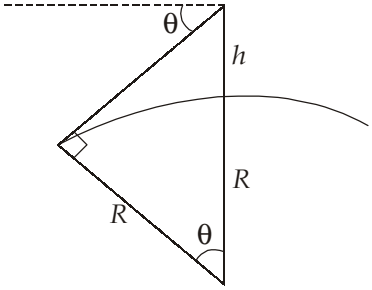
BS is the first sight taken on a levelling staff held at a point of known elevation.

11. (b)

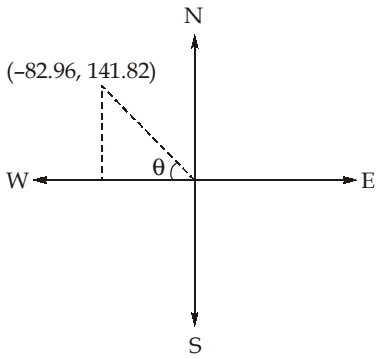
$$\text{Dip} = \theta = \cos^{-1}\left(\frac{R}{R+h}\right)$$

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

$$\Rightarrow \quad \theta = 0.2907^\circ = 17.44 \text{ minutes}$$



12. (c)



$$\tan\theta = \frac{141.82}{82.96} = 1.7095^\circ$$

$$\therefore \quad \theta = \tan^{-1}(1.7095) = 59.674^\circ$$

$$\text{WCB} = 270 + \theta = 270 + 59.674 = 329.674^\circ$$

$$= 329.674 \times \pi \text{ rad} = 5.75 \text{ rad}$$

13. (b)

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

14. (d)

$$\text{Number of photographs per strip} = \frac{\text{Length of area}}{(1-P_l)S\times l}+1$$

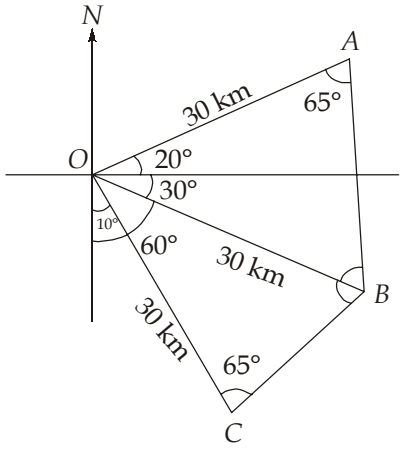
$$= \frac{20\times 1000}{(1-0.7)\times 100\times 0.25}+1 = 2667.67 \simeq 2668$$

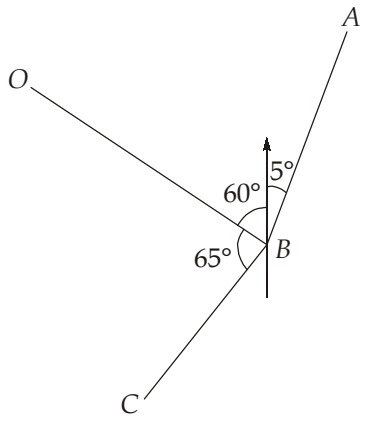
$$\text{Number of strips} = \frac{\text{Width of area}}{(1-P_w)S\times w}+1$$

$$= \frac{15\times 1000}{(1-0.35)\times 100\times 0.25}+1 = 924.08 \simeq 925$$

$\therefore$ Number of photographs required = 2668 × 925 = 2467900

15. (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°

$\angle BOD$ = 50°

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

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

= 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 and (d) is incorrect.

16. (b)

h_P = 1.824 m, h_Q = 2.748 m
h_P' = 0.928 m, h'_Q = 1.606 m
Correct difference of elevation between P and Q is

$$h = \frac{\left(h_Q' - h_P'\right) + \left(h_Q - h_P\right)}{2}$$

$$= \frac{(1.606 - 0.928) + (2.748 - 1.824)}{2}$$

= 0.801 m
$\because$ Staff reading at Q is more than staff reading at P and thus Q is at lower level than P.
$\therefore$ The reduced level of Q = (142.815 – 0.801)
= 142.014 m

17. (d)

$$\text{Correction in line } AB = \frac{-h^2}{2L} = -\frac{1.2^2}{2\times 35} = -0.02057 \text{ m}$$

$$\text{Correction in line } BC = \frac{-h^2}{2L} = -\frac{2^2}{2\times 40} = -0.05 \text{ m}$$

$$\text{Correction in line } CD = \frac{-h^2}{2L} = -\frac{1.8^2}{2\times 80} = -0.02025 \text{ m}$$

$\therefore$ Corrected horizontal distance =35 + 40 + 80 – [0.02057 + 0.05 + 0.02025]
= 154.909 m

18. (b)

Circumference = $2\pi r = 2\pi(15) = 94.25$ m

$$\text{Error in circumference, } e_c^2 = \left(\frac{\partial C}{\partial r} e_r\right)^2$$

$$\Rightarrow \quad e_c^2 = \left(2\pi e_r\right)^2$$

$$\Rightarrow \quad e_c = 2\pi e_r$$

$= 2\pi\ (0.30) = \pm 1.885$ m

19. (d)

$A = \frac{d}{3}$ [(First ordinate + Last ordinate) + 4 (Sum of even ordinates) + 2(Sum of odd ordinates)]

$$\Rightarrow \quad A = \frac{d}{3}\left[\left(O_1 + O_9\right) + 4\left(O_2 + O_4 + O_6 + O_8\right) + 2\left(O_3 + O_5 + O_7\right)\right]$$

$$\Rightarrow \quad A = \frac{30}{3}\left[(0+0) + 4(6.5 + 5.8 + 7.6 + 5.8) + 2(7.0 + 4.5 + 6.0)\right]$$

$$\Rightarrow \quad A = 1378 \text{ m}^2$$

20. (b)

Scale of photograph, $S = \dfrac{108\times10^{-3}}{400} = \dfrac{1}{3703.70}$

We know, $S = \dfrac{f}{H}$

$\therefore$ $H = \dfrac{152.4\times10^{-3}}{\left(\dfrac{1}{3703.70}\right)} = 564.44\text{ m}$

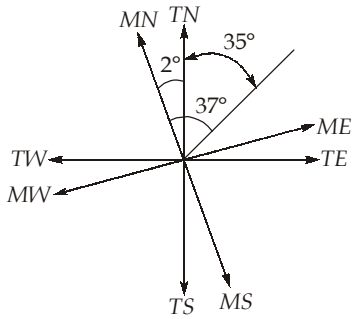
Now, we know, $d = \dfrac{r\,h}{H}$

$\Rightarrow$ $0.07 - 0.06 = \dfrac{0.07\times h}{564.44}$

$\Rightarrow$ $h = 80.63\text{ m}$

21. (b)

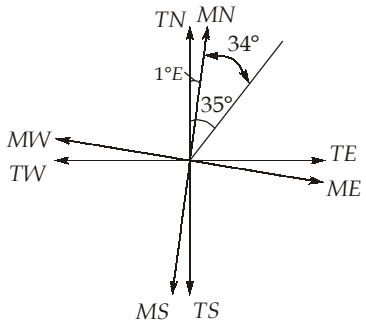
In December 1985



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.

$\therefore$ $TB = MB - \delta_W$

$= 37° - 2° = 35°$



$TB = MB - \delta_E$

$\Rightarrow$ $35° = MB + 1°$

$\Rightarrow$ $MB = 34°$

22. (a)

$\because$ Link length in metric chain is 20 cm

The actual length of 30 m chain is = 30 m – 20 cm = 30 – 0.20 = 29.80 m

In measuring 1345 m, the chain completes 44 full chain length for measuring length upto $20 \times 44 = 1320$ m in which there is error, and rest of measured length of 25 m with no error.

$\therefore$ Actual length of line $= (44 \times 29.80) + 25$

$= 1336.2$ m

Measured length of line = 1341 m (given)

$$\therefore \text{The actual chain length of 20 m} = \frac{1336.2 \times 20}{1341} = 19.9284 \text{ m}$$

That means the error in 20 m chain is + 0.07158 m i.e. +7.158 cm

23. (c)

Triangulation stations are selected, keeping in view of following considerations:

1. Intervisiblity of triangulation stations.
2. Easy access to the stations with the instrument.
3. Various triangulation stations should form well conditioned triangles.

A good signal should fulfill the following requirements:

1. It should be conspicuous i.e., it should be clearly visible from a distance against any background.
2. It should be capable of being accurately centered over the station mark.

24. (a)

The difference of levels A and B,

$$\Delta h = \frac{(2.595 - 1.155) + (2.415 - 0.985)}{2} = 1.435 \text{ m}$$

$\therefore$ True reading at B when instrument is at

$A = 1.155 + 1.435 = 2.590$ m

$\therefore$ Error = 2.595 – 2.590 = +0.005 m

Let's assume collimation error is in upward direction (i.e., positive error)

Error equation:

Total error = Collimation error + Combined error due to curvature and retraction

$$\Rightarrow \quad 0.005 = E_C + \frac{6}{7} \times \frac{800^2}{2 \times 6370 \times 1000}$$

$\Rightarrow$ E_C = –0.03805 m i.e. collimation error is in downward direction

$\Rightarrow$ E_C = 38.05 mm (Downwards)

25. (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.

26. (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 sued 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.

27. (d)

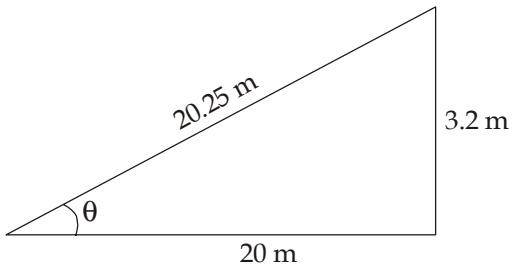
Isogonic lies: It is the line passing through points on the earth surface at which declination is same at a given point.

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.

28. (a)



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

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

$= 0.25\text{m}$

$= 25\text{ cm}$

29. (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.

30. (d)

- Orientation is the operation of keeping the plane table parallel to the position it occupied at the first station.
- Plane table survey has one of the advantages that, irregular objects can be plotted accurately as the lay of land is in view.
- An alidade is a straightedge ruler having some sighting device, it is used for sighting the objects and drawing the lines.

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