GATE Geomatics Engineering

Sample Paper – 5

Duration: 128 Minutes **Maximum Marks: 72**

Instructions

- This paper contains **46 questions** covering the core **Geomatics Engineering** subject of the GATE paper conducted by the IITs and IISc (General Aptitude and Engineering Mathematics are provided as separate papers).
- **Q1–Q20 carry 1 mark each** and **Q21–Q46 carry 2 marks each**, for a total of **72 marks**.
- Each question carries **negative marking of one-third of its allotted marks**: a wrong 1-mark question costs **0.33** and a wrong 2-mark question costs **0.67**. Unattempted questions carry no penalty.
- Every question here is a single-correct **MCQ**. The real GATE paper also has Multiple Select (MSQ) and Numerical Answer Type (NAT) questions, and **those carry no negative marking**.
- Attempt this paper in one timed sitting of about **128 minutes**, the share this core subject earns at GATE's overall pace of 180 minutes for 65 questions. Unless stated otherwise take the speed of light $c = 3 \times 10^8$ m/s and the coefficient of thermal expansion of steel $\alpha = 11.7 \times 10^{-6}\ ^\circ\mathrm{C}^{-1}$.

Principles of Surveying and Error Theory

Q1. The probable error of a single observation is $E_s = 0.6745\,\sigma$, where σ is the standard deviation. For a set of levelling observations with $\sigma = \pm 4.0$ mm, the probable error of a single observation is nearest to: **[1 mark]**

(A) ± 2.70 mm

(B) ± 4.00 mm

(C) ± 5.93 mm

(D) ± 1.35 mm

Q2. The probable error of an arithmetic mean is $E_m = E_s/\sqrt{n}$, where E_s is the probable error of a single observation and n the number of observations. If $E_s = \pm 0.30$ m and 9 equally reliable observations are taken, the probable error of the mean is: **[1 mark]**

(A) ± 0.30 m

(B) ± 0.90 m

(C) ± 0.033 m

(D) ± 0.10 m

Q3. A survey line is measured in two independent sections whose standard errors are ± 9 mm and ± 12 mm. Taking the errors as combining in quadrature, the standard error of the total length is: **[1 mark]**

(A) ± 21 mm

(B) ± 3 mm

(C) ± 15 mm

(D) ± 225 mm

Q4. For a normally distributed measurement, the 95% confidence interval about the mean corresponds approximately to a half-width of: **[1 mark]**

(A) $0.6745\,\sigma$

(B) $1.00\,\sigma$

(C) $3.00\,\sigma$

(D) $1.96\,\sigma$

Q5. The weight of an observation is inversely proportional to the square of its probable error. If two angles are observed with probable errors of $\pm 2''$ and $\pm 3''$, the ratio of their weights $w_1 : w_2$ is: **[1 mark]**

(A) $4 : 9$

(B) $9:4$

(C) $2:3$

(D) $3:2$

Q6. Errors that are equally likely to be positive or negative and that tend to cancel one another over a large number of observations are classified as: **[1 mark]**

(A) systematic (cumulative) errors

(B) mistakes or blunders

(C) accidental (random) errors

(D) constant instrumental errors

Distance Measurement, Levelling and Contouring

Q7. In trigonometric levelling, a vertical angle of elevation of 10° is observed to a point whose horizontal distance from the instrument is 100 m. Neglecting curvature and refraction, the difference in elevation ($D\tan\theta$) is nearest to: **[1 mark]**

(A) 8.75 m

(B) 17.6 m

(C) 100 m

(D) 26.8 m

Q8. In barometric levelling, the difference of elevation between two stations is determined from the difference in: **[1 mark]**

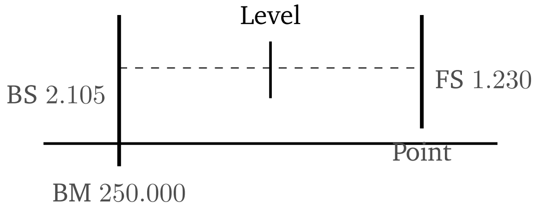
(A) atmospheric pressure recorded by a barometer

(B) air temperature only

(C) wind speed at the two stations

(D) relative humidity of the air

Q9. In the differential-levelling set-up shown, the backsight on a benchmark of RL 250.000 m is 2.105 m and the foresight to the next point is 1.230 m. The reduced level of the forepoint is: **[1 mark]**



(A) 253.335 m

(B) 250.875 m

(C) 249.125 m

(D) 251.230 m

Q10. The combined correction for curvature and refraction in levelling is approximately $0.0673\,D^2$ (with D in kilometres and the correction in metres). For a sight distance of 1 km, this combined correction is nearest to: **[1 mark]**

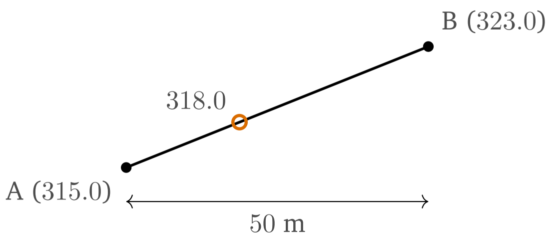
(A) 0.0785 m

(B) 0.0673 m

(C) 0.0112 m

(D) 0.673 m

Q11. Points A and B lie 50 m apart on a uniform slope. A has RL 315.0 m and B has RL 323.0 m, as shown. By linear interpolation the horizontal distance from A to the point where the 318.0 m contour crosses AB is: **[1 mark]**



(A) 18.75 m

(B) 31.25 m

(C) 12.5 m

(D) 25 m

Q12. On a map of scale 1:5000 with a contour interval of 2 m, two adjacent contours are 5 mm apart on the paper. The ground slope (gradient) between them is: **[1 mark]**

(A) 1 in 12.5

(B) 1 in 25

(C) 1 in 5

(D) 1 in 250

Theodolite, Traverse and Triangulation

Q13. The fore bearing (whole-circle bearing) of a line AB is $115°45'$. The back bearing of the line is: **[1 mark]**

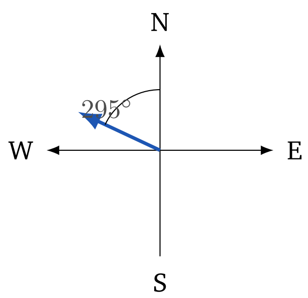
(A) $115°45'$

(B) $295°45'$

(C) $244°15'$

(D) $64°15'$

Q14. The whole-circle bearing of a survey line is $295°$, as shown on the compass diagram. Its reduced (quadrantal) bearing is: **[1 mark]**



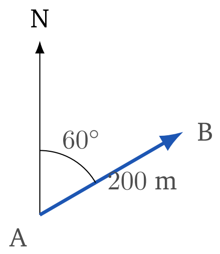
(A) S65°W

(B) N65°E

(C) N65°W

(D) S65°E

Q15. A traverse line AB of length 200 m has a whole-circle bearing of $60°$, as shown. Its latitude ($L\cos\theta$) and departure ($L\sin\theta$) are respectively: **[1 mark]**



(A) 173.2 m N, 100 m E

(B) 100 m N, 100 m E

(C) 100 m N, 173.2 m E

(D) 141.4 m N, 141.4 m E

Q16. In a theodolite, the errors due to imperfect adjustment of the line of collimation and of the trunnion (horizontal) axis are eliminated by: **[1 mark]**

(A) observing on a single face only and applying a constant

(B) observing on both faces (face left and face right) and meaning the readings

(C) changing the observer between rounds

(D) taking only very long sights

Q17. For a closed polygon traverse having 8 sides, the theoretical sum of the interior angles, given by $(2n - 4) \times 90°$, is: **[1 mark]**

(A) $720°$

(B) $900°$

(C) 540°

(D) 1080°

Q18. The Transit rule of traverse adjustment is generally preferred over Bowditch's rule when: **[1 mark]**

(A) the linear measurements are much more precise than the angular ones

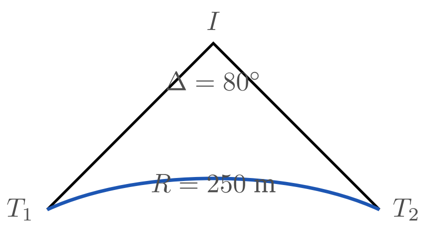
(B) the angular measurements are more precise than the linear ones

(C) all sides of the traverse are exactly equal in length

(D) the traverse is open and unclosed

Curves, Tacheometry and Field Astronomy

Q19. A simple circular curve of radius $R = 250$ m has a deflection angle $\Delta = 80^\circ$ between its tangents, as shown. The tangent length ($T = R\tan(\Delta/2)$) is nearest to: **[1 mark]**



(A) 175 m

(B) 209.8 m

(C) 250 m

(D) 300 m

Q20. A simple circular curve of radius 300 m subtends a deflection angle of 45°. The length of the curve, $L = \dfrac{\pi R \Delta}{180^\circ}$, is nearest to: **[1 mark]**

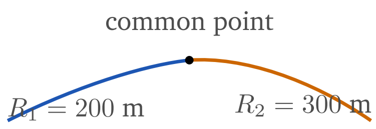
(A) 150 m

(B) 300 m

(C) 471.2 m

(D) 235.6 m

Q21. A compound curve is made of two circular arcs of radii 200 m and 300 m meeting at a common tangent point, as sketched. If the first arc (radius 200 m) has a deflection angle of 30°, its arc length $\left(\frac{\pi R_1 \Delta_1}{180^\circ}\right)$ is nearest to: **[2 marks]**



(A) 209.4 m

(B) 157.1 m

(C) 104.7 m

(D) 52.4 m

Q22. A simple circular curve has radius 500 m and deflection angle 40°. The mid-ordinate, $M = R\big(1 - \cos(\Delta/2)\big)$, is nearest to: **[2 marks]**

(A) 60.3 m

(B) 15.1 m

(C) 30.2 m

(D) 100 m

Q23. A tacheometer ($k = 100$, $C = 0$) reads a staff intercept of 1.200 m with the line of sight inclined at 6° to the horizontal. The horizontal distance, $D = k\, s \cos^2\theta$, is nearest to: **[2 marks]**

(A) 118.7 m

(B) 120 m

(C) 100 m

(D) 105.6 m

Q24. In field astronomy the co-latitude of a place is its angular distance from the pole, equal to (90° − latitude). For an observing station at latitude 62°N, the co-latitude is: **[2 marks]**

(A) 62°

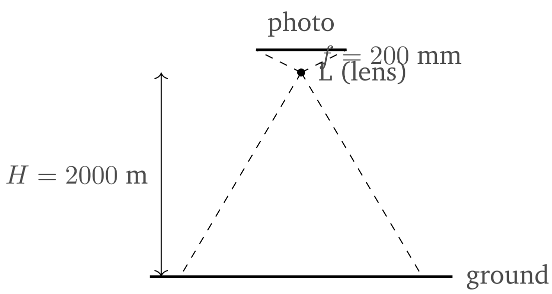
(B) 90°

(C) 28°

(D) 152°

Photogrammetry

Q25. A vertical aerial photograph is taken with a camera of focal length 200 mm from a flying height of 2000 m above flat ground, as shown. The scale of the photograph (f/H) is: **[2 marks]**



(A) 1:10,000

(B) 1:1000

(C) 1:20,000

(D) 1:4000

Q26. A vertical photograph has a scale of 1:6000 and was taken with a camera of focal length 150 mm. The flying height above the ground datum is: **[2 marks]**

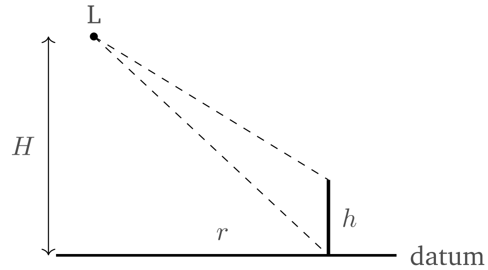
(A) 900 m

(B) 40,000 m

(C) 1500 m

(D) 9000 m

Q27. On a vertical photograph the relief displacement of the top of a vertical object is $d = \frac{r\,h}{H}$. For radial distance $r = 75$ mm, object height $h = 80$ m and flying height $H = 2000$ m (see figure), the relief displacement is: **[2 marks]**



(A) 1.5 mm

(B) 3 mm

(C) 6 mm

(D) 9 mm

Q28. A straight line images as 60 mm long on a vertical photograph of scale 1:8000. The corresponding ground length of the line is: **[2 marks]**

(A) 48 m

(B) 480 m

(C) 4800 m

(D) 4.8 m

Q29. In stereoscopic measurement on a stereo-pair, the principle of the floating mark is used to: **[2 marks]**

(A) measure only the colour (tone) of the ground surface

(B) correct the photographs for radial lens distortion

(C) determine the focal length of the camera

(D) measure the elevation of points by fusing the two half-marks onto the stereomodel surface

Q30. A vertical photograph of scale 1:5000 shows a rectangular field measuring 50 mm $\times$ 40 mm on the print. The ground area of the field is: **[2 marks]**

(A) 2 ha

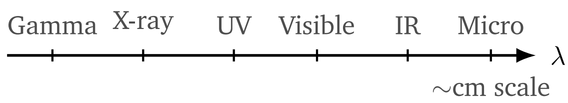
(B) 20 ha

(C) 5 ha

(D) 50 ha

Remote Sensing

Q31. Electromagnetic radiation of frequency 3×10^9 Hz travels in vacuum at $c = 3 \times 10^8$ m/s. Its wavelength ($\lambda = c/f$), located on the spectrum below, is: **[2 marks]**



(A) 1 m

(B) 0.5 m

(C) 3 m

(D) 0.1 m

Q32. In remote sensing the wavelength band 8–14 μm, widely used for night-time land-surface temperature mapping, corresponds to which region of the electromagnetic spectrum? **[2 marks]**

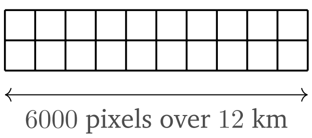
(A) thermal infrared

(B) visible

(C) microwave

(D) ultraviolet

Q33. A pushbroom sensor images a ground swath of 12 km using 6000 detector pixels across the line, as sketched. The ground sampling distance (spatial resolution) per pixel is: **[2 marks]**



(A) 6 m

(B) 0.5 m

(C) 1 m

(D) 2 m

Q34. In supervised classification of a multispectral satellite image, the very first step performed by the analyst is to: **[2 marks]**

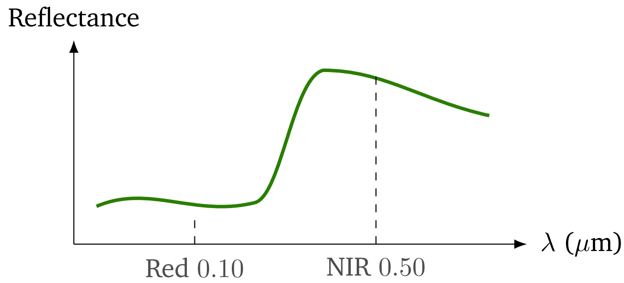
(A) let the algorithm cluster the pixels with no analyst input

(B) use only a single spectral band and ignore the rest

(C) define training sites of known land-cover classes to train the classifier

(D) apply a fixed threshold to the raw digital numbers

Q35. The Normalized Difference Vegetation Index is NDVI $= \dfrac{\text{NIR} - \text{Red}}{\text{NIR} + \text{Red}}$. For a healthy canopy with near-infrared reflectance 0.50 and red reflectance 0.10 (see the spectral curve), the NDVI is: **[2 marks]**



(A) 0.67

(B) 0.40

(C) 0.60

(D) 0.17

Q36. A satellite sensor records each pixel with 10 bits of data. The number of discrete grey levels (radiometric resolution) it can represent is: **[2 marks]**

(A) 10

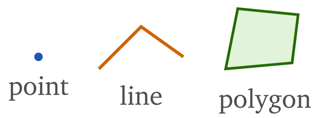
(B) 100

(C) 512

(D) 1024

Geographic Information Systems

Q37. In a GIS, the vector data model (illustrated below) represents geographic features as: [2 marks]



(A) points, lines and polygons defined by (x, y) coordinate pairs

(B) a matrix of grid cells each holding a single value

(C) a continuous surface built from square pixels

(D) a set of equally spaced contour bands

Q38. A GIS query written as "SELECT all parcels WHERE area > 500 m^2 AND landuse $=$ residential" operates purely on the feature table. It is best described as a(n): [2 marks]

(A) network shortest-path (routing) query

(B) buffer generation operation

(C) spatial interpolation of a surface

(D) attribute (tabular, non-spatial) query

Q39. A single-band raster layer has 2000 rows and 1500 columns, with each cell stored as one byte. The uncompressed storage size of the layer is nearest to: [2 marks]

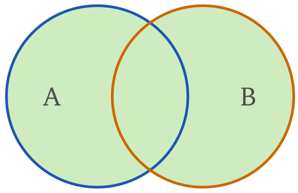
(A) 1 MB

(B) 8 MB

(C) 3 MB

(D) 3 GB

Q40. Two polygon layers A and B are combined using a GIS union (logical OR) overlay, as shown by the shaded region. The output layer contains: [2 marks]



A ∪ B

(A) only the area common to both A and B

(B) only the part of A that lies outside B

(C) all areas that lie in either A or B (or both)

(D) only the areas lying outside both A and B

Q41. In a topologically structured vector dataset, the stored relationship that records which polygon lies to the left and which to the right of a directed arc is called: **[2 marks]**

(A) connectivity of arcs at nodes

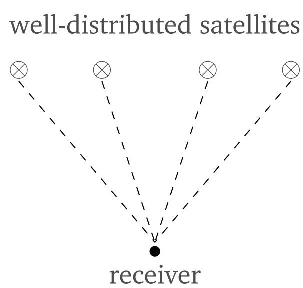
(B) containment of points in areas

(C) proximity between features

(D) adjacency (left–right polygon relationship)

GNSS, Cartography and Map Projections

Q42. In GNSS positioning, a smaller value of the Geometric Dilution of Precision (GDOP), associated with a well-spread satellite geometry as sketched, indicates: **[2 marks]**



(A) poorer positional accuracy

(B) a larger receiver clock error

(C) fewer visible satellites

(D) better satellite geometry and higher positional accuracy

Q43. A GNSS signal takes 0.08 s to travel from a satellite to a ground receiver. Taking the speed of light as 3×10^8 m/s, the (approximate) pseudorange to the satellite is: **[2 marks]**

(A) $24{,}000$ km

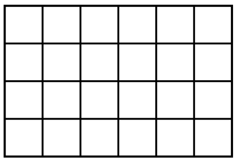
(B) 2400 km

(C) 300 km

(D) $240{,}000$ km

Q44. Which of the following is a conformal (orthomorphic) map projection widely adopted for national topographic mapping and the UTM grid (graticule shown)? **[2 marks]**

meridians and parallels at right angles



(A) Transverse Mercator

(B) Albers equal-area conic

(C) sinusoidal (equal-area) projection

(D) Mollweide (equal-area) projection

Q45. A map projection that preserves the true area of every feature but distorts their shapes and angles is classified as a(n): **[2 marks]**

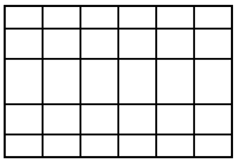
(A) conformal (orthomorphic) projection

(B) equal-area (equivalent) projection

(C) azimuthal-only projection

(D) gnomonic projection

Q46. On a conformal projection such as the Mercator (graticule shown), the property that makes it conformal is that, at any point, the scale is: **[2 marks]**



meridians and parallels cross at right angles

(A) zero at the poles

(B) the same in every direction at that point (so shapes of small features are preserved)

(C) always equal to unity everywhere on the map

(D) made deliberately different for area and distance

Detailed Solutions

Q1.

Solution

Concept – probable error of a single observation: The probable error is the value on either side of the mean within which half the observations are expected to fall; it is a fixed multiple of the standard deviation.

Step 1 – write the defining relation: $E_s = 0.6745\,\sigma$

Step 2 – substitute the given standard deviation: $E_s = 0.6745 \times 4.0$

Step 3 – multiply out: $E_s = 2.698$ mm

Step 4 – round to the given precision: $E_s \approx \pm 2.70$ mm

Why the other options are wrong:

- B: ± 4.00 mm is σ itself, not the probable error.
- C: ± 5.93 mm wrongly divides by 0.6745 instead of multiplying.
- D: ± 1.35 mm halves σ instead of using the 0.6745 factor.

Final Answer: $E_s \approx \pm 2.70 \text{ mm} \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q1

Q2.

Solution

Concept – probable error of the mean: Averaging n equally reliable observations reduces the probable error by a factor of $\sqrt{n}$.

Step 1 – write the relation: $E_m = \dfrac{E_s}{\sqrt{n}}$

Step 2 – take the square root of n: $\sqrt{9} = 3$

Step 3 – substitute the values: $E_m = \dfrac{0.30}{3}$

Step 4 – divide: $E_m = 0.10$ m

Why the other options are wrong:

- A: ± 0.30 m ignores the averaging entirely.
- B: ± 0.90 m multiplies by 3 instead of dividing.
- C: ± 0.033 m divides by 9 instead of by $\sqrt{9}$.

Final Answer: $E_m = \pm 0.10 \text{ m} \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q2

Q3.

Solution

Concept – propagation of error in a sum: When independent quantities are added, their standard errors combine in quadrature: $\sigma = \sqrt{\sigma_1^2 + \sigma_2^2}$.

Step 1 – square each component error: $\sigma_1^2 = 9^2 = 81$

$\sigma_2^2 = 12^2 = 144$

Step 2 – add the squares: $81 + 144 = 225$

Step 3 – take the square root: $\sigma = \sqrt{225}$

$\sigma = 15$ mm

Why the other options are wrong:

- A: ± 21 mm adds the errors linearly $(9 + 12)$.
- B: ± 3 mm subtracts them.
- D: ± 225 mm forgets to take the square root.

Final Answer: $\sigma = \pm 15$ mm $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q3

Q4.

Solution

Concept – confidence interval of a normal distribution: For a normally distributed quantity, a chosen confidence level corresponds to a fixed multiple of the standard deviation σ.

Step 1 – recall the standard multipliers: About 68% of values lie within $\pm 1\sigma$, and about 95% lie within $\pm 1.96\sigma$ (often rounded to 2σ).

Step 2 – match the required level: The 95% confidence half-width is therefore $1.96\,\sigma$.

Why the other options are wrong:

- A: $0.6745\,\sigma$ is the 50% (probable-error) band.
- B: $1.00\,\sigma$ gives only about 68% confidence.
- C: $3.00\,\sigma$ corresponds to about 99.7% confidence, not 95%.

Final Answer: $1.96\,\sigma \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q4

Q5.

Solution

Concept – weight and probable error: The weight of an observation is inversely proportional to the square of its probable error: $w \propto \frac{1}{E^2}$.

Step 1 – form each weight: $w_1 \propto \frac{1}{2^2} = \frac{1}{4}$

$w_2 \propto \frac{1}{3^2} = \frac{1}{9}$

Step 2 – write the ratio: $w_1 : w_2 = \frac{1}{4} : \frac{1}{9}$

Step 3 – clear the fractions (multiply both by 36): $w_1 : w_2 = 9 : 4$

Why the other options are wrong:

- A: $4 : 9$ is the inverse of the correct ratio (it takes weight $\propto E^2$).
- C and D: $2 : 3$ and $3 : 2$ use the probable errors directly instead of their squares.

Final Answer: $w_1 : w_2 = 9 : 4 \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q5

Q6.

Solution

Concept – classifying observational errors: Errors are grouped by how their signs behave over many repetitions.

Step 1 – read the description: The errors are "equally likely to be positive or negative" and "tend to cancel" over many observations.

Step 2 – match this to a class: Errors that change sign randomly and average out are accidental (random) errors, obeying the normal law of errors.

Why the other options are wrong:

- A: systematic errors keep the same sign and accumulate.
- B: blunders are isolated gross mistakes, not small balanced errors.
- D: a constant instrumental error is one-signed and does not cancel.

Final Answer: accidental (random) errors $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q6

Q7.

Solution

Concept – trigonometric levelling: When the instrument and staff are a horizontal distance D apart and the line of sight makes an angle θ with the horizontal, the difference in elevation is $V = D \tan \theta$.

Step 1 – list the data: $D = 100$ m, $\theta = 10°$.

Step 2 – evaluate the tangent: $\tan 10° = 0.17633$

Step 3 – multiply by the horizontal distance: $V = 100 \times 0.17633$

Step 4 – compute: $V = 17.63 \text{ m} \approx 17.6 \text{ m}$

Why the other options are wrong:

- A: 8.75 m uses $\tan 5°$, the wrong angle.
- C: 100 m is the horizontal distance, not the height.
- D: 26.8 m corresponds to $\tan 15°$.

Final Answer: $V \approx 17.6 \text{ m} \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q7

Q8.

Solution

Concept – barometric levelling: Atmospheric pressure falls in a known way as elevation increases, so a barometer can be used to infer height differences.

Step 1 – identify the measured quantity: The barometer reads atmospheric pressure at each station.

Step 2 – relate it to elevation: Because pressure decreases with height, the difference in barometric pressure between two stations is converted (with temperature data) into their difference in elevation.

Why the other options are wrong:

- B: temperature is only a correction term, not the primary measurement.
- C: wind speed has no direct link to elevation.
- D: humidity is a minor correction, not the basis of the method.

Final Answer: difference in atmospheric pressure $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q8

Q9.

Solution

Concept – reduced level by the rise-and-fall / HI method: RL of forepoint $=$ RL of BM $+$ BS $-$ FS.

Step 1 – add the backsight to the benchmark RL (gives the collimation line): $250.000 + 2.105 = 252.105$ m

Step 2 – subtract the foresight: $252.105 - 1.230 = 250.875$ m

Step 3 – sanity check the sign: The backsight (2.105) exceeds the foresight (1.230), so the ground has risen; $250.875 > 250.000$, which is consistent.

Why the other options are wrong:

- A: 253.335 m adds both readings.
- C: 249.125 m subtracts the backsight and adds the foresight (signs swapped).
- D: 251.230 m ignores the foresight.

Final Answer: RL $= 250.875$ m $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q9

Q10.

Solution

Concept – curvature and refraction correction: The combined correction for the earth's curvature and atmospheric refraction is $C = 0.0673\,D^2$, with D in kilometres and C in metres.

Step 1 – square the sight distance: $D^2 = 1^2 = 1$

Step 2 – multiply by the constant: $C = 0.0673 \times 1$

Step 3 – state the result: $C = 0.0673$ m

Why the other options are wrong:

- A: 0.0785 m is the curvature-only correction ($0.0785\,D^2$).
- C: 0.0112 m is the refraction-only part.
- D: 0.673 m misplaces the decimal by a factor of ten.

Final Answer: $C \approx 0.0673$ m $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q10

Q11.

Solution

Concept – linear interpolation of a contour on a uniform slope: The horizontal distance to a given level is proportional to its height above the lower point.

Step 1 – total rise from A to B: $323.0 - 315.0 = 8.0$ m

Step 2 – rise from A up to the contour: $318.0 - 315.0 = 3.0$ m

Step 3 – form the proportion of the total distance: $\frac{3.0}{8.0} = 0.375$

Step 4 – multiply by the horizontal distance AB: $d = 0.375 \times 50$

$d = 18.75$ m

Why the other options are wrong:

- B: 31.25 m is measured from B instead of A.
- C and D: use the wrong height fraction.

Final Answer: $d = 18.75$ m from A $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q11

Q12.

Solution

Concept – ground slope from contour spacing: Slope $= \frac{\text{contour interval}}{\text{horizontal ground distance between contours}}$.

Step 1 – convert the map spacing to a ground distance using the scale: 5 mm$\times$ $5000 = 25{,}000$ mm

Step 2 – convert to metres: $25{,}000$ mm $= 25$ m

Step 3 – form the slope ratio: slope $= \frac{2\text{ m}}{25\text{ m}}$

Step 4 – reduce to 1 in n: $\frac{2}{25} = \frac{1}{12.5}$

Why the other options are wrong:

- B: 1 in 25 forgets to divide by the contour interval.
- C: 1 in 5 uses the map distance directly.
- D: 1 in 250 mishandles the unit conversion.

Final Answer: slope $= 1$ in $12.5 \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q12

Q13.

Solution

Concept – back bearing from fore bearing: Back bearing = fore bearing $\pm 180^\circ$ (use + when the fore bearing is below 180°).

Step 1 – note the fore bearing: FB $= 115^\circ 45'$

Step 2 – since it is less than 180°, add 180°: BB $= 115^\circ 45' + 180^\circ$

Step 3 – evaluate: BB $= 295^\circ 45'$

Why the other options are wrong:

- A: $115^\circ 45'$ is the fore bearing unchanged.
- C: $244^\circ 15'$ subtracts from 360° instead of adding 180°.
- D: $64^\circ 15'$ is the reduced-bearing angle, not the back bearing.

Final Answer: BB $= 295^\circ 45' \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q13

Q14.

Solution

Concept – whole-circle to reduced bearing: A WCB between 270° and 360° lies in the fourth (north-west) quadrant, with RB $= 360^\circ -$ WCB measured from north towards west.

Step 1 – identify the quadrant: 295° is between 270° and 360°, i.e. the NW quadrant.

Step 2 – subtract from 360°: $360^\circ - 295^\circ = 65^\circ$

Step 3 – attach the quadrant letters: Measured from north towards west, the bearing is N65°W.

Why the other options are wrong:

- A: S65°W would be for a WCB near 245° (SW quadrant).
- B: N65°E is the NE quadrant (WCB $\approx 65^\circ$).
- D: S65°E is the SE quadrant.

Final Answer: N65°W $\Rightarrow$ $\boxed{\text{C}}$

$\boxed{\textbf{Answer: (C)}}$ Go Back to Q14

Q15.

Solution

Concept – latitude and departure of a line: Latitude $= L\cos\theta$ (N–S component), Departure $= L\sin\theta$ (E–W component), θ measured from north.

Step 1 – compute the latitude: Lat $= 200\cos 60^\circ$

Lat $= 200 \times 0.5$

Lat $= 100$ m (northerly)

Step 2 – compute the departure: Dep $= 200\sin 60^\circ$

Dep $= 200 \times 0.8660$

Dep $= 173.2$ m (easterly)

Why the other options are wrong:

- A: swaps the sine and cosine components.
- B: uses $\cos 60^\circ$ for both.
- D: uses 45° instead of 60°.

Final Answer: 100 m N, 173.2 m E $\Rightarrow$ $\boxed{\text{C}}$

$\boxed{\textbf{Answer: (C)}}$ Go Back to Q15

Q16.

Solution

Concept – eliminating theodolite adjustment errors: Collimation error and trunnion-axis (horizontal-axis) error reverse their effect when the instrument is transited to the other face, so their means cancel.

Step 1 – recall the behaviour of these errors: On face left they shift the reading one way; on face right they shift it the opposite way by the same amount.

Step 2 – state the remedy: Observing the angle on both faces and taking the mean removes the error automatically.

Why the other options are wrong:

- A: a single face retains the full error.

- C: changing the observer does not affect an instrumental misadjustment.
- D: sight length does not cancel these axis errors.

Final Answer: observe on both faces and mean the readings $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q16

Q17.

Solution

Concept – sum of interior angles of a closed polygon: For a closed traverse of n sides the interior angles sum to $(2n - 4) \times 90°$.

Step 1 – substitute $n = 8$: $(2 \times 8 - 4) \times 90°$

Step 2 – simplify inside the bracket: $(16 - 4) = 12$

Step 3 – multiply: $12 \times 90° = 1080°$

Why the other options are wrong:

- A: $720°$ is for $n = 6$.
- B: $900°$ is for $n = 7$.
- C: $540°$ is for $n = 5$.

Final Answer: $1080° \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q17

Q18.

Solution

Concept – Transit rule versus Bowditch's rule: Both rules distribute the closing error, but they assume different relative quality of the linear and angular work.

Step 1 – recall Bowditch's assumption: Bowditch's rule assumes linear and angular measurements are of comparable precision, distributing corrections in proportion to side length.

Step 2 – recall the Transit rule assumption: The Transit rule distributes corrections in proportion to the latitudes and departures, which suits surveys where the angles are measured more precisely than the lengths.

Step 3 – select the matching condition: Hence the Transit rule is preferred when angular measurements are more precise than linear ones.

Why the other options are wrong:

- A: reverses the precision assumption.
- C: equal side lengths is not the deciding factor.
- D: neither balancing rule applies to an unclosed traverse.

Final Answer: angular measurements more precise than linear $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q18

Q19.

Solution

Concept – tangent length of a simple curve: $T = R\tan\left(\frac{\Delta}{2}\right)$, measured from the point of intersection to each tangent point.

Step 1 – halve the deflection angle: $\frac{\Delta}{2} = \frac{80^\circ}{2} = 40^\circ$

Step 2 – evaluate the tangent: $\tan 40^\circ = 0.8391$

Step 3 – multiply by the radius: $T = 250 \times 0.8391$

Step 4 – compute: $T = 209.8$ m

Why the other options are wrong:

- A: 175 m uses $\tan 35^\circ$ (wrong half-angle).
- C: 250 m is the radius itself.
- D: 300 m does not follow from the formula.

Final Answer: $T \approx 209.8$ m $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q19

Q20.

Solution

Concept – length of a circular curve: $L = \frac{\pi R \Delta}{180^\circ}$, the arc length subtending the deflection angle Δ at radius R.

Step 1 – substitute the values: $L = \frac{\pi \times 300 \times 45}{180}$

Step 2 – simplify the fraction $45/180$: $\frac{45}{180} = 0.25$

Step 3 – multiply: $L = \pi \times 300 \times 0.25 = 75\pi$

Step 4 – evaluate: $L = 235.6$ m

Why the other options are wrong:

- A: 150 m ignores the factor π.
- B: 300 m is the radius.
- C: 471.2 m uses $\Delta = 90°$ instead of $45°$.

Final Answer: $L \approx 235.6 \text{ m} \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q20

Q21.

Solution

Concept – arc length of one branch of a compound curve: Each arc of a compound curve is itself a circular arc, so its length is $L = \dfrac{\pi R \Delta}{180°}$ using that branch's own radius and deflection angle.

Step 1 – pick the first-arc data: $R_1 = 200$ m, $\Delta_1 = 30°$.

Step 2 – substitute into the arc formula: $L_1 = \dfrac{\pi \times 200 \times 30}{180}$

Step 3 – simplify $30/180$**:** $\dfrac{30}{180} = \dfrac{1}{6}$

Step 4 – multiply: $L_1 = \pi \times 200 \times \dfrac{1}{6} = \dfrac{200\pi}{6} = 33.33\pi$

Step 5 – evaluate: $L_1 = 104.7$ m

Why the other options are wrong:

- A: 209.4 m uses $\Delta_1 = 60°$.
- B: 157.1 m uses the second radius $R_2 = 300$ m.
- D: 52.4 m halves the correct value.

Final Answer: $L_1 \approx 104.7 \text{ m} \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q21

Q22.

Solution

Concept – mid-ordinate of a simple curve: $M = R\big(1 - \cos(\Delta/2)\big)$, the distance from the mid-point of the long chord to the mid-point of the curve.

Step 1 – halve the deflection angle: $\dfrac{\Delta}{2} = \dfrac{40°}{2} = 20°$

Step 2 – evaluate the cosine: $\cos 20° = 0.9397$

Step 3 – subtract from one: $1 - 0.9397 = 0.0603$

Step 4 – multiply by the radius: $M = 500 \times 0.0603$

$M = 30.2$ m

Why the other options are wrong:

- A: 60.3 m doubles the correct value.
- B: 15.1 m halves it.
- D: 100 m does not follow from the formula.

Final Answer: $M \approx 30.2 \text{ m} \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q22

Q23.

Solution

Concept – horizontal distance in inclined tacheometry: For an anallactic tacheometer, $D = k\,s\cos^2\theta$, where k is the multiplying constant, s the staff intercept and θ the vertical angle.

Step 1 – form the product $k\,s$: $k\,s = 100 \times 1.200 = 120$

Step 2 – evaluate $\cos\theta$: $\cos 6^\circ = 0.99452$

Step 3 – square it: $\cos^2 6^\circ = 0.98907$

Step 4 – multiply: $D = 120 \times 0.98907$

$D = 118.7$ m

Why the other options are wrong:

- B: 120 m ignores the $\cos^2\theta$ reduction.
- C: 100 m drops the intercept factor.
- D: 105.6 m uses a steeper angle.

Final Answer: $D \approx 118.7 \text{ m} \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q23

Q24.

Solution

Concept – co-latitude in field astronomy: The co-latitude is the complement of the latitude, i.e. the angular distance of the place from the nearer celestial pole: co-latitude $= 90° - \phi$.

Step 1 – write the latitude: $\phi = 62°$

Step 2 – subtract from $90°$: $90° - 62° = 28°$

Step 3 – state the result: Co-latitude $= 28°$.

Why the other options are wrong:

- A: $62°$ is the latitude itself.
- B: $90°$ would require a latitude of $0°$.
- D: $152°$ adds instead of subtracting.

Final Answer: co-latitude $= 28° \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q24

Q25.

Solution

Concept – scale of a vertical photograph: For flat ground the photo scale is $\frac{f}{H}$, the ratio of focal length to flying height (in the same unit).

Step 1 – convert the focal length to metres: $f = 200$ mm $= 0.200$ m

Step 2 – form the ratio: scale $= \dfrac{0.200}{2000}$

Step 3 – simplify: $\dfrac{0.200}{2000} = \dfrac{1}{10{,}000}$

Why the other options are wrong:

- B: $1{:}1000$ misplaces the decimal.
- C: $1{:}20{,}000$ forgets to convert mm to m.
- D: $1{:}4000$ does not match f/H.

Final Answer: scale $= 1{:}10{,}000 \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q25

Q26.

Solution

Concept – flying height from photo scale: From scale $= \dfrac{f}{H}$ we get $H = f \times$ (scale denominator).

Step 1 – convert the focal length: $f = 150 \text{ mm} = 0.150 \text{ m}$

Step 2 – multiply by the scale denominator: $H = 0.150 \times 6000$

Step 3 – compute: $H = 900 \text{ m}$

Why the other options are wrong:

- B: $40{,}000$ m ignores the focal length unit.
- C: 1500 m uses $f = 250$ mm.
- D: 9000 m misplaces the decimal by ten.

Final Answer: $H = 900 \text{ m} \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q26

Q27.

Solution

Concept – relief displacement: The outward radial shift of the image of a tall object on a vertical photograph is $d = \dfrac{r\,h}{H}$.

Step 1 – multiply the radial distance by the object height: $r\,h = 75 \times 80 = 6000$

Step 2 – divide by the flying height: $d = \dfrac{6000}{2000}$

Step 3 – evaluate (units are those of r, i.e. mm): $d = 3 \text{ mm}$

Why the other options are wrong:

- A: 1.5 mm uses $H = 4000$ m.
- C: 6 mm halves the flying height.
- D: 9 mm does not follow from the numbers.

Final Answer: $d = 3 \text{ mm} \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q27

Q28.

Solution

Concept – ground length from photo length: Ground distance = photo distance × scale denominator.

Step 1 – multiply the image length by the scale factor: $60 \text{ mm} \times 8000 = 480{,}000 \text{ mm}$

Step 2 – convert to metres: $480{,}000 \text{ mm} = 480 \text{ m}$

Why the other options are wrong:

- A: 48 m divides by ten too many.
- C: 4800 m over-scales by ten.
- D: 4.8 m confuses the unit conversion.

Final Answer: ground length $= 480$ m $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q28

Q29.

Solution

Concept – the floating-mark principle: In a stereoscope, two identical measuring half-marks (one in each image) fuse into a single mark that appears to "float" in the three-dimensional model. Raising or lowering it until it just rests on the terrain gives the point's elevation.

Step 1 – recall how the mark is used: The operator moves the floating mark in the z-direction until it appears to sit exactly on the ground surface of the stereo-model.

Step 2 – state the purpose: The setting is read as the height (elevation) of that point, so the floating mark measures elevations and enables contouring.

Why the other options are wrong:

- A: colour/tone is not what the floating mark measures.
- B: lens distortion is handled by calibration, not the floating mark.
- C: focal length is a camera constant, unrelated to the mark.

Final Answer: it measures point elevations on the stereomodel $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q29

Q30.

Solution

Concept – ground area from photo dimensions: Convert each photo side to a ground length using the scale, then multiply.

Step 1 – ground length of the first side: $50 \text{ mm} \times 5000 = 250{,}000 \text{ mm} = 250 \text{ m}$

Step 2 – ground length of the second side: $40 \text{ mm} \times 5000 = 200{,}000 \text{ mm} = 200 \text{ m}$

Step 3 – multiply to get the area: $A = 250 \times 200 = 50{,}000 \text{ m}^2$

Step 4 – convert to hectares (1 ha $= 10{,}000$ m^2): $A = \dfrac{50{,}000}{10{,}000} = 5 \text{ ha}$

Why the other options are wrong:

- A: 2 ha under-scales one side.
- B: 20 ha squares the scale error.
- D: 50 ha keeps the area in the wrong unit.

Final Answer: $A = 5 \text{ ha} \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q30

Q31.

Solution

Concept – wavelength from frequency: $\lambda = \dfrac{c}{f}$, with $c = 3 \times 10^8$ m/s.

Step 1 – substitute the values: $\lambda = \dfrac{3 \times 10^8}{3 \times 10^9}$

Step 2 – divide the mantissas: $\dfrac{3}{3} = 1$

Step 3 – subtract the exponents: $10^{8-9} = 10^{-1}$

Step 4 – combine: $\lambda = 1 \times 10^{-1} \text{ m} = 0.1 \text{ m}$

Step 5 – locate it on the spectrum: 0.1 m (10 cm) falls in the microwave region, consistent with the far right of the sketch.

Why the other options are wrong:

- A, B, C: 1 m, 0.5 m and 3 m all mishandle the powers of ten.

Final Answer: $\lambda = 0.1 \text{ m} \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q31

Q32.

Solution

Concept – spectral regions used in remote sensing: Different wavelength bands are named by their position in the electromagnetic spectrum.

Step 1 – locate the band: $8–14\ \mu$m lies well beyond the visible ($0.4–0.7\ \mu$m) and the reflective infrared.

Step 2 – name the region: This is the thermal infrared window, where the Earth's own emitted radiation peaks, so it is used for night-time surface-temperature mapping.

Why the other options are wrong:

- B: visible is $0.4–0.7\ \mu$m.
- C: microwave is at millimetre-to-centimetre wavelengths.
- D: ultraviolet is shorter than the visible.

Final Answer: thermal infrared $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q32

Q33.

Solution

Concept – ground sampling distance: GSD $=$ (ground swath width) $\div$ (number of detector pixels across the line).

Step 1 – convert the swath to metres: 12 km $= 12{,}000$ m

Step 2 – divide by the pixel count: $\text{GSD} = \dfrac{12{,}000}{6000}$

Step 3 – evaluate: $\text{GSD} = 2$ m

Why the other options are wrong:

- A: 6 m does not match the division.
- B: 0.5 m inverts the ratio.
- C: 1 m uses $12{,}000$ pixels.

Final Answer: $\text{GSD} = 2\text{ m} \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q33

Q34.

Solution

Concept – supervised image classification: In supervised classification the analyst guides the algorithm by supplying examples of each class before the whole image is labelled.

Step 1 – identify the first action: The analyst delineates training sites (areas of known land cover) on the image.

Step 2 – state its role: The spectral statistics of these training pixels are used to build the decision rule (for example maximum-likelihood) that then classifies every pixel.

Why the other options are wrong:

- A: clustering without input is unsupervised classification.
- B: using one band discards most spectral information and is not the defining first step.
- D: a fixed DN threshold is a simple density slice, not supervised training.

Final Answer: define training sites of known classes $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q34

Q35.

Solution

Concept – Normalized Difference Vegetation Index: $\text{NDVI} = \dfrac{\text{NIR} - \text{Red}}{\text{NIR} + \text{Red}}$, exploiting the large NIR-versus-red reflectance gap of healthy vegetation.

Step 1 – form the numerator: $\text{NIR} - \text{Red} = 0.50 - 0.10 = 0.40$

Step 2 – form the denominator: $\text{NIR} + \text{Red} = 0.50 + 0.10 = 0.60$

Step 3 – divide: $\text{NDVI} = \dfrac{0.40}{0.60}$

Step 4 – evaluate: $\text{NDVI} = 0.667 \approx 0.67$

Why the other options are wrong:

- B: 0.40 is only the numerator.
- C: 0.60 is only the denominator.
- D: 0.17 divides the wrong quantities.

Final Answer: $\text{NDVI} \approx 0.67 \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q35

Q36.

Solution

Concept – radiometric resolution: A sensor that stores each pixel in n bits can represent 2^n distinct grey (brightness) levels.

Step 1 – note the bit depth: $n = 10$ bits.

Step 2 – raise two to that power: $2^{10} = 1024$

Step 3 – state the result: The sensor resolves 1024 grey levels.

Why the other options are wrong:

- A: 10 is the bit count, not the level count.
- B: 100 has no basis in powers of two.
- C: $512 = 2^9$ corresponds to 9 bits.

Final Answer: 1024 grey levels $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q36

Q37.

Solution

Concept – the vector data model: The vector model stores discrete features by their boundary coordinates rather than as a filled grid.

Step 1 – recall the three primitives: A single location is a point, a connected string of coordinates is a line, and a closed string enclosing an area is a polygon.

Step 2 – state the representation: Each feature is defined by one or more (x, y) coordinate pairs, exactly as shown in the sketch.

Why the other options are wrong:

- B: a matrix of grid cells is the raster model.
- C: a surface of square pixels is again raster.
- D: contour bands are a derived product, not the vector primitives.

Final Answer: points, lines and polygons by (x, y) pairs $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q37

Q38.

Solution

Concept – attribute versus spatial queries: An attribute query selects features using only the values stored in their table fields, with no reference to location or geometry.

Step 1 – inspect the query: It filters on “area” and “landuse”, both of which are columns in the parcel table.

Step 2 – classify it: Because it uses only tabular conditions, it is a (non-spatial) attribute query.

Why the other options are wrong:

- A: routing needs a connected network, not table filtering.
- B: a buffer creates new geometry around features.
- C: interpolation estimates a continuous surface from samples.

Final Answer: attribute (tabular) query $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q38

Q39.

Solution

Concept – uncompressed raster storage: Size $=$ (rows) $\times$ (columns) $\times$ (bytes per cell).

Step 1 – multiply the cell counts: $2000 \times 1500 = 3{,}000{,}000$ cells

Step 2 – multiply by bytes per cell: $3{,}000{,}000 \times 1$ byte $= 3{,}000{,}000$ bytes

Step 3 – convert to megabytes (1 MB $\approx 10^6$ bytes): $\dfrac{3{,}000{,}000}{1{,}000{,}000} = 3$ MB

Why the other options are wrong:

- A: 1 MB uses only one-third of the cells.
- B: 8 MB assumes 8 bytes per cell.
- D: 3 GB is off by a factor of a thousand.

Final Answer: ≈ 3 MB $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q39

Q40.

Solution

Concept – union (logical OR) overlay: A union overlay keeps every area that belongs to either input layer, splitting the geometry along all boundaries.

Step 1 – interpret the shaded figure: Both circles are shaded, meaning all of A together with all of B is retained.

Step 2 – state the output: The result contains all areas in A or B (including their overlap), i.e. the logical OR.

Why the other options are wrong:

- A: the common area only is an intersection (logical AND).
- B: A outside B is the difference (erase).
- D: areas outside both would be the complement, not a union.

Final Answer: all areas in either A or B $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q40

Q41.

Solution

Concept – topological relationships in vector data: Topology stores how features relate spatially, independent of their exact coordinates.

Step 1 – read what is recorded: The dataset stores, for each directed arc, the polygon on its left and the polygon on its right.

Step 2 – name the relationship: Recording which areas share a common boundary is the adjacency (left–right) relationship.

Why the other options are wrong:

- A: connectivity records how arcs meet at nodes, not polygon neighbours.
- B: containment is a point-in-polygon relationship.
- C: proximity is a distance-based relationship, not stored topology.

Final Answer: adjacency (left–right polygon relationship) $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q41

Q42.

Solution

Concept – Geometric Dilution of Precision (GDOP): GDOP scales how the geometry of the tracked satellites amplifies ranging errors into position error.

Step 1 – recall the relation: Position error $\approx$ GDOP $\times$ ranging error, so a smaller GDOP means a smaller position error for the same ranging quality.

Step 2 – link geometry to GDOP: Satellites spread widely across the sky (as sketched) give a low GDOP.

Step 3 – state the meaning: A small GDOP therefore indicates good satellite geometry and higher positional accuracy.

Why the other options are wrong:

- A: worse accuracy corresponds to a large GDOP, not a small one.
- B: GDOP is about geometry, not the size of clock error.
- C: bunched (fewer effective) satellites raise GDOP.

Final Answer: better geometry and higher accuracy $\Rightarrow \boxed{\text{D}}$

$\boxed{\textbf{Answer: (D)}}$ **Go Back to Q42**

Q43.

Solution

Concept – pseudorange from travel time: $\rho = c \times t$, distance equals the speed of light times the signal travel time.

Step 1 – substitute the values: $\rho = (3 \times 10^8) \times (0.08)$

Step 2 – multiply the mantissas: $3 \times 0.08 = 0.24$

Step 3 – write with the power of ten: $\rho = 0.24 \times 10^8$ m

Step 4 – normalise: $\rho = 2.4 \times 10^7$ m

Step 5 – convert to kilometres: $\rho = 2.4 \times 10^4$ km $= 24{,}000$ km

Why the other options are wrong:

- B: 2400 km is off by ten.
- C: 300 km uses $t = 0.001$ s.
- D: $240{,}000$ km is off by ten the other way.

Final Answer: $\rho \approx 24{,}000$ km $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q43

Q44.

Solution

Concept – conformal projections: A conformal (orthomorphic) projection preserves angles and the shapes of small features; its meridians and parallels cross at right angles.

Step 1 – test each option: The Transverse Mercator preserves local angles and underlies the UTM grid, so it is conformal.

Step 2 – confirm the others' class: Albers conic, sinusoidal and Mollweide are all equal-area (equivalent) projections, which preserve area at the expense of shape.

Why the other options are wrong:

- B, C, D: all are equal-area projections, so they distort shape and are not conformal.

Final Answer: Transverse Mercator $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q44

Q45.

Solution

Concept – equal-area (equivalent) projections: An equal-area projection is designed so that any region on the map has the correct relative area, accepting distortion of shape and angle.

Step 1 – match the stated property: "Preserves true area but distorts shape" is the defining property of an equal-area projection.

Step 2 – contrast with conformal: A conformal projection does the opposite, keeping shape but distorting area.

Why the other options are wrong:

- A: conformal preserves shape, not area.
- C: "azimuthal" names the developable surface, not the area property.
- D: the gnomonic projection is neither conformal nor equal-area (it shows great circles as straight lines).

Final Answer: equal-area (equivalent) projection $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q45

Q46.

Solution

Concept – the defining property of conformality: A projection is conformal when, at any point, the scale factor is identical in every direction, so infinitesimally small figures keep their true shape.

Step 1 – state the point property: At a given point the scale does not depend on the azimuth of the direction chosen.

Step 2 – give the consequence: Because the scale is the same in all directions, local angles and the shapes of small features are preserved (which is why rhumb lines plot straight on the Mercator).

Why the other options are wrong:

- A: the scale is not zero at the poles; on Mercator it grows without bound there.
- C: the scale is not unity everywhere; only along the standard line(s).
- D: conformality is a single-scale-per-point property, not a split between area and distance.

Final Answer: the same in every direction at that point $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q46

Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	A	2	D	3	C	4	D	5	B
6	C	7	B	8	A	9	B	10	B
11	A	12	A	13	B	14	C	15	C
16	B	17	D	18	B	19	B	20	D
21	C	22	C	23	A	24	C	25	A
26	A	27	B	28	B	29	D	30	C
31	D	32	A	33	D	34	C	35	A
36	D	37	A	38	D	39	C	40	C
41	D	42	D	43	A	44	A	45	B
46	B								