GATE Geomatics Engineering

Sample Paper – 4

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 $\alpha = 11.7 \times 10^{-6}$ °C^{-1}.

Principles of Surveying and Error Theory

Q1. A surveyor records a measured distance as 405.60 m. The number of significant figures contained in this recorded value is: **[1 mark]**

(A) 3

(B) 4

(C) 5

(D) 6

Q2. Three tape lengths 12.5 m, 1.24 m and 0.036 m are added. Following the rule that a sum is rounded to the least number of decimal places among the terms, the total is correctly stated as: **[1 mark]**

(A) 13.8 m

(B) 13.78 m

(C) 13.776 m

(D) 14 m

Q3. Two independently measured lengths have standard errors of ± 8 mm and ± 6 mm. When the two lengths are added, their errors combine in quadrature. The standard error of the total is: **[1 mark]**

(A) ± 14 mm

(B) ± 2 mm

(C) ± 100 mm

(D) ± 10 mm

Q4. By the principle of least squares, the most probable value of a quantity derived from a set of equally reliable observations is the value that makes the sum of the squares of the residuals: **[1 mark]**

(A) a maximum

(B) exactly zero

(C) a minimum

(D) equal to unity

Q5. In the theory of errors, the weight assigned to an observation is inversely proportional to: **[1 mark]**

(A) the square of its standard error (its variance)

(B) its standard error

(C) the serial number of the observation

(D) the length being measured

Q6. Which class of errors follows the laws of probability (the normal distribution), is equally likely to be positive or negative, and tends to cancel out over a large number of observations? **[1 mark]**

(A) systematic errors

(B) blunders (gross mistakes)

(C) cumulative errors

(D) random (accidental) errors

Distance Measurement, Levelling and Contouring

Q7. A 30 m steel tape standardized at a pull of 50 N is used in the field at a pull of 100 N. The tape has cross-sectional area $A = 3$ mm^2 and Young's modulus $E = 2 \times 10^5$ N/mm^2. Using $C_p = \dfrac{(P - P_0)L}{AE}$, the pull (tension) correction to one tape length is: **[1 mark]**

(A) $+5.0$ mm

(B) $+1.25$ mm

(C) -2.5 mm

(D) $+2.5$ mm

Q8. A length of 50 m is measured along a slope on which the two ends differ in level by 4 m. Using the approximate slope correction $-\dfrac{h^2}{2L}$, the correction that reduces the slope length to the horizontal is: **[1 mark]**

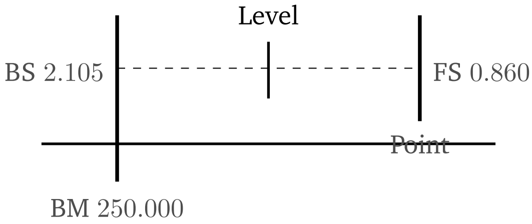
(A) -0.32 m

(B) -0.16 m

(C) -0.08 m

(D) -0.04 m

Q9. In the differential-levelling set-up shown, a backsight of 2.105 m is taken on a benchmark of RL 250.000 m and a foresight of 0.860 m is taken to the next point. The reduced level of the forepoint is: **[1 mark]**



(A) 252.965 m

(B) 247.895 m

(C) 250.860 m

(D) 251.245 m

Q10. The sensitiveness of a level tube is tested. When the bubble is moved through 3 divisions, the staff readings at two ends change by 0.015 m over a sight length of 100 m. Using $\alpha = \dfrac{s}{n\,D}$ (in radians), the angular value of one division is nearest to: **[1 mark]**

(A) $20.6''$

(B) $10.3''$

(C) $30.9''$

(D) $5.2''$

Q11. A dumpy level has a small collimation error, so the line of sight is tilted slightly upward instead of being truly horizontal. If, during levelling, the backsight and foresight distances are kept equal, the effect of this collimation error on the computed difference of level is: **[1 mark]**

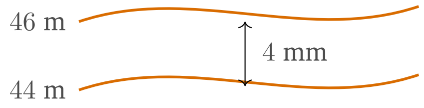
(A) doubled

(B) eliminated (reduced to zero)

(C) halved but not removed

(D) increased in proportion to the sight distance

Q12. On a map of scale 1:2500 with a contour interval of 2 m, two adjacent contours are drawn 4 mm apart on the paper (see the contour sketch). The ground slope between them is: **[1 mark]**



(A) 1 in 20

(B) 1 in 2.5

(C) 1 in 10

(D) 1 in 5

Theodolite, Traverse and Triangulation

Q13. The fore bearing (whole-circle bearing) of a survey line PQ is $125°45'$. The back bearing of the line is: **[1 mark]**

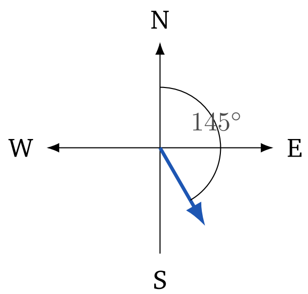
(A) $125°45'$

(B) $305°45'$

(C) $54°15'$

(D) $234°15'$

Q14. The whole-circle bearing of a line is $145°$, as shown on the compass diagram. Its reduced (quadrantal) bearing is: **[1 mark]**



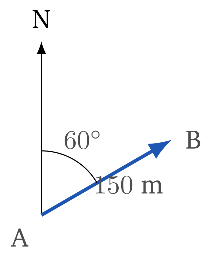
(A) N35°E

(B) N35°W

(C) S35°E

(D) S35°W

Q15. A traverse line AB of length 150 m has a whole-circle bearing of $60°$, as shown. Its latitude ($L\cos\theta$) and departure ($L\sin\theta$) are respectively: **[1 mark]**



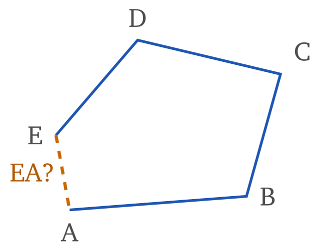
(A) 129.9 m N, 75.0 m E

(B) 75.0 m N, 75.0 m E

(C) 129.9 m N, 129.9 m E

(D) 75.0 m N, 129.9 m E

Q16. In the closed traverse shown, the length and bearing of the closing line EA were not measured. The algebraic sum of the latitudes of all the other sides is $+40$ m and the sum of their departures is $+30$ m. The length of the omitted closing line EA is: **[1 mark]**



(A) 50 m

(B) 70 m

(C) 35 m

(D) 10 m

Q17. For a closed polygon traverse having 5 sides, the theoretical sum of the interior angles, given by $(2n-4)\times 90°$, is: **[1 mark]**

(A) $360°$

(B) $720°$

(C) 540°

(D) 900°

Q18. In a closed traverse both the length and the bearing of one side are missing (an "omitted measurement"). These two unknowns can be recovered provided that, for all the remaining sides, one knows the: **[1 mark]**

(A) interior angles only

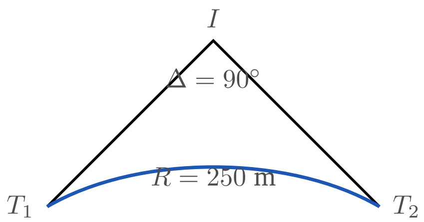
(B) included angles only

(C) latitudes and departures

(D) area of the traverse

Curves, Tacheometry and Field Astronomy

Q19. A simple circular curve of radius $R = 250$ m has a deflection angle $\Delta = 90^\circ$ between its tangents, as shown. The tangent length ($T = R\tan(\Delta/2)$) is: **[1 mark]**



(A) 125 m

(B) 250 m

(C) 353.6 m

(D) 500 m

Q20. A simple circular curve of radius 180 m subtends a deflection angle of 80°. The length of the curve, $L = \dfrac{\pi R \Delta}{180^\circ}$, is nearest to: **[1 mark]**

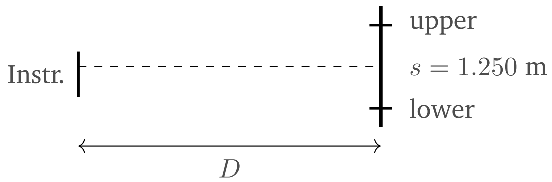
(A) 180 m

(B) 80 m

(C) 502.7 m

(D) 251.3 m

Q21. In a tacheometric observation with an anallactic telescope (multiplying constant $k = 100$, additive constant $C = 0$) the staff intercept is 1.250 m with the line of sight horizontal, as shown. The horizontal distance to the staff is: **[2 marks]**



(A) 125.0 m

(B) 12.5 m

(C) 1250 m

(D) 100.25 m

Q22. To find the tacheometer constants, two staff intercepts are read on a horizontal line of sight: at a known distance of 50 m the intercept is 0.480 m, and at 100 m it is 0.980 m. Using $D = k\,s + C$, the multiplying constant k is: **[2 marks]**

(A) 100

(B) 50

(C) 104

(D) 96

Q23. A tacheometer ($k = 100$, $C = 0$) reads a staff intercept of 1.500 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) 150 m

(B) 149.2 m

(C) 148.3 m

(D) 132.7 m

Q24. In field astronomy the altitude of the celestial equator above the south point of the horizon equals the co-latitude of the observer. For a station at latitude $40°$N, this altitude is: **[2 marks]**

(A) $40°$

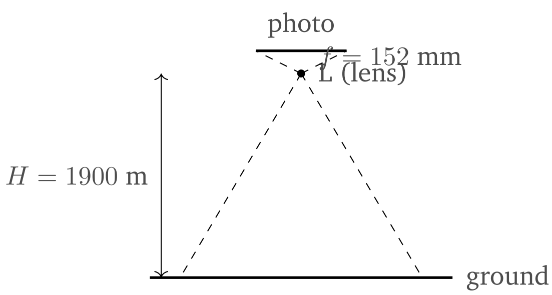
(B) $90°$

(C) $50°$

(D) $130°$

Photogrammetry

Q25. A vertical aerial photograph is taken with a camera of focal length 152 mm from a flying height of 1900 m above flat ground, as shown. The scale of the photograph (f/H) is: **[2 marks]**



(A) 1:10,000

(B) 1:12,500

(C) 1:19,000

(D) 1:1250

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]**

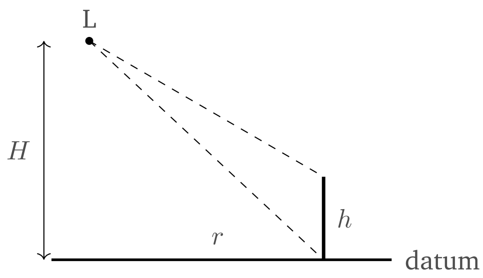
(A) 400 m

(B) 900 m

(C) 6000 m

(D) 90 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 $r = 100$ mm, object height $h = 120$ m and flying height $H = 2400$ m (see figure), the relief displacement is: **[2 marks]**



(A) 5 mm

(B) 2.5 mm

(C) 10 mm

(D) 1 mm

Q28. An orthophoto is produced from an aerial photograph mainly so that it can be used like a map. Compared with the original perspective photograph, an orthophoto: **[2 marks]**

(A) is always recorded in true colour

(B) shows greater relief displacement of tall objects

(C) remains a perspective projection but at a single fixed scale

(D) has relief and tilt displacements removed, giving a uniform (map-like) scale

Q29. Several overlapping prints are joined to cover a large area. Compared with an uncontrolled mosaic, a **controlled** mosaic: **[2 marks]**

(A) simply overlaps the prints with no reference to ground control

(B) is matched using only the principal points of the photographs

(C) is built from rectified prints fitted to ground control points, giving higher positional accuracy

(D) cannot be used for any measurement of distance or area

Q30. A vertical photograph of scale 1:8000 shows a rectangular field measuring 200 mm $\times$ 250 mm on the print. The corresponding ground area of the field is: **[2 marks]**

(A) 320 ha

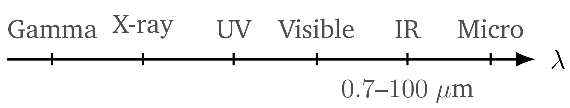
(B) 32 ha

(C) 3200 ha

(D) 40 ha

Remote Sensing

Q31. Electromagnetic radiation of frequency 1.5×10^{14} 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) 0.5 μm

(B) 20 μm

(C) 5 μm

(D) 2 μm

Q32. In remote sensing, the wavelength band 8–14 μm (used to sense the heat radiated by the Earth's surface) corresponds to which region of the electromagnetic spectrum? **[2 marks]**

(A) thermal infrared

(B) visible

(C) microwave

(D) near infrared

Q33. A pushbroom sensor images a ground swath of 6 km using 12,000 detector pixels across the line. The ground sampling distance (spatial resolution) per pixel is: **[2 marks]**

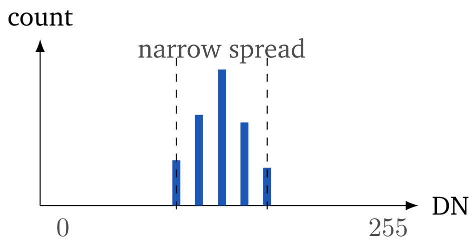
(A) 0.5 m

(B) 1 m

(C) 2 m

(D) 5 m

Q34. The image histogram below (before enhancement) shows that a scene occupies only a narrow range of digital-number (DN) values, so the image looks flat and low in contrast. A linear contrast stretch improves the display by: **[2 marks]**



(A) reducing the total number of grey levels stored

(B) expanding the narrow DN range to span the full display range (0–255)

(C) blurring the image to suppress random noise

(D) replacing every pixel by a single constant DN value

Q35. In histogram equalization, the contrast enhancement is concentrated on the digital-number ranges that: **[2 marks]**

(A) occur least frequently in the image

(B) lie only along the edges of the image

(C) occur most frequently (contain the most pixels) in the image

(D) are exactly equal to zero

Q36. A satellite sensor records each pixel with 6 bits of data. The number of discrete grey levels (radiometric resolution) it can represent is: **[2 marks]**

(A) 6

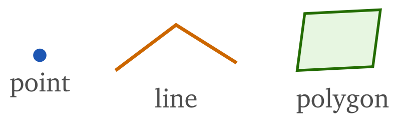
(B) 64

(C) 128

(D) 36

Geographic Information Systems

Q37. A road centre-line, a survey control point and a land parcel (illustrated below) are to be stored in a GIS as discrete features with explicit coordinates and topology. The data model best suited to this is the: **[2 marks]**



(A) raster (grid-cell) model

(B) vector model

(C) triangulated irregular network (TIN) only

(D) continuous-field grid model

Q38. A GIS "shortest-path" analysis carried out on a road network finds the route between two nodes that minimizes: **[2 marks]**

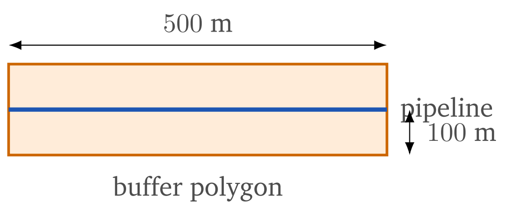
(A) the number of polygons the route crosses

(B) the straight-line (Euclidean) distance, ignoring the roads

(C) the total impedance (distance or travel time) along the connected network edges

(D) the area of the buffer around the route

Q39. A 100 m buffer is generated on both sides of a straight pipeline 500 m long, as shown (ignore the rounded end caps). The area of the resulting buffer strip is: **[2 marks]**



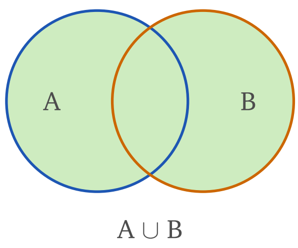
(A) 5 ha

(B) 10 ha

(C) 20 ha

(D) 1 ha

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



(A) all areas lying in either layer, keeping the attributes of both

(B) only the area common to both layers

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

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

Q41. To list all residential plots that fall within 500 m of a proposed metro line, an analyst first builds a 500 m buffer around the metro line and then combines it with the plots layer using a(n): **[2 marks]**

(A) network trace along the metro line

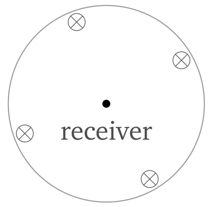
(B) overlay (intersection) of the buffer with the plots layer

(C) contour-generation operation

(D) histogram stretch of the plots layer

GNSS, Cartography and Map Projections

Q42. The geometry of the tracked satellites controls the Geometric Dilution of Precision (GDOP) of a GNSS fix (see sky plot). The GDOP is smallest, i.e. the position is most accurate, when the satellites are: **[2 marks]**



(A) clustered close together near the zenith

(B) all bunched near the horizon in one direction

(C) only two in number

(D) widely spread across the sky, giving a low GDOP

Q43. A GNSS signal takes 0.06 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) $18{,}000$ km

(B) 1800 km

(C) 180 km

(D) $21{,}000$ km

Q44. When a map is compiled at a much smaller scale (for example, reduced from $1{:}10{,}000$ to $1{:}250{,}000$), cartographic generalization must be applied. This process mainly involves: **[2 marks]**

(A) adding extra detail to every feature

(B) increasing only the number of text labels

(C) enlarging small buildings so they appear at true ground size

(D) simplifying, selecting and smoothing features while omitting minor detail

Q45. Among the map scales 1:1000, 1:50,000 and 1:1,000,000, the one that is the **smallest** scale (covering the largest ground area per sheet with the least detail) is: [2 marks]

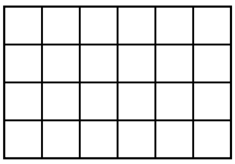
(A) 1:1,000,000

(B) 1:1000

(C) 1:50,000

(D) all three are the same scale

Q46. An equal-area (equivalent) map projection, whose graticule is shown, is preferred for thematic maps of density or distribution because it: [2 marks]


equal-area graticule

(A) preserves the true shape of every continent

(B) preserves true bearing along every line

(C) preserves the true relative areas of regions on the map

(D) preserves true ground distance in every direction

Detailed Solutions

Q1.

Solution

Concept – significant figures: Significant figures are all the digits known with certainty plus one estimated digit. Zeros between non-zero digits and trailing zeros after a decimal point are significant.

Step 1 – write out the value: 405.60 m

Step 2 – identify the digits and test each zero: The "4", "5" and "6" are non-zero and always significant.

Step 3 – the zero between 4 and 5: It sits between non-zero digits, so it is significant.

Step 4 – the trailing zero after the decimal point: A zero written after the decimal point (in 405.60) is a recorded, meaningful digit, so it too is significant.

Step 5 – count them: $4, 0, 5, 6, 0 \Rightarrow 5$ significant figures.

Final Answer: 5 significant figures $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q1

Q2.

Solution

Concept – significant figures in a sum: When quantities are added, the result cannot be more precise than the least precise term, so it is rounded to the smallest number of decimal places among the addends.

Step 1 – add the three lengths exactly: $12.5 + 1.24 = 13.74$

$13.74 + 0.036 = 13.776$

Step 2 – find the least number of decimal places: 12.5 has 1 decimal place, 1.24 has 2, 0.036 has 3; the least is 1.

Step 3 – round the exact sum to 1 decimal place: $13.776 \to 13.8$

Step 4 – interpret: Quoting 13.776 would claim a precision the first tape length (12.5 m) never had.

Final Answer: 13.8 m $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q2

Q3.

Solution

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

Step 1 – square the first error: $\sigma_1^2 = 8^2 = 64$

Step 2 – square the second error: $\sigma_2^2 = 6^2 = 36$

Step 3 – add the squares: $64 + 36 = 100$

Step 4 – take the square root: $\sigma = \sqrt{100}$

$\sigma = 10$ mm

Why the other options are wrong:

- A, 14 mm: that is the simple sum $8 + 6$, which over-states the error.
- B, 2 mm: that is the difference $8 - 6$, not valid for a sum.
- C, 100 mm: that is the sum of squares before taking the root.

Final Answer: $\sigma = \pm 10$ mm $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q3

Q4.

Solution

Concept – the principle of least squares: The most probable value of an over-determined set of equally reliable observations is the one for which the sum of the squares of the residuals (observed minus adjusted) is as small as possible.

Step 1 – write the residuals: Each residual is $v_i = x_i - \bar{x}$.

Step 2 – state the least-squares condition: The best estimate makes $\sum v_i^2$ a minimum.

Step 3 – confirm the result: Minimizing $\sum (x_i - \bar{x})^2$ with respect to $\bar{x}$ gives the arithmetic mean, which is why the mean is the most probable value.

Why the other options are wrong:

- A: a maximum would give the worst, not the best, fit.
- B: the residuals cannot all be zero for scattered observations.
- D: there is no reason for the sum of squares to equal one.

Final Answer: the sum of squares of residuals is a minimum $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q4

Q5.

Solution

Concept – weight of an observation: The weight measures how much trust is placed in a value; a more precise observation (smaller error) deserves a larger weight.

Step 1 – recall the defining relation: $w \propto \dfrac{1}{\sigma^2}$, where σ is the standard error.

Step 2 – read the proportionality: The weight varies inversely with the *square* of the standard error, i.e. with the variance.

Step 3 – sanity check: Halving the standard error makes the variance one-quarter, so the weight becomes four times larger, which matches intuition.

Why the other options are wrong:

- B: weight goes as $1/\sigma^2$, not $1/\sigma$.
- C and D: the serial number or the measured length has no bearing on precision.

Final Answer: inversely proportional to the square of the standard error $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q5

Q6.

Solution

Concept – classifying errors: Random (accidental) errors arise from many small, uncontrollable causes; they are equally likely to be positive or negative and follow the normal (Gaussian) law.

Step 1 – match the description: The question describes errors that obey probability, are equally likely either way, and cancel over many readings.

Step 2 – name the class: These are precisely the random (accidental) errors.

Step 3 – note the consequence: Because they tend to cancel, taking the mean of many observations reduces their effect.

Why the other options are wrong:

- A and C: systematic (cumulative) errors keep the same sign and add up; they do not cancel.

- B: a blunder is an isolated gross mistake, not a distribution of small chance errors.

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

Answer: (D) Go Back to Q6

Q7.

Solution

Concept – pull (tension) correction to a tape: $C_p = \dfrac{(P - P_0)\,L}{A\,E}$, positive when the applied pull exceeds the standard pull because the tape is stretched.

Step 1 – find the excess pull: $P - P_0 = 100 - 50 = 50$ N

Step 2 – form the numerator (excess pull times length): $(P - P_0)\,L = 50 \times 30 = 1500$ N m

Step 3 – form the denominator (area times modulus): $A\,E = 3 \times (2 \times 10^5) = 6 \times 10^5$ N

Step 4 – divide: $C_p = \dfrac{1500}{6 \times 10^5}$

$C_p = 0.0025$ m

Step 5 – convert to millimetres and fix the sign: $C_p = 2.5$ mm; the field pull is larger than standard, so the tape lengthens and the correction is added: $C_p = +2.5$ mm.

Final Answer: $C_p = +2.5$ mm $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q7

Q8.

Solution

Concept – slope (reduction to horizontal) correction: For a small height difference the correction is $C_s = -\dfrac{h^2}{2L}$, always subtractive.

Step 1 – square the height difference: $h^2 = 4^2 = 16$

Step 2 – form the denominator: $2L = 2 \times 50 = 100$

Step 3 – divide: $\dfrac{h^2}{2L} = \dfrac{16}{100}$

$\dfrac{h^2}{2L} = 0.16$

Step 4 – apply the negative sign: $C_s = -0.16$ m

Final Answer: $C_s = -0.16$ m $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q8

Q9.

Solution

Concept – reduced level by the HI (collimation) method: RL of forepoint $=$ RL of BM $+$ BS $-$ FS.

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

Step 2 – subtract the foresight: $252.105 - 0.860 = 251.245$ m

Step 3 – interpret: The backsight (2.105) exceeds the foresight (0.860), so the ground has risen; $251.245 > 250.000$, which is consistent.

Final Answer: RL $= 251.245$ m $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q9

Q10.

Solution

Concept – sensitiveness of a level tube: The angular value of one division is $\alpha = \dfrac{s}{n\,D}$ radians, where s is the change in staff reading, n the number of divisions moved and D the sight distance.

Step 1 – list the data: $s = 0.015$ m, $n = 3$ divisions, $D = 100$ m.

Step 2 – form the denominator: $n\,D = 3 \times 100 = 300$

Step 3 – divide to get radians per division: $\alpha = \dfrac{0.015}{300}$

$\alpha = 5 \times 10^{-5}$ rad

Step 4 – convert radians to seconds of arc (1 rad $= 206265''$): $\alpha = 5 \times 10^{-5} \times 206265''$

$\alpha = 10.31''$

Step 5 – round: $\alpha \approx 10.3''$ per division.

Final Answer: $\alpha \approx 10.3'' \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q10

Q11.

Solution

Concept – collimation error and balanced sight distances: A collimation error tilts the line of sight by a fixed small angle, so at any sight it adds an error proportional to the sight distance to the staff reading.

Step 1 – write the error at each staff: Backsight error $= e \times d_{BS}$; foresight error $= e \times d_{FS}$ (same tilt e).

Step 2 – form the level difference: $\Delta H = (\text{BS} + e\, d_{BS}) - (\text{FS} + e\, d_{FS})$

Step 3 – set the distances equal ($d_{BS} = d_{FS}$): The two error terms $e\, d_{BS}$ and $e\, d_{FS}$ are identical and cancel.

Step 4 – conclude: The collimation error is eliminated from the computed difference of level.

Why the other options are wrong:

- A: the errors cancel, they do not add.
- C: with equal distances the cancellation is complete, not partial.
- D: growth with distance is exactly what equalizing the distances removes.

Final Answer: the error is eliminated $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q11

Q12.

Solution

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

Step 1 – convert the map spacing to a ground distance using the scale: $4\ \text{mm} \times 2500 = 10{,}000\ \text{mm}$

Step 2 – convert to metres: $10{,}000\ \text{mm} = 10\ \text{m}$

Step 3 – form the slope ratio: slope $= \dfrac{2\ \text{m}}{10\ \text{m}}$

Step 4 – reduce to 1 in n: $\dfrac{2}{10} = \dfrac{1}{5}$

Final Answer: slope $= 1$ in $5 \Rightarrow \boxed{\text{D}}$

Answer: (D) 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: $\mathrm{FB} = 125^\circ 45'$

Step 2 – since it is less than 180°, add 180°: $\mathrm{BB} = 125^\circ 45' + 180^\circ$

Step 3 – add the whole degrees: $125^\circ + 180^\circ = 305^\circ$

Step 4 – carry the minutes: $\mathrm{BB} = 305^\circ 45'$

Final Answer: $\mathrm{BB} = 305^\circ 45' \Rightarrow \boxed{\mathrm{B}}$

Answer: (B) Go Back to Q13

Q14.

Solution

Concept – whole-circle to reduced bearing: A WCB between 90° and 180° lies in the second (south-east) quadrant, with $\mathrm{RB} = 180^\circ - \mathrm{WCB}$ measured from south towards east.

Step 1 – identify the quadrant: 145° is between 90° and 180°, i.e. the SE quadrant.

Step 2 – subtract from 180°: $180^\circ - 145^\circ = 35^\circ$

Step 3 – attach the quadrant letters: Measured from south towards east, the bearing is S35°E.

Why the other options are wrong:

- A/B: an "N" prefix applies only to WCB below 90° or above 270°.
- D: the "W" suffix belongs to the SW quadrant (180°–270°).

Final Answer: S35°E $\Rightarrow \boxed{\mathrm{C}}$

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), with θ measured from north.

Step 1 – compute the latitude: Lat $= 150\cos 60^\circ$

Lat $= 150 \times 0.5$

Lat $= 75.0$ m (northerly)

Step 2 – compute the departure: Dep $= 150\sin 60^\circ$

Dep $= 150 \times 0.8660$

Dep $= 129.9$ m (easterly)

Step 3 – pair them correctly: Latitude 75.0 m N, departure 129.9 m E.

Final Answer: 75.0 m N, 129.9 m E $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q15

Q16.

Solution

Concept – omitted measurement (length of closing line): For a closed traverse the latitudes must sum to zero and the departures must sum to zero. The closing line therefore has a latitude and departure equal and opposite to the sums of the known sides, and its length is $L = \sqrt{(\sum \text{Lat})^2 + (\sum \text{Dep})^2}$.

Step 1 – read the sums of the known sides: $\sum$ Lat $= +40$ m, $\sum$ Dep $= +30$ m.

Step 2 – the closing line must balance these: Its latitude is -40 m and its departure is -30 m, but its length depends only on the magnitudes.

Step 3 – square the components: $40^2 = 1600$

$30^2 = 900$

Step 4 – add: $1600 + 900 = 2500$

Step 5 – take the square root: $L = \sqrt{2500} = 50$ m

Final Answer: $L = 50$ m $\Rightarrow \boxed{\text{A}}$

Answer: (A) 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 $n = 5$: $(2 \times 5 - 4) \times 90°$

Step 2 – simplify inside the bracket: $(10 - 4) = 6$

Step 3 – multiply: $6 \times 90° = 540°$

Final Answer: $540° \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q17

Q18.

Solution

Concept – recovering an omitted side: The length and bearing of a line are fixed once its latitude and departure are known, because $L = \sqrt{\text{Lat}^2 + \text{Dep}^2}$ and $\tan\theta = \text{Dep}/\text{Lat}$.

Step 1 – use the closing condition: $\sum \text{Lat} = 0$ and $\sum \text{Dep} = 0$ around a closed traverse.

Step 2 – isolate the missing side: Its latitude and departure equal minus the sums of the latitudes and departures of all the other sides.

Step 3 – state the requirement: Hence one must know the latitudes and departures of every remaining side.

Why the other options are wrong:

- A/B: angles alone fix directions but not lengths, so latitudes/departures are still needed.
- D: the enclosed area does not determine an individual missing side.

Final Answer: the latitudes and departures of the other sides $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q18

Q19.

Solution

Concept – tangent length of a simple circular curve: $T = R\tan\left(\dfrac{\Delta}{2}\right)$.

Step 1 – halve the deflection angle: $\dfrac{\Delta}{2} = \dfrac{90^\circ}{2} = 45^\circ$

Step 2 – take the tangent of the half-angle: $\tan 45^\circ = 1$

Step 3 – multiply by the radius: $T = 250 \times 1$

Step 4 – evaluate: $T = 250$ m

Final Answer: $T = 250 \text{ m} \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q19

Q20.

Solution

Concept – length of a circular curve: $L = \dfrac{\pi R \Delta}{180^\circ}$ with Δ in degrees.

Step 1 – form the ratio $\Delta/180^\circ$: $\dfrac{80^\circ}{180^\circ} = 0.4444$

Step 2 – multiply by πR: $L = \pi \times 180 \times 0.4444$

Step 3 – simplify 180×0.4444: $180 \times 0.4444 = 80$

Step 4 – multiply by π: $L = 80\pi$

Step 5 – evaluate with $\pi = 3.1416$: $L = 251.33 \text{ m} \approx 251.3$ m

Final Answer: $L \approx 251.3 \text{ m} \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q20

Q21.

Solution

Concept – horizontal-sight tacheometry (stadia formula): $D = k\,s + C$, where k is the multiplying constant, s the staff intercept and C the additive constant.

Step 1 – list the data: $k = 100$, $s = 1.250$ m, $C = 0$.

Step 2 – multiply the constant by the intercept: $k\,s = 100 \times 1.250$

$k\,s = 125.0$

Step 3 – add the additive constant: $D = 125.0 + 0$

$D = 125.0$ m

Why the other options are wrong:

- B, 12.5 m: uses $k = 10$ instead of 100.
- C, 1250 m: misplaces the decimal (uses $k = 1000$).
- D, 100.25 m: wrongly adds 100 as an additive constant.

Final Answer: $D = 125.0 \text{ m} \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q21

Q22.

Solution

Concept – finding tacheometer constants from two sightings: With $D = k\,s + C$ measured at two known distances, subtracting the two equations removes C and leaves k.

Step 1 – write the two equations: $50 = 0.480\,k + C \quad \text{(at 50 m)}$

$100 = 0.980\,k + C \quad \text{(at 100 m)}$

Step 2 – subtract the first from the second (eliminates C): $100 - 50 = (0.980 - 0.480)\,k$

Step 3 – simplify both sides: $50 = 0.500\,k$

Step 4 – solve for k: $k = \dfrac{50}{0.500}$

$k = 100$

Step 5 – (check) back-substitute for C: $C = 50 - 0.480 \times 100 = 50 - 48 = 2$, a small, realistic additive constant.

Final Answer: $k = 100 \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q22

Q23.

Solution

Concept – inclined-sight tacheometry: For an inclined line of sight the horizontal distance is $D = k\,s\cos^2\theta$ (with $C = 0$).

Step 1 – compute the stadia distance along the sight: $k\,s = 100 \times 1.500 = 150$

Step 2 – take the cosine of the vertical angle: $\cos 6^\circ = 0.9945$

Step 3 – square it: $\cos^2 6^\circ = (0.9945)^2 = 0.9891$

Step 4 – multiply: $D = 150 \times 0.9891$

$D = 148.36 \text{ m} \approx 148.3 \text{ m}$

Why the other options are wrong:

- A, 150 m: ignores the $\cos^2\theta$ reduction.
- B, 149.2 m: uses $\cos\theta$ once instead of squared.
- D, 132.7 m: uses $\cos^2\theta$ with a much larger (wrong) angle.

Final Answer: $D \approx 148.3 \text{ m} \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q23

Q24.

Solution

Concept – altitude of the celestial equator: On the observer's meridian, the celestial equator crosses at an altitude above the south point equal to the co-latitude, $90^\circ - \phi$.

Step 1 – state the relation: altitude of equator $= 90^\circ - \phi$

Step 2 – substitute the latitude: $90^\circ - 40^\circ$

Step 3 – evaluate: $= 50^\circ$

Why the other options are wrong:

- A, 40°: that is the latitude itself, i.e. the altitude of the celestial *pole*, not the equator.
- B, 90°: the equator would pass through the zenith only on the terrestrial equator.
- D, 130°: exceeds 90°, which is impossible for an altitude.

Final Answer: altitude $= 50^\circ \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q24

Q25.

Solution

Concept – scale of a vertical photograph: Scale $= \dfrac{f}{H}$, with f the focal length and H the flying height above the ground, both in the same unit.

Step 1 – convert the focal length to metres: $f = 152 \text{ mm} = 0.152 \text{ m}$

Step 2 – form the ratio: Scale $= \dfrac{0.152}{1900}$

Step 3 – carry out the division: $\dfrac{0.152}{1900} = 8 \times 10^{-5}$

Step 4 – express as $1{:}n$**:** $8 \times 10^{-5} = \dfrac{1}{12{,}500}$

Final Answer: scale $= 1{:}12{,}500 \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q25

Q26.

Solution

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

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 – evaluate: $H = 900\text{ m}$

Why the other options are wrong:

- A, 400 m: would need $f = 66.7$ mm.
- C, 6000 m: is the scale denominator, not a height.
- D, 90 m: is off by a factor of ten (misplaced decimal).

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

Answer: (B) Go Back to Q26

Q27.

Solution

Concept – relief displacement on a vertical photograph: $d = \dfrac{r\,h}{H}$, where r is the radial distance of the image from the principal point, h the object height and H the flying height.

Step 1 – multiply the radial distance by the object height: $r\,h = 100 \times 120$

$r\,h = 12{,}000$

Step 2 – divide by the flying height: $d = \dfrac{12{,}000}{2400}$

Step 3 – evaluate (result carries the unit of r, i.e. mm): $d = 5\text{ mm}$

Final Answer: $d = 5$ mm $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q27

Q28.

Solution

Concept – what an orthophoto is: An orthophoto is a photograph that has been differentially rectified so that every point is shown in its correct planimetric position, as in an orthographic (map) projection.

Step 1 – recall the defect of a raw photo: A perspective photograph has scale that varies with ground height (relief displacement) and with tilt.

Step 2 – state what rectification removes: Ortho-rectification removes both relief and tilt displacements.

Step 3 – state the result: The corrected image has a single, uniform scale and can be measured like a map.

Why the other options are wrong:

- A: colour has nothing to do with orthorectification.
- B: displacements are removed, not increased.
- C: an orthophoto is an orthographic projection, no longer a single-scale perspective view.

Final Answer: relief and tilt displacements removed, uniform scale $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q28

Q29.

Solution

Concept – controlled versus uncontrolled mosaic: A mosaic is an assembly of overlapping prints. A controlled mosaic is built from rectified prints laid to fit surveyed ground-control points, whereas an uncontrolled mosaic is matched only by eye along the overlaps.

Step 1 – recall the uncontrolled case: Prints are simply overlapped and matched on detail, with no ground control, so positions drift.

Step 2 – recall the controlled case: Rectified prints are fitted to plotted control points, so features fall close to their true map positions.

Step 3 – compare accuracy: The control makes the controlled mosaic far more accurate for measurement.

Why the other options are wrong:

- A: overlapping with no control describes the uncontrolled mosaic.
- B: matching on principal points only is again the uncontrolled approach.
- D: a controlled mosaic *can* support approximate measurement.

Final Answer: rectified prints fitted to ground control, higher accuracy $\Rightarrow \boxed{\text{C}}$

$\boxed{\textbf{Answer: (C)}}$ **Go Back to Q29**

Q30.

Solution

Concept – ground area from a photograph: Convert each photo dimension to a ground dimension using the scale, then multiply to get the area.

Step 1 – ground length of the first side: $200 \text{ mm} \times 8000 = 1{,}600{,}000 \text{ mm} = 1600 \text{ m}$

Step 2 – ground length of the second side: $250 \text{ mm} \times 8000 = 2{,}000{,}000 \text{ mm} = 2000 \text{ m}$

Step 3 – multiply for the area: $A = 1600 \times 2000$

$A = 3{,}200{,}000 \text{ m}^2$

Step 4 – convert to hectares (1 ha = 10,000 m^2): $A = \dfrac{3{,}200{,}000}{10{,}000} = 320 \text{ ha}$

Final Answer: $A = 320 \text{ ha} \Rightarrow \boxed{\text{A}}$

$\boxed{\textbf{Answer: (A)}}$ **Go Back to Q30**

Q31.

Solution

Concept – wavelength from frequency: $\lambda = \dfrac{c}{f}$.

Step 1 – substitute the values: $\lambda = \dfrac{3 \times 10^8}{1.5 \times 10^{14}}$

Step 2 – divide the mantissas: $\dfrac{3}{1.5} = 2$

Step 3 – subtract the exponents: $10^{8-14} = 10^{-6}$

Step 4 – combine: $\lambda = 2 \times 10^{-6} \text{ m}$

Step 5 – convert to micrometres: $\lambda = 2\ \mu\text{m}$, which falls in the infrared part of the spectrum shown.

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

Answer: (D) Go Back to Q31

Q32.

Solution

Concept – regions of the electromagnetic spectrum: The heat radiated by the Earth peaks in the 8–$14\ \mu$m window, which is the thermal-infrared region.

Step 1 – match the band to its name: 8–$14\ \mu$m is the atmospheric window used for thermal (emitted-heat) imaging.

Step 2 – name the region: It is the thermal infrared.

Why the other options are wrong:

- B, visible: is 0.4–$0.7\ \mu$m.
- C, microwave: lies at millimetre-to-centimetre wavelengths.
- D, near infrared: is about 0.7–$1.3\ \mu$m, far shorter than 8–$14\ \mu$m.

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

Answer: (A) Go Back to Q32

Q33.

Solution

Concept – ground sampling distance: $\text{GSD} = \dfrac{\text{swath width}}{\text{number of pixels across the swath}}$.

Step 1 – convert the swath to metres: $6\ \text{km} = 6000\ \text{m}$

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

Step 3 – evaluate: $\text{GSD} = 0.5\ \text{m}$

Final Answer: $\text{GSD} = 0.5\ \text{m} \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q33

Q34.

Solution

Concept – linear contrast stretching: A low-contrast image uses only a small part of the available brightness range. A linear stretch maps the smallest occupied DN to 0 and the largest to 255, spreading the values across the full display range.

Step 1 – read the histogram: The pixels occupy only a narrow band of DN values (between the two dashed lines), so the scene looks flat.

Step 2 – apply the stretch relation: $\text{DN}_{out} = \dfrac{\text{DN}_{in} - \text{DN}_{min}}{\text{DN}_{max} - \text{DN}_{min}} \times 255$

Step 3 – state the effect: The narrow input range is expanded to fill 0–255, so light and dark areas separate and contrast improves.

Why the other options are wrong:

- A: a stretch spreads, it does not reduce, the grey levels used.
- C: blurring is smoothing, a different (spatial) operation.
- D: assigning one constant DN would erase the image.

Final Answer: expand the narrow DN range to span 0–$255 \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q34

Q35.

Solution

Concept – histogram equalization: Equalization redistributes DN values so that the output histogram is as nearly uniform as possible; the mapping stretches most where the cumulative histogram is steepest, i.e. where pixels are most numerous.

Step 1 – recall the mapping: The transformation is the cumulative distribution function (CDF) of the input DN values.

Step 2 – see where the CDF rises fastest: The CDF climbs steeply over the DN ranges that hold the most pixels.

Step 3 – conclude: Those heavily populated DN ranges get the greatest contrast enhancement, while sparse ranges are compressed.

Why the other options are wrong:

- A: rarely-occurring DNs are compressed, not enhanced.
- B: equalization works on the DN distribution, not on image edges.
- D: there is nothing special about DN $= 0$.

Final Answer: the most frequently occurring DN ranges $\Rightarrow$ $\boxed{\text{C}}$

Answer: (C) Go Back to Q35

Q36.

Solution

Concept – radiometric resolution: With b bits per pixel the number of grey levels is 2^b.

Step 1 – substitute $b = 6$: levels $= 2^6$

Step 2 – expand the power step by step: $2^3 = 8$, so $2^6 = 8 \times 8$

Step 3 – multiply: $8 \times 8 = 64$

Why the other options are wrong:

- A, 6: is the number of bits, not the levels.
- C, 128: is 2^7 (seven bits).
- D, 36: is 6^2, an incorrect operation.

Final Answer: 64 grey levels $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q36

Q37.

Solution

Concept – the vector data model: The vector model stores discrete geographic objects as points, lines and polygons defined by coordinate pairs, together with topology (how features connect and adjoin).

Step 1 – classify the three features: A control point is a point, a road centre-line is a line, and a land parcel is a polygon.

Step 2 – match to the model: Storing such discrete objects with exact coordinates and topology is exactly what the vector model does.

Why the other options are wrong:

- A: a raster stores continuous grids of cells, not discrete bounded objects.
- C: a TIN is used for surfaces, not for a mix of points, lines and parcels.
- D: a continuous-field grid represents phenomena like elevation, not discrete parcels.

Final Answer: the vector model $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q37

Q38.

Solution

Concept – shortest-path (network) analysis: A network is a graph of edges (road segments) and nodes (junctions), each edge carrying an impedance such as length or travel time. Shortest-path routines (e.g. Dijkstra's algorithm) find the connected sequence of edges with the least total impedance.

Step 1 – recall what is minimized: The algorithm sums the impedance of the edges along a candidate route.

Step 2 – state the objective: It selects the route whose total impedance (distance or time) is smallest, moving only along connected edges.

Why the other options are wrong:

- A: polygons crossed are irrelevant to network routing.
- B: straight-line distance ignores the road connectivity the network enforces.
- D: buffer area is a proximity concept, not a routing cost.

Final Answer: the total impedance along the connected edges $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q38

Q39.

Solution

Concept – area of a buffer strip: Ignoring the rounded ends, a buffer around a straight line is a rectangle whose width is twice the buffer distance and whose length is the line length.

Step 1 – find the strip width (buffer on both sides): width $= 2 \times 100 = 200$ m

Step 2 – take the strip length: length $= 500$ m

Step 3 – multiply for the area: $A = 200 \times 500$

$A = 100{,}000 \text{ m}^2$

Step 4 – convert to hectares: $A = \dfrac{100{,}000}{10{,}000} = 10$ ha

Final Answer: $A = 10 \text{ ha} \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q39

Q40.

Solution

Concept – union (OR) overlay: A union keeps the combined extent of both input layers; every location that lies in A or in B (or in both) is retained, and the output carries attributes from both layers.

Step 1 – apply the logical OR: A location is kept if it is in A *or* in B.

Step 2 – describe the shaded output: The result is the whole of both circles, $A \cup B$, as shaded in the figure.

Step 3 – note the attributes: Overlapping areas inherit attributes from both A and B.

Why the other options are wrong:

- B: keeping only the common area is an intersection (AND).
- C: keeping A outside B is an erase/difference.
- D: keeping the outside of both is the complement.

Final Answer: all areas in either layer, attributes of both $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q40

Q41.

Solution

Concept – combining a buffer with an overlay: Selecting features that fall inside a distance band is a two-step workflow: first build the buffer zone, then overlay (intersect) it with the target layer to keep only the features lying inside it.

Step 1 – build the proximity zone: Generate a 500 m buffer polygon around the metro line.

Step 2 – intersect with the plots: Overlay the buffer on the plots layer and keep the plots that intersect the buffer.

Step 3 – name the second operation: That second step is an overlay (intersection).

Why the other options are wrong:

- A: a network trace follows connected lines, not an area band.
- C: contour generation builds equal-value lines, unrelated here.
- D: a histogram stretch is an image-enhancement step, not a spatial selection.

Final Answer: overlay (intersection) of the buffer with the plots $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q41

Q42.

Solution

Concept – Geometric Dilution of Precision (GDOP): GDOP scales the receiver's ranging error into position error; it depends only on the geometry of the tracked satellites. A large, well-spread arrangement (a large tetrahedron of directions) gives a small GDOP.

Step 1 – link geometry to GDOP: The better the satellites are spread over the sky, the larger the volume they subtend and the smaller the GDOP.

Step 2 – read the sky plot: The four satellites are spread widely around the receiver, a favourable geometry.

Step 3 – conclude: A wide spread gives the lowest GDOP and hence the most accurate fix.

Why the other options are wrong:

- A and B: clustered or one-sided satellites give a large (poor) GDOP.
- C: only two satellites cannot fix a 3-D position with clock error.

Final Answer: widely spread satellites, low GDOP $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q42

Q43.

Solution

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

Step 1 – substitute the values: $\rho = (3 \times 10^8) \times (0.06)$

Step 2 – multiply the mantissas: $3 \times 0.06 = 0.18$

Step 3 – write with the power of ten: $\rho = 0.18 \times 10^8$ m

Step 4 – normalise: $\rho = 1.8 \times 10^7$ m

Step 5 – convert to kilometres: $\rho = 1.8 \times 10^4$ km $= 18{,}000$ km

Final Answer: $\rho \approx 18{,}000$ km $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q43

Q44.

Solution

Concept – cartographic generalization: When a map is reduced to a much smaller scale, there is far less space, so the cartographer must generalize: simplify shapes, select which features to keep, smooth lines, aggregate small features and omit minor detail.

Step 1 – recognise the scale reduction: Going from $1{:}10{,}000$ to $1{:}250{,}000$ shrinks every feature about 25 times on paper.

Step 2 – state the response: Detail that can no longer be shown legibly is simplified, selected, smoothed or dropped.

Why the other options are wrong:

- A: adding detail at a smaller scale would clutter the map.
- B: generalization is about geometry and content, not just labels.
- C: buildings are usually omitted or symbolized, not enlarged to true size (which would exaggerate them).

Final Answer: simplify, select, smooth and omit minor detail $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q44

Q45.

Solution

Concept – large versus small scale: Map scale is the fraction $1/n$; the larger the denominator n, the smaller the fraction and hence the smaller the scale. A small-scale map shows a large ground area with little detail.

Step 1 – compare the denominators: $1000 < 50{,}000 < 1{,}000{,}000$.

Step 2 – pick the largest denominator: $1{:}1{,}000{,}000$ has the largest denominator, so it is the smallest scale.

Step 3 – confirm the meaning: It covers the largest area per sheet and carries the least detail.

Why the other options are wrong:

- B, $1{:}1000$: is the largest scale (most detail).
- C, $1{:}50{,}000$: is intermediate.
- D: the three scales are clearly different.

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

Answer: (A) Go Back to Q45

Q46.

Solution

Concept – equal-area (equivalent) projection: An equal-area projection keeps the ratio of mapped area to true ground area constant everywhere, so regions are shown in their correct relative sizes (at the cost of distorting shapes).

Step 1 – state the defining property: Everywhere on the map, area is preserved to the same scale.

Step 2 – link to the use: Because true relative areas are kept, density and distribution patterns (e.g. population per unit area) are not misleading.

Why the other options are wrong:

- A: preserving shape is the property of a conformal projection, not an equal-area one.
- B: true bearing everywhere is not a property of equal-area projections.
- D: no flat map preserves true distance in every direction at every point.

Final Answer: preserves true relative areas of regions $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q46

Answer Key

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