GATE Geomatics Engineering

Sample Paper – 10

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. The standard deviation of a single measurement of an angle is $\pm 20''$. If the angle is measured 25 times under the same conditions, the standard error of the arithmetic mean is: **[1 mark]**

(A) $\pm 20''$

(B) $\pm 4''$

(C) $\pm 0.8''$

(D) $\pm 100''$

Q2. In the theory of least squares, the weight assigned to an observation is inversely proportional to: **[1 mark]**

(A) its standard error (first power)

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

(C) the number of observations taken

(D) the length of the line measured

Q3. Two horizontal angles are measured independently, each with a standard error of $\pm 6''$. Taking the errors as combining in quadrature, the standard error of their sum is nearest to: **[1 mark]**

(A) $\pm 12''$

(B) $\pm 6''$

(C) $\pm 3''$

(D) $\pm 8.5''$

Q4. For the standard (positional) error ellipse of an adjusted survey point, the direction of the semi-major axis represents the direction of: **[1 mark]**

(A) minimum positional uncertainty

(B) zero positional uncertainty

(C) the mean of all uncertainties

(D) maximum positional uncertainty

Q5. Five equally reliable measurements of a horizontal angle gave $45°10'20''$, $45°10'24''$, $45°10'22''$, $45°10'18''$ and $45°10'26''$. The most probable value of the angle is: **[1 mark]**

(A) $45°10'22''$

(B) $45°10'24''$

(C) $45°10'20''$

(D) $45°10'26''$

Q6. If two measured quantities are statistically independent of one another, the covariance between them is: **[1 mark]**

(A) equal to each of their variances

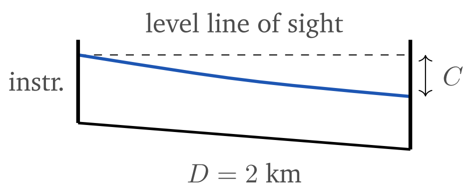
(B) infinitely large

(C) zero

(D) equal to unity

Distance Measurement, Levelling and Contouring

Q7. A backsight and foresight are taken over a line of sight of length $D = 2$ km. Using the combined correction for curvature and refraction $C = 0.0673\, D^2$ (with D in km and C in m), the correction shown between the level line and the refracted ray is nearest to: **[1 mark]**



(A) 0.019 m

(B) 0.067 m

(C) 0.27 m

(D) 0.54 m

Q8. In a two-peg test the level is first set midway between pegs A and B, giving staff readings 1.475 m at A and 1.255 m at B. The instrument is then shifted close to A, where the readings are 1.500 m at A and 1.310 m at B. The reading that *should* have been obtained at B (for a truly horizontal line of sight) from the second set-up is: **[1 mark]**

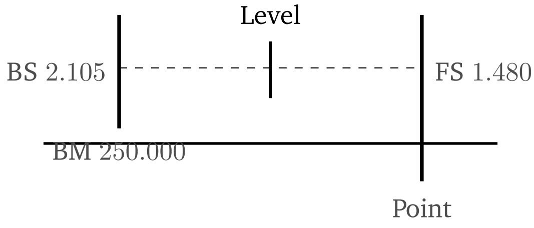
(A) 1.310 m

(B) 1.280 m

(C) 1.255 m

(D) 1.500 m

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 1.480 m. The reduced level of the forepoint is: **[1 mark]**



(A) 248.895 m

(B) 253.585 m

(C) 251.480 m

(D) 250.625 m

Q10. Reciprocal levelling is carried out across a wide river by taking observations from both banks. Averaging the two sets of readings is done chiefly to eliminate the combined effect of: **[1 mark]**

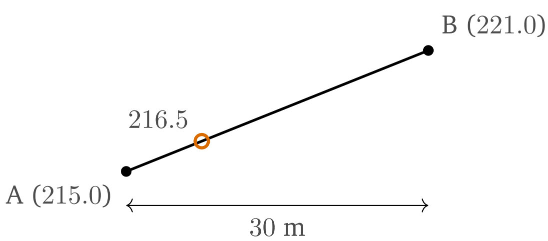
(A) tape temperature and pull errors

(B) staff graduation and parallax errors

(C) earth curvature, atmospheric refraction and collimation error

(D) random reading (accidental) errors only

Q11. Points A and B lie 30 m apart on a uniform slope, with A at RL 215.0 m and B at RL 221.0 m, as shown. By linear interpolation the horizontal distance from A to the point where the 216.5 m contour crosses AB is: **[1 mark]**



(A) 7.5 m

(B) 15.0 m

(C) 3.75 m

(D) 22.5 m

Q12. On a map of scale 1:5000 with a contour interval of 5 m, two adjacent contours are 25 mm apart on the paper. The ground slope (gradient) between them is: **[1 mark]**

(A) 1 in 25

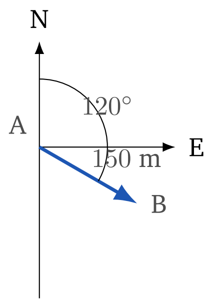
(B) 1 in 12.5

(C) 1 in 50

(D) 1 in 5

Theodolite, Traverse and Triangulation

Q13. A total station measures a line AB of length 150 m at a whole-circle bearing of 120°, as shown. Its latitude ($L \cos \theta$) and departure ($L \sin \theta$) are respectively: **[1 mark]**



(A) 129.9 m S, 75.0 m E

(B) 75.0 m S, 129.9 m E

(C) 75.0 m N, 129.9 m E

(D) 129.9 m N, 75.0 m E

Q14. A total station occupies station A with plane coordinates $(1000.00 \text{ m E}, 2000.00 \text{ m N}$ It sights point B, 100 m away, along a whole-circle bearing of 45°. The coordinates (E, N) of B are: **[1 mark]**

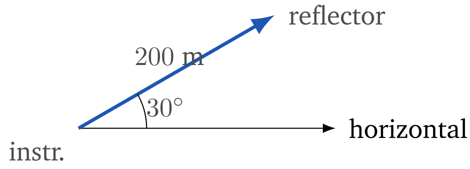
(A) $(2070.71, 1070.71)$

(B) $(929.29, 1929.29)$

(C) $(1070.71, 1929.29)$

(D) $(1070.71, 2070.71)$

Q15. A total station measures a slope distance of 200 m to a reflector, with the line of sight inclined at a vertical angle of $30°$ above the horizontal, as shown. The horizontal distance to the reflector is: **[1 mark]**



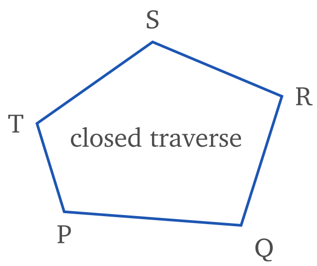
(A) 100.0 m

(B) 200.0 m

(C) 173.2 m

(D) 150.0 m

Q16. A closed traverse (shown schematically) has a total latitude misclosure of $+0.6$ m and a total departure misclosure of $+0.8$ m. The linear closing error of the traverse is: **[1 mark]**



(A) 1.0 m

(B) 1.4 m

(C) 0.5 m

(D) 0.2 m

Q17. After balancing, a closed traverse has a linear closing error of 1.0 m and a total perimeter of 2000 m. The relative precision (accuracy) of the traverse is: **[1 mark]**

(A) 1 in 2000

(B) 1 in 1000

(C) 1 in 4000

(D) 1 in 500

Q18. In triangulation, a triangle is described as "well-conditioned" when it gives the strongest fix of the computed sides. This is best achieved when each of its three angles lies preferably between: **[1 mark]**

(A) 0° and 30°

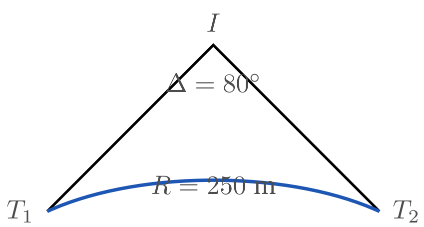
(B) 60° and 90°

(C) 90° and 120°

(D) 30° and 120°

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) 150.0 m

(B) 250.0 m

(C) 209.8 m

(D) 321.4 m

Q20. A simple circular curve of radius 300 m subtends a deflection angle of $60°$. The length of the curve, $L = \dfrac{\pi R\Delta}{180°}$, is nearest to: **[1 mark]**

(A) 300.0 m

(B) 157.1 m

(C) 628.3 m

(D) 314.2 m

Q21. On a highway curve the chainage of the point of intersection (apex) I is 1250.00 m and the tangent length is 100 m. The chainage of the point of curvature (tangent point T_1) is: **[2 marks]**

(A) 1350.00 m

(B) 1150.00 m

(C) 1250.00 m

(D) 1100.00 m

Q22. A simple circular curve has radius 200 m and deflection angle $60°$. The length of its long chord, $L_c = 2R\sin(\Delta/2)$, is: **[2 marks]**

(A) 100.0 m

(B) 346.4 m

(C) 200.0 m

(D) 173.2 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) 120.0 m

(C) 100.0 m

(D) 59.4 m

Q24. In field astronomy, a star whose diurnal circle passes exactly through the observer's zenith must have a declination equal to the observer's: [2 marks]

(A) latitude

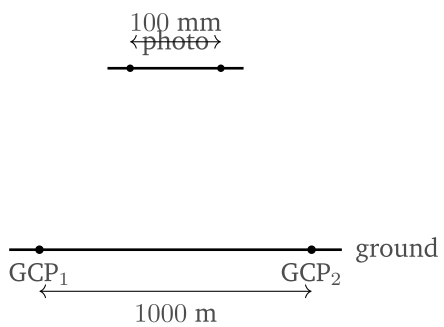
(B) longitude

(C) co-latitude

(D) altitude at transit

Photogrammetry

Q25. Two ground control points are 1000 m apart on flat terrain. On a vertical aerial photograph their images are 100 mm apart, as shown. The scale of the photograph is: [2 marks]



(A) 1:5000

(B) 1:2000

(C) 1:20,000

(D) 1:10,000

Q26. A vertical photograph has a scale of 1:12,000 and was taken with a camera of focal length 150 mm. The flying height above the ground datum is: [2 marks]

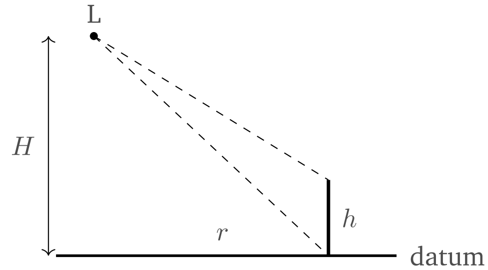
(A) 900 m

(B) 1800 m

(C) 12,000 m

(D) 80 m

Q27. On a vertical photograph the relief displacement of the top of a vertical object is $d = \dfrac{r\,h}{H}$. For radial distance $r = 90$ mm, object height $h = 50$ m and flying height $H = 2500$ m (see figure), the relief displacement is: **[2 marks]**



(A) 1.8 mm

(B) 3.6 mm

(C) 0.9 mm

(D) 9.0 mm

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

(A) 48 m

(B) 4800 m

(C) 60 m

(D) 480 m

Q29. In a bundle block adjustment (aerial triangulation) the exterior orientation of a block of overlapping photographs is fixed to the ground datum by means of: **[2 marks]**

(A) a single ground control point only

(B) no ground control at all

(C) the camera calibration certificate alone

(D) a suitable distribution of horizontal and vertical ground control points

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) 5 ha

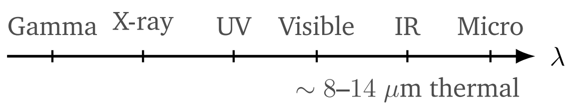
(B) 50 ha

(C) 0.5 ha

(D) 2 ha

Remote Sensing

Q31. Electromagnetic radiation of frequency 3×10^{13} 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) 3 μm

(B) 1 μm

(C) 10 μm

(D) 30 μm

Q32. A hyperspectral imaging sensor is distinguished from a conventional multispectral sensor mainly by recording: **[2 marks]**

(A) hundreds of contiguous, very narrow spectral bands

(B) a single broad panchromatic band

(C) only three broad bands (red, green, blue)

(D) no spectral information, only geometry

Q33. An airborne LiDAR pulse leaves the sensor, strikes the ground and returns after a total travel time of 20 μs. Taking $c = 3 \times 10^{8}$ m/s, the range (sensor height above the target, $= ct/2$) is: **[2 marks]**

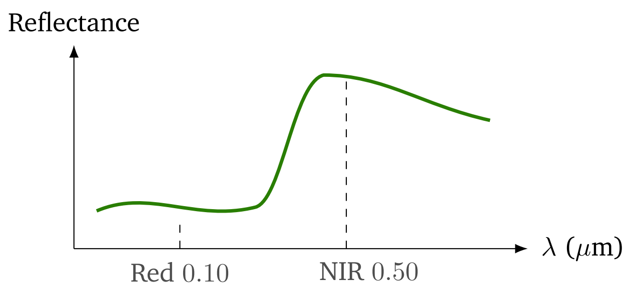
(A) 6000 m

(B) 3000 m

(C) 1500 m

(D) 300 m

Q34. For a healthy vegetation pixel the near-infrared reflectance is 0.50 and the red reflectance is 0.10, as read off the spectral signature below. The Normalized Difference Vegetation Index, NDVI $= \dfrac{\text{NIR} - \text{Red}}{\text{NIR} + \text{Red}}$, is: **[2 marks]**



(A) 0.67

(B) 0.20

(C) 0.40

(D) 0.83

Q35. The number of days a satellite takes before it can image the same area on the ground again, under the same viewing geometry, defines its: **[2 marks]**

(A) spatial resolution

(B) spectral resolution

(C) temporal resolution

(D) radiometric resolution

Q36. A satellite sensor quantizes each pixel using 12 bits. The number of discrete grey levels (radiometric resolution) it can represent is: **[2 marks]**

(A) 1024

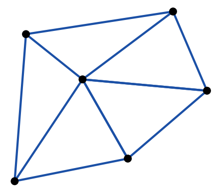
(B) 2048

(C) 4096

(D) 256

Geographic Information Systems

Q37. A terrain surface represented as a set of non-overlapping, contiguous triangles whose vertices are irregularly spaced spot heights (shown below) is known in GIS as a: **[2 marks]**



(A) a raster elevation grid

(B) a set of contour lines

(C) a Thiessen (Voronoi) polygon layer

(D) a triangulated irregular network (TIN)

Q38. In raster map algebra, adding two suitability layers on a cell-by-cell basis, where each output cell depends only on the values of the corresponding input cells, is an example of a: **[2 marks]**

(A) focal (neighbourhood) operation

(B) local (cell-by-cell) operation

(C) zonal operation

(D) global operation

Q39. In a weighted linear combination for multi-criteria evaluation (MCE), three criteria have weights 0.5, 0.3 and 0.2 and, at a given cell, standardized suitability scores of 8, 6 and 5 respectively. The combined suitability score of the cell is: **[2 marks]**

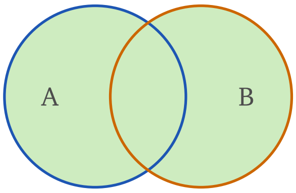
(A) 19.0

(B) 6.0

(C) 6.8

(D) 7.5

Q40. Two polygon layers A and B are combined so that the output retains *all* areas belonging to either layer (logical OR), as shaded below. This GIS overlay operation is a: **[2 marks]**



A ∪ B

(A) union overlay

(B) intersection overlay

(C) erase (difference) overlay

(D) clip overlay

Q41. Reclassifying a continuous slope raster into five ordered suitability classes, and then combining it with other reclassified layers to locate a site, is a characteristic step of: **[2 marks]**

(A) network (shortest-path) analysis

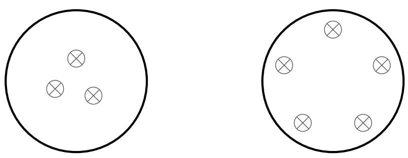
(B) cartographic modelling

(C) coordinate transformation

(D) image rectification

GNSS, Cartography and Map Projections

Q42. A GNSS receiver obtains its best (lowest) geometric dilution of precision (GDOP) when the satellites it is tracking are (see sky plots): **[2 marks]**



clustered well spread

(A) tightly clustered in one part of the sky

(B) all bunched near the horizon

(C) widely and evenly distributed across the sky

(D) all concentrated at the zenith

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]**

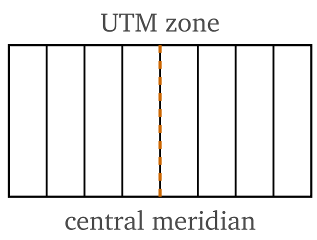
(A) 1800 km

(B) $18{,}000$ km

(C) $180{,}000$ km

(D) 3000 km

Q44. In the Universal Transverse Mercator (UTM) grid (graticule shown), the central meridian of every zone is assigned a false easting so that all easting coordinates stay positive. This assigned false easting is: **[2 marks]**



(A) 0 m

(B) $100{,}000$ m

(C) $1{,}000{,}000$ m

(D) $500{,}000$ m

Q45. The World Geodetic System 1984 (WGS-84) defines geodetic coordinates on an Earth-centred reference ellipsoid. The flattening f of this ellipsoid is approximately: **[2 marks]**

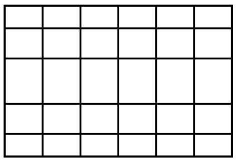
(A) $1/150$

(B) $1/298.257$

(C) $1/6378$

(D) $1/1000$

Q46. The Transverse Mercator projection on which the UTM coordinate system is built (graticule shown) belongs to which class of map projection? **[2 marks]**



meridians and parallels meet at right angles

(A) equal-area (equivalent)

(B) conformal (orthomorphic)

(C) equidistant

(D) gnomonic (azimuthal)

Detailed Solutions

Q1.

Solution

Concept – standard error of the mean: Averaging n equally reliable observations reduces the standard error of a single observation by a factor $\sqrt{n}$: $\sigma_{\bar{x}} = \dfrac{\sigma}{\sqrt{n}}$.

Step 1 – note the single-observation error: $\sigma = \pm 20''$

Step 2 – note the number of observations: $n = 25$

Step 3 – take the square root of n: $\sqrt{25} = 5$

Step 4 – divide: $\sigma_{\bar{x}} = \dfrac{20''}{5}$

$\sigma_{\bar{x}} = \pm 4''$

Why the other options are wrong:

- A: that is the single-observation error, not the mean's.
- C: dividing by 25 instead of $\sqrt{25}$.
- D: multiplying by 5 instead of dividing.

Final Answer: $\pm 4'' \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q1

Q2.

Solution

Concept – weight and precision: In least-squares adjustment the weight w of an observation measures its reliability. A more precise observation (smaller variance) is trusted more, so weight varies inversely with variance.

Step 1 – write the definition: $w \propto \dfrac{1}{\sigma^2}$

Step 2 – interpret σ^2: σ^2 is the variance, i.e. the square of the standard error of the observation.

Step 3 – state the relationship: Weight is inversely proportional to the variance (the square of the standard error).

Why the other options are wrong:

- A: weight varies as $1/\sigma^2$, not $1/\sigma$.
- C: number of observations affects the variance, but the fundamental rule is stated through variance.

- D: line length is unrelated to the definition of weight.

Final Answer: inversely proportional to the variance $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q2

Q3.

Solution

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

Step 1 – square each error: $\sigma_1^2 = 6^2 = 36$

$\sigma_2^2 = 6^2 = 36$

Step 2 – add the squares: $36 + 36 = 72$

Step 3 – take the square root: $\sigma = \sqrt{72}$

$\sigma = 8.49''$

Step 4 – round: $\sigma \approx \pm 8.5''$

Why the other options are wrong:

- A: $\pm 12''$ adds the errors arithmetically instead of in quadrature.
- B: $\pm 6''$ ignores the second angle entirely.
- C: $\pm 3''$ would be the error of the mean, not the sum.

Final Answer: $\pm 8.5'' \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q3

Q4.

Solution

Concept – the standard error ellipse: The error ellipse pictures the variance–covariance of a point's adjusted coordinates. Its axes point along the directions of extreme positional uncertainty.

Step 1 – recall the axis meanings: The semi-major axis is the longer half-axis of the ellipse.

Step 2 – link length to uncertainty: A longer axis means the standard error is largest in that direction.

Step 3 – conclude: The semi-major axis gives the direction of maximum positional uncertainty (the semi-minor axis gives the minimum).

Why the other options are wrong:

- A: minimum uncertainty is along the semi-minor axis.
- B: no real direction has zero uncertainty.
- C: the ellipse describes extremes, not a mean direction.

Final Answer: maximum positional uncertainty $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q4

Q5.

Solution

Concept – most probable value: For equally reliable observations the most probable value is the arithmetic mean. Work with the seconds above the common $45°10'$.

Step 1 – list the seconds: $20,\ 24,\ 22,\ 18,\ 26$

Step 2 – add them: $20 + 24 = 44$

$44 + 22 = 66$

$66 + 18 = 84$

$84 + 26 = 110$

Step 3 – divide by the count: $\dfrac{110}{5} = 22''$

Step 4 – add back the common part: $45°10'22''$

Final Answer: $45°10'22'' \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q5

Q6.

Solution

Concept – covariance and independence: Covariance measures how two quantities vary together. If they are statistically independent, one carries no information about the other.

Step 1 – write the definition: $\text{cov}(X, Y) = E[(X - \mu_X)(Y - \mu_Y)]$

Step 2 – apply independence: For independent variables $E[(X - \mu_X)(Y - \mu_Y)] = E[X - \mu_X]\, E[Y - \mu_Y]$.

Step 3 – evaluate each factor: $E[X - \mu_X] = 0$ and $E[Y - \mu_Y] = 0$.

Step 4 – multiply: $\text{cov}(X, Y) = 0 \times 0 = 0$

Why the other options are wrong:

- A: covariance equals the variance only of a variable with itself.
- B and D: independence forces zero, not infinity or unity.

Final Answer: covariance $= 0 \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q6

Q7.

Solution

Concept – combined curvature and refraction correction: Over a long sight the level line rises above the true horizontal (curvature) while the ray bends down (refraction); the net correction is $C = 0.0673\, D^2$, with D in km giving C in metres.

Step 1 – note the sight length: $D = 2$ km

Step 2 – square it: $D^2 = 2^2 = 4$

Step 3 – multiply by the constant: $C = 0.0673 \times 4$

Step 4 – evaluate: $C = 0.2692$ m

Step 5 – round: $C \approx 0.27$ m

Why the other options are wrong:

- A and B: use 0.0785 (curvature only) type constants or drop the square.
- D: doubles the correct value.

Final Answer: $C \approx 0.27 \text{ m} \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q7

Q8.

Solution

Concept – two-peg test: With the level midway between two pegs, equal sight lengths cancel any collimation error, so the midpoint gives the true difference in level. From an end set-up the correct far reading is the near reading minus that true difference.

Step 1 – true difference in level (midpoint set-up): $\Delta = 1.475 - 1.255 = 0.220$ m (B higher than A by 0.220).

Step 2 – take the near-A reading on A: Reading at A (second set-up) $= 1.500$ m.

Step 3 – apply the true difference to get the correct B reading: $B_{correct} = 1.500 - 0.220$

Step 4 – evaluate: $B_{correct} = 1.280$ m

Step 5 – interpret: The observed B reading was 1.310 m, i.e. 0.030 m more than 1.280 m, revealing that the line of collimation is inclined.

Final Answer: correct B reading $= 1.280$ m $\Rightarrow \boxed{B}$

Answer: (B) Go Back to Q8

Q9.

Solution

Concept – reduced level (HI method): RL of forepoint = RL of BM + BS − FS.

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

Step 2 – subtract the foresight: $252.105 - 1.480 = 250.625$ m

Step 3 – check the sense: BS (2.105) exceeds FS (1.480), so the ground has risen; $250.625 > 250.000$, which is consistent.

Final Answer: RL $= 250.625$ m $\Rightarrow \boxed{D}$

Answer: (D) Go Back to Q9

Q10.

Solution

Concept – reciprocal levelling: When a long sight (across a river) is unavoidable, equal-and-opposite systematic effects at the two ends cancel on averaging.

Step 1 – list the systematic effects over a long sight: Earth curvature, atmospheric refraction, and any residual collimation (line-of-sight) error.

Step 2 – see why averaging removes them: Observing from both banks makes each of these act with opposite sign in the two sets, so the mean is free of them.

Step 3 – conclude: Reciprocal levelling eliminates the combined error of curvature, refraction and collimation.

Why the other options are wrong:

- A, B: tape and staff errors are not what reciprocal levelling targets.
- D: purely random errors are reduced by averaging generally, but the method

is specifically for the systematic trio above.

Final Answer: curvature, refraction and collimation $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q10

Q11.

Solution

Concept – contour interpolation on a uniform slope: Horizontal distance to a given level is proportional to its height above the lower end.

Step 1 – total rise A to B: $221.0 - 215.0 = 6.0$ m

Step 2 – rise from A to the contour: $216.5 - 215.0 = 1.5$ m

Step 3 – form the proportion: $\dfrac{1.5}{6.0} = 0.25$

Step 4 – multiply by the distance AB: $d = 0.25 \times 30$

$d = 7.5$ m

Final Answer: $d = 7.5$ m from A $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q11

Q12.

Solution

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

Step 1 – convert map spacing to ground using the scale: $25 \text{ mm} \times 5000 = 125{,}000$ mm

Step 2 – convert to metres: $125{,}000 \text{ mm} = 125$ m

Step 3 – form the slope ratio: slope $= \dfrac{5 \text{ m}}{125 \text{ m}}$

Step 4 – reduce to 1 in n: $\dfrac{5}{125} = \dfrac{1}{25}$

Final Answer: slope $= 1$ in $25 \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q12

Q13.

Solution

Concept – latitude and departure: Latitude $= L\cos\theta$ (N–S), Departure $= L\sin\theta$ (E–W), with θ the whole-circle bearing from north.

Step 1 – compute the latitude: Lat $= 150\cos 120°$

$\cos 120° = -0.5$

Lat $= 150 \times (-0.5) = -75.0$ m (i.e. 75.0 m S)

Step 2 – compute the departure: Dep $= 150\sin 120°$

$\sin 120° = 0.8660$

Dep $= 150 \times 0.8660 = 129.9$ m (i.e. 129.9 m E)

Step 3 – state with directions: A bearing of $120°$ is in the south-east quadrant, so latitude is southerly and departure easterly.

Final Answer: 75.0 m S, 129.9 m E $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q13

Q14.

Solution

Concept – coordinates of a point from a total station: $E_B = E_A + L\sin\theta$, $N_B = N_A + L\cos\theta$.

Step 1 – compute the departure: $L\sin\theta = 100\sin 45°$

$\sin 45° = 0.7071$

$L\sin\theta = 70.71$ m

Step 2 – compute the latitude: $L\cos\theta = 100\cos 45°$

$\cos 45° = 0.7071$

$L\cos\theta = 70.71$ m

Step 3 – add to the easting of A: $E_B = 1000.00 + 70.71 = 1070.71$ m

Step 4 – add to the northing of A: $N_B = 2000.00 + 70.71 = 2070.71$ m

Final Answer: $(1070.71,\ 2070.71) \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q14

Q15.

Solution

Concept – reducing a slope distance to horizontal: Horizontal distance = slope distance $\times \cos$(vertical angle).

Step 1 – write the values: Slope distance $= 200$ m, vertical angle $= 30°$.

Step 2 – take the cosine: $\cos 30° = 0.8660$

Step 3 – multiply: $H = 200 \times 0.8660$

$H = 173.2$ m

Why the other options are wrong:

- A: 100 m would use $\sin 30°$ (that gives the vertical component).
- B: 200 m ignores the slope entirely.
- D: 150 m does not correspond to any correct trig ratio here.

Final Answer: $H = 173.2 \text{ m} \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q15

Q16.

Solution

Concept – linear closing error: $e = \sqrt{(\sum L)^2 + (\sum D)^2}$, with $\sum L$ and $\sum D$ the total latitude and departure misclosures.

Step 1 – square the latitude misclosure: $(\sum L)^2 = (0.6)^2 = 0.36$

Step 2 – square the departure misclosure: $(\sum D)^2 = (0.8)^2 = 0.64$

Step 3 – add: $0.36 + 0.64 = 1.00$

Step 4 – take the square root: $e = \sqrt{1.00} = 1.0$ m

Final Answer: $e = 1.0 \text{ m} \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q16

Q17.

Solution

Concept – relative precision of a traverse: Relative precision $= \dfrac{\text{closing error}}{\text{perimeter}}$, expressed as 1 in n.

Step 1 – form the ratio: $\dfrac{1.0}{2000}$

Step 2 – express as 1 **in** n**:** $\dfrac{1.0}{2000} = \dfrac{1}{2000}$

Step 3 – state the result: The traverse closes to 1 part in 2000.

Why the other options are wrong:

- B: 1 in 1000 would use a 2 m error or a 1000 m perimeter.
- C, D: arise from doubling or halving the perimeter incorrectly.

Final Answer: 1 in $2000 \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q17

Q18.

Solution

Concept – well-conditioned triangle: The computed length of a side of a triangle is most reliable when the sine ratios used are not near their extremes, which happens when no angle is too small or too large.

Step 1 – recall the sensitivity: A very small angle makes $\sin$ change rapidly, so a small observing error causes a large length error.

Step 2 – state the accepted rule: For a strong (well-conditioned) triangle, keep every angle roughly between 30° and 120°; the equilateral (60°) case is ideal.

Why the other options are wrong:

- A: angles below 30° give a weak (ill-conditioned) triangle.
- B and C: too narrow a band; the accepted working range is wider.

Final Answer: between 30° and $120^\circ \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q18

Q19.

Solution

Concept – tangent length of a simple curve: $T = R\tan(\Delta/2)$.

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

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

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

Step 4 – evaluate: $T = 209.8$ m

Why the other options are wrong:

- A: 150 m uses $\tan 30°$.
- B: 250 m is simply R.
- D: 321.4 m uses Δ instead of $\Delta/2$.

Final Answer: $T = 209.8 \text{ m} \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q19

Q20.

Solution

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

Step 1 – substitute the values: $L = \dfrac{\pi \times 300 \times 60}{180}$

Step 2 – simplify $\dfrac{60}{180}$: $\dfrac{60}{180} = \dfrac{1}{3}$

Step 3 – multiply: $L = \pi \times 300 \times \dfrac{1}{3} = \pi \times 100$

Step 4 – evaluate: $L = 314.16 \text{ m} \approx 314.2$ m

Why the other options are wrong:

- C: 628.3 m doubles the arc (uses $\Delta = 120°$).
- B: 157.1 m halves it.
- A: 300 m is just R.

Final Answer: $L \approx 314.2 \text{ m} \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q20

Q21.

Solution

Concept – chainage of the point of curvature: The tangent point T_1 lies one tangent length *back* from the apex, so $\text{Ch}(T_1) = \text{Ch}(I) - T$.

Step 1 – write the apex chainage: $\text{Ch}(I) = 1250.00$ m

Step 2 – write the tangent length: $T = 100$ m

Step 3 – subtract: $\text{Ch}(T_1) = 1250.00 - 100$

Step 4 – evaluate: $\text{Ch}(T_1) = 1150.00$ m

Why the other options are wrong:

- A: 1350.00 m adds instead of subtracts (that would head towards T_2).
- C: 1250.00 m forgets to move back by T.
- D: 1100.00 m subtracts twice the tangent length.

Final Answer: $\text{Ch}(T_1) = 1150.00 \text{ m} \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q21

Q22.

Solution

Concept – long chord of a simple curve: $L_c = 2R\sin(\Delta/2)$.

Step 1 – halve the deflection angle: $\dfrac{\Delta}{2} = \dfrac{60^\circ}{2} = 30^\circ$

Step 2 – take the sine: $\sin 30^\circ = 0.5$

Step 3 – substitute: $L_c = 2 \times 200 \times 0.5$

Step 4 – evaluate: $L_c = 200.0$ m

Why the other options are wrong:

- A: 100 m drops the factor of 2.
- B: 346.4 m uses $\sin(\Delta)$ with a wrong factor.
- D: 173.2 m uses $\cos 30^\circ$ instead of $\sin 30^\circ$.

Final Answer: $L_c = 200.0 \text{ m} \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q22

Q23.

Solution

Concept – inclined tacheometric sight: For an anallactic tacheometer the horizontal distance is $D = k\,s\cos^2\theta$.

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

Step 2 – take the cosine of the inclination: $\cos 6^\circ = 0.99452$

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

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

Step 5 – evaluate: $D = 118.7$ m

Why the other options are wrong:

- B: 120 m ignores the $\cos^2\theta$ reduction.
- C: 100 m mis-reads $k\,s$.
- D: 59.4 m halves the result with no basis.

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

Answer: (A) Go Back to Q23

Q24.

Solution

Concept – a star passing through the zenith: On the celestial sphere the zenith has an altitude of $90°$; a star culminating there has zenith distance zero.

Step 1 – relate declination, latitude and zenith distance at transit: At upper transit, declination $=$ latitude $\pm$ zenith distance.

Step 2 – set the zenith distance to zero: If the star passes through the zenith, its zenith distance $= 0$.

Step 3 – solve: declination $=$ latitude

Why the other options are wrong:

- B: longitude sets the hour angle, not the declination.
- C: co-latitude $(90° - \phi)$ is the polar distance of the zenith, not the star's declination here.
- D: altitude at transit would be $90°$, a value not a match to declination.

Final Answer: equal to the observer's latitude $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q24

Q25.

Solution

Concept – photo scale from a ground control distance: Scale $= \dfrac{\text{photo distance}}{\text{ground distance}}$, both in the same unit.

Step 1 – convert the ground distance to millimetres: $1000 \text{ m} = 1000 \times 1000 = 1{,}000{,}000 \text{ mm}$

Step 2 – write the photo distance: 100 mm

Step 3 – form the ratio: Scale $= \dfrac{100}{1{,}000{,}000}$

Step 4 – simplify: $\dfrac{100}{1{,}000{,}000} = \dfrac{1}{10{,}000}$

Final Answer: $1{:}10{,}000 \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q25

Q26.

Solution

Concept – flying height from scale and focal length: Scale $= \dfrac{f}{H}$, so $H = f \times$ (scale denominator).

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

Step 2 – write the scale denominator: $12{,}000$

Step 3 – multiply: $H = 0.150 \times 12{,}000$

Step 4 – evaluate: $H = 1800 \text{ m}$

Why the other options are wrong:

- A: 900 m uses $f = 75$ mm.
- C: $12{,}000$ m forgets the focal length.
- D: 80 m divides instead of multiplying.

Final Answer: $H = 1800 \text{ m} \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q26

Q27.

Solution

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

Step 1 – form the numerator: $r\,h = 90 \text{ mm} \times 50 \text{ m} = 4500 \text{ mm m}$

Step 2 – divide by the flying height: $d = \dfrac{4500}{2500}$

Step 3 – evaluate (units of mm): $d = 1.8$ mm

Why the other options are wrong:

- B: 3.6 mm doubles h.
- C: 0.9 mm halves r.
- D: 9.0 mm uses $H = 500$ m.

Final Answer: $d = 1.8 \text{ mm} \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q27

Q28.

Solution

Concept – ground length from photo length: Ground length $=$ photo length $\times$ scale denominator.

Step 1 – write the photo length: 60 mm

Step 2 – multiply by the scale denominator: $60 \text{ mm} \times 8000 = 480{,}000$ mm

Step 3 – convert to metres: $480{,}000 \text{ mm} = 480$ m

Why the other options are wrong:

- A: 48 m is a factor of 10 short.
- B: 4800 m is a factor of 10 too large.
- C: 60 m ignores the scale.

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

Answer: (D) Go Back to Q28

Q29.

Solution

Concept – control for a photogrammetric block: Bundle block adjustment recovers the exterior orientation of every photo, but the whole block still has to be tied and scaled to the ground.

Step 1 – identify what floats: Without ground ties, the block can translate, rotate and scale freely.

Step 2 – see what fixes it: Ground control points of known (X, Y) (horizontal) and Z (vertical) anchor the block to the datum.

Step 3 – conclude: A suitable distribution of horizontal and vertical ground control points is required (fewer are needed if GNSS/IMU exterior orientation is available, but control still defines the datum).

Why the other options are wrong:

- A: one point cannot fix rotation and scale.
- B: no control leaves the block undefined in the mapping frame.
- C: calibration fixes interior, not exterior, orientation.

Final Answer: a distribution of horizontal and vertical control points $\Rightarrow \boxed{\text{D}}$

Answer: (D) **Go Back to Q29**

Q30.

Solution

Concept – ground area from photo dimensions: Convert each side to the ground with the scale, then multiply; finally convert to hectares.

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

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

Step 3 – multiply for 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:

- B: 50 ha forgets to divide by $10{,}000$ once.
- C: 0.5 ha is off by a factor of 10.
- D: 2 ha uses wrong side lengths.

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

Answer: (A) Go Back to Q30

Q31.

Solution

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

Step 1 – substitute: $\lambda = \frac{3 \times 10^8}{3 \times 10^{13}}$

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

Step 3 – subtract the exponents: $10^{8-13} = 10^{-5}$

Step 4 – write the wavelength: $\lambda = 1 \times 10^{-5}$ m

Step 5 – convert to micrometres (1 μm $= 10^{-6}$ m): $\lambda = 10\ \mu$m

Step 6 – locate on the spectrum: 10 μm falls in the thermal-infrared region, as marked.

Final Answer: $\lambda = 10\ \mu\text{m} \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q31

Q32.

Solution

Concept – hyperspectral imaging: Hyperspectral systems sample the spectrum almost continuously with very fine spectral steps, letting them resolve narrow absorption features.

Step 1 – contrast with multispectral: Multispectral sensors carry a handful of broad, discrete bands.

Step 2 – state the hyperspectral feature: Hyperspectral sensors record hundreds of contiguous, very narrow bands, giving a near-continuous reflectance curve per pixel.

Why the other options are wrong:

- B: a single band is panchromatic imaging.
- C: three broad bands is ordinary colour (multispectral) imaging.
- D: all remote sensing captures some spectral information.

Final Answer: hundreds of contiguous narrow bands $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q32

Q33.

Solution

Concept – LiDAR ranging: A laser pulse travels to the target and back, so the one-way range is $R = \frac{ct}{2}$, where t is the round-trip time.

Step 1 – convert the travel time: $t = 20\ \mu\text{s} = 20 \times 10^{-6}\ \text{s} = 2 \times 10^{-5}\ \text{s}$

Step 2 – multiply by the speed of light: $ct = (3 \times 10^8) \times (2 \times 10^{-5})$

$ct = 6 \times 10^3\ \text{m} = 6000\ \text{m}$

Step 3 – halve for the one-way range: $R = \frac{6000}{2}$

$R = 3000\ \text{m}$

Why the other options are wrong:

- A: 6000 m forgets to halve the round trip.
- C: 1500 m halves twice.
- D: 300 m mis-scales the time.

Final Answer: $R = 3000\ \text{m} \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q33

Q34.

Solution

Concept – NDVI: $\text{NDVI} = \frac{\text{NIR} - \text{Red}}{\text{NIR} + \text{Red}}$, a ratio bounded between -1 and $+1$.

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: $\text{NDVI} = \frac{0.40}{0.60}$

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

Step 5 – interpret: A value near 0.67 is typical of dense healthy vegetation, matching the strong NIR rise in the signature.

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

Answer: (A) Go Back to Q34

Q35.

Solution

Concept – temporal resolution: The four resolutions of a remote-sensing system are spatial (pixel size), spectral (band width), radiometric (grey levels) and temporal (revisit time).

Step 1 – match the description: "Days before the same area is imaged again" describes how often the scene is revisited.

Step 2 – name it: This is the temporal resolution (the revisit period).

Why the other options are wrong:

- A: spatial resolution is ground pixel size.
- B: spectral resolution is band narrowness.
- D: radiometric resolution is the number of grey levels.

Final Answer: temporal resolution $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q35

Q36.

Solution

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

Step 1 – note the bit depth: $n = 12$

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

$2^{11} = 2048$

$2^{12} = 4096$

Step 3 – state the result: The sensor represents 4096 grey levels.

Why the other options are wrong:

- A: $1024 = 2^{10}$.
- B: $2048 = 2^{11}$.
- D: $256 = 2^8$.

Final Answer: 4096 grey levels $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q36

Q37.

Solution

Concept – TIN surface model: A vector surface model can store elevation at irregularly placed points and connect them into triangles that tile the area without gaps or overlaps.

Step 1 – read the figure: Irregular spot heights are joined into contiguous, non-overlapping triangles.

Step 2 – name the structure: This is a triangulated irregular network (TIN), commonly built by Delaunay triangulation.

Why the other options are wrong:

- A: a raster grid uses regular square cells, not irregular triangles.
- B: contour lines are iso-height curves, not a triangulated surface.
- C: Thiessen polygons partition around points; they are not elevation triangles.

Final Answer: triangulated irregular network (TIN) $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q37

Q38.

Solution

Concept – classes of raster operation: Raster map algebra operations are grouped as local (per cell), focal (per neighbourhood), zonal (per zone) and global (whole layer).

Step 1 – read what is done: Each output cell is computed from only the matching input cells, with no reference to neighbours or zones.

Step 2 – match to a class: A per-cell computation is a local operation.

Why the other options are wrong:

- A: focal operations use a moving window of neighbours.
- C: zonal operations summarise over predefined zones.
- D: global operations use the whole layer (e.g. distance, viewshed).

Final Answer: a local (cell-by-cell) operation $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q38

Q39.

Solution

Concept – weighted linear combination (MCE): Combined score $= \sum(\text{weight} \times \text{score})$, with the weights summing to 1.

Step 1 – check the weights sum to one: $0.5 + 0.3 + 0.2 = 1.0$ (valid)

Step 2 – multiply each weight by its score: $0.5 \times 8 = 4.0$

$0.3 \times 6 = 1.8$

$0.2 \times 5 = 1.0$

Step 3 – add the products: $4.0 + 1.8 + 1.0 = 6.8$

Why the other options are wrong:

- A: 19.0 just sums the raw scores, ignoring the weights.
- B: 6.0 is a plain average.
- D: 7.5 does not follow from the given weights.

Final Answer: combined score $= 6.8 \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q39

Q40.

Solution

Concept – polygon overlay operators: Overlays are defined by set logic: union (OR) keeps everything in either layer; intersection (AND) keeps only the common area.

Step 1 – read the shading: The whole of both circles is filled, i.e. all area in A or in B.

Step 2 – match to the logic: Retaining all area in either layer is the logical OR, i.e. a union.

Why the other options are wrong:

- B: intersection keeps only the overlap.
- C: erase removes B's area from A.
- D: clip cuts A to B's boundary.

Final Answer: union overlay $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q40

Q41.

Solution

Concept – cartographic modelling: Cartographic (map) modelling solves a spatial problem by a sequence of raster steps: reclassify criteria onto a common scale, weight them, and combine to a result map.

Step 1 – identify the operation described: A continuous raster is reclassed into ordered suitability classes and then combined with other reclassed layers.

Step 2 – name the workflow: This step-by-step map processing to reach a decision surface is cartographic modelling.

Why the other options are wrong:

- A: network analysis works on connected line features.
- C: coordinate transformation re-projects data.
- D: image rectification geometrically corrects imagery.

Final Answer: cartographic modelling $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q41

Q42.

Solution

Concept – geometric dilution of precision (GDOP): GDOP scales how satellite geometry amplifies ranging errors into position errors; a smaller GDOP means a stronger fix.

Step 1 – link geometry to GDOP: Satellites bunched together give nearly parallel range lines and a large error volume (high GDOP).

Step 2 – state the good case: Satellites spread widely and evenly (some high, some low, in different azimuths) intersect at strong angles, shrinking the error volume.

Step 3 – conclude: The lowest (best) GDOP occurs when the satellites are widely and evenly distributed across the sky, as in the right-hand sky plot.

Why the other options are wrong:

- A, B, D: clustering, low elevation, or a single zenith cluster all give weak geometry and high GDOP.

Final Answer: widely and evenly distributed $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q42

Q43.

Solution

Concept – pseudorange from travel time: $\rho = ct$.

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

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

Why the other options are wrong:

- A: 1800 km is a factor of 10 short.
- C: 180,000 km is a factor of 10 too large.
- D: 3000 km ignores the time value.

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

Answer: (B) Go Back to Q43

Q44.

Solution

Concept – UTM false easting: To avoid negative easting values west of the central meridian, UTM assigns the central meridian a large positive easting.

Step 1 – recall the convention: The central meridian of each 6° zone is given an easting of 500,000 m.

Step 2 – see the effect: Points west of the central meridian then have eastings below 500,000 m but still positive; points east have eastings above it.

Why the other options are wrong:

- A: 0 m would give negative eastings west of the meridian.
- B: 100,000 m is a grid-square value, not the UTM false easting.
- C: 1,000,000 m is not used; the large offset of 10,000,000 m belongs to the southern-hemisphere false *northing*, not the easting.

Final Answer: 500,000 m $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q44

Q45.

Solution

Concept – WGS-84 ellipsoid parameters: WGS-84 fixes a semi-major axis $a = 6{,}378{,}137$ m and a flattening $f = (a - b)/a$.

Step 1 – recall the defined flattening: $1/f = 298.257223563$

Step 2 – write f: $f \approx \dfrac{1}{298.257}$

Why the other options are wrong:

- A: $1/150$ is far too large a flattening for the Earth.
- C: $1/6378$ confuses flattening with the semi-major axis in km.
- D: $1/1000$ is not the WGS-84 value.

Final Answer: $f \approx 1/298.257 \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q45

Q46.

Solution

Concept – class of the Transverse Mercator: Map projections are classified by the property they preserve: area (equal-area), angle/shape (conformal), or distance (equidistant).

Step 1 – recall the Mercator family property: Meridians and parallels intersect at right angles and the scale is the same in every direction at a point.

Step 2 – identify the preserved quantity: Equal point-scale in all directions means local angles and small-feature shapes are preserved, i.e. the projection is conformal.

Step 3 – apply to UTM: UTM is built on the Transverse Mercator, which is a conformal (orthomorphic) projection, ideal for accurate large-scale mapping.

Why the other options are wrong:

- A: equal-area projections deliberately distort shape to keep area true.
- C: equidistant projections keep true distance only along selected lines.
- D: gnomonic is an azimuthal projection with very different properties.

Final Answer: conformal (orthomorphic) $\Rightarrow \boxed{\text{B}}$

$\boxed{\text{Answer: (B)}}$ Go Back to Q46

Answer Key

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