# GATE Geomatics Engineering

## Sample Paper – 7

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

### Instructions

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

## Principles of Surveying and Error Theory

**Q1.** A map is drawn to a representative fraction of $1{:}25{,}000$. A straight road that measures $4$ cm on the map has an actual ground length of: **[1 mark]**

(A) $0.5$ km

(B) $1$ km

(C) $2.5$ km

(D) $10$ km

**Q2.** Five equally reliable measurements of a base line gave $250.10$ m, $250.14$ m, $250.12$ m, $250.16$ m and $250.08$ m. The most probable value (arithmetic mean) of the length is: **[1 mark]**

(A) $250.14$ m

(B) $250.10$ m

(C) $250.16$ m

(D) $250.12$ m

**Q3.** A line is measured in two independent parts whose standard errors are $\pm 6$ mm and $\pm 8$ mm. Taking the errors as combining in quadrature, the standard error of the whole line is: **[1 mark]**

(A) $\pm 10$ mm

(B) $\pm 14$ mm

(C) $\pm 100$ mm

(D) $\pm 2$ mm

**Q4.** According to the theory of probability applied to accidental (random) errors of observation, which statement is correct? **[1 mark]**

(A) Large errors occur just as frequently as small errors.

(B) Small errors are more frequent, and positive and negative errors of the same size are equally likely.

(C) All the errors carry the same algebraic sign.

(D) The size of the errors increases without any bound.

**Q5.** A horizontal angle is observed in three sets with weights $1$, $2$ and $3$, giving $60°30'12''$, $60°30'18''$ and $60°30'24''$ respectively. The weighted mean of the angle is: **[1 mark]**

(A) $60°30'12''$

(B) $60°30'18''$

(C) $60°30'20''$

(D) $60°30'24''$

**Q6.** The small error that arises each time an observer estimates the fractional part of the smallest division while reading a levelling staff is best classified as: **[1 mark]**

(A) systematic (cumulative) error

(B) accidental (random) error

(C) gross mistake or blunder

(D) constant instrumental error

## Distance Measurement, Levelling and Contouring

**Q7.** A $50$ m steel tape standardized at $20°$C is used in the field at $35°$C. With coefficient of thermal expansion $\alpha = 11.7 \times 10^{-6}$ °C$^{-1}$, the temperature correction to be applied to one full tape length is nearest to: **[1 mark]**

(A) $+4.4$ mm

(B) $-8.8$ mm

(C) $+17.6$ mm

(D) $+8.8$ mm

**Q8.** A distance of $100$ m is measured along a slope, the two ends differing in level by $8$ m. Using the approximate slope correction $-\dfrac{h^2}{2L}$, the correction to reduce the length to the horizontal is: **[1 mark]**

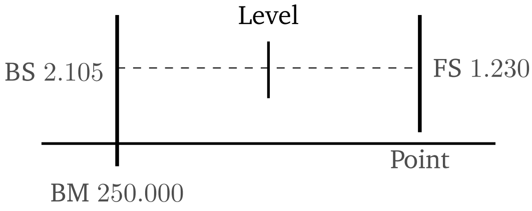
(A) $-0.16$ m

(B) $-0.32$ m

(C) $-0.64$ m

(D) $-0.08$ 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 1.230 m is taken to the next point. The reduced level of the forepoint is: **[1 mark]**




(A) 253.335 m

(B) 250.875 m

(C) 249.125 m

(D) 251.230 m

**Q10.** During levelling the line of collimation (height of instrument) is at RL 320.500 m. A staff reading of 2.750 m is taken on an intermediate point. The reduced level of that point is: **[1 mark]**

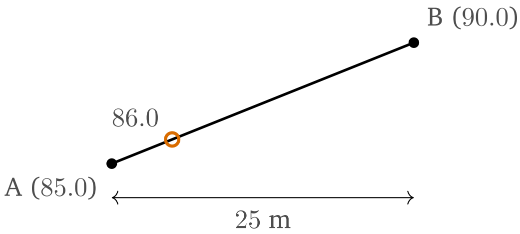
(A) 323.250 m

(B) 320.500 m

(C) 317.750 m

(D) 318.750 m

**Q11.** Points A and B lie 25 m apart on a uniform slope. A has RL 85.0 m and B has RL 90.0 m, as shown. By linear interpolation the horizontal distance from A to the point where the 86.0 m contour crosses AB is: **[1 mark]**




(A) 5 m

(B) 10 m

(C) 12.5 m

(D) 2 m

**Q12.** On a map of scale 1:5000 with a contour interval of 2 m, two adjacent contours are 10 mm apart on the paper. The ground slope (gradient) between them is: **[1 mark]**

(A) 1 in 10

(B) 1 in 50

(C) 1 in 25

(D) 1 in 100

## Theodolite, Traverse and Triangulation

**Q13.** The fore bearing (whole-circle bearing) of a line PQ is $120°30'$. The back bearing of the line is: **[1 mark]**

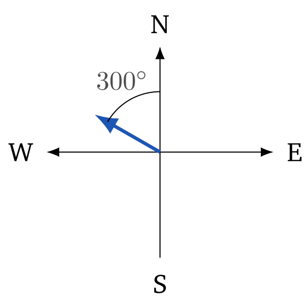
(A) $120°30'$

(B) $60°30'$

(C) $240°30'$

(D) $300°30'$

**Q14.** The whole-circle bearing of a survey line is $300°$, as shown on the compass diagram. Its reduced (quadrantal) bearing is: **[1 mark]**



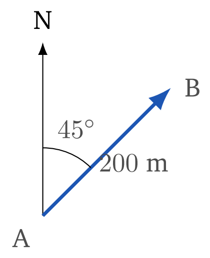

(A) N60°E

(B) S60°W

(C) S60°E

(D) N60°W

**Q15.** A traverse line AB of length $200$ m has a whole-circle bearing of $45°$, as shown. Its latitude ($L\cos\theta$) and departure ($L\sin\theta$) are respectively: **[1 mark]**



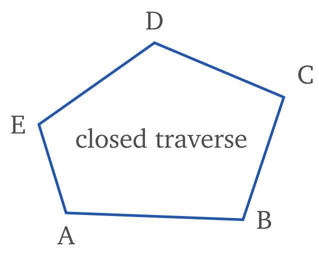

(A) $100$ m N, $173.2$ m E

(B) $141.4$ m N, $141.4$ m E

(C) $173.2$ m N, $100$ m E

(D) $200$ m N, $141.4$ m E

**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) $0.7$ m

(C) $1.4$ m

(D) $0.2$ m

**Q17.** The three-point problem (resection) in surveying is used to: **[1 mark]**

(A) find the area of a triangle from its three sides

(B) balance the latitudes and departures of a closed traverse

(C) set out a simple circular curve from its tangent point

(D) locate the position of an unknown station by observing directions to three visible stations of known position

**Q18.** In triangulation a "well-conditioned" triangle is one in which no angle is smaller than about $30°$ nor larger than about $120°$. Such a triangle is preferred because it: **[1 mark]**

(A) minimizes the propagation of angular error into the computed side lengths

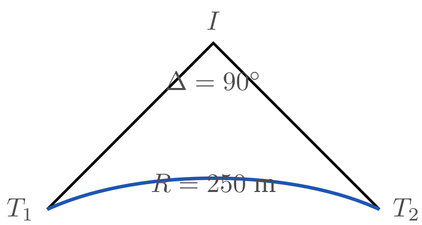
(B) increases the total number of survey stations required

(C) shortens the measured base line

(D) removes the need to observe any angles

## Curves, Tacheometry and Field Astronomy

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




(A) $250$ m

(B) $125$ m

(C) $500$ m

(D) $353.6$ 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: **[1 mark]**

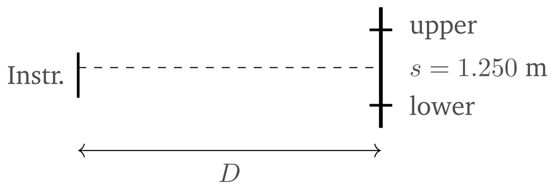
(A) $300$ m

(B) 100 m

(C) 471.2 m

(D) 314.2 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) 1250 m

(B) 12.5 m

(C) 125.0 m

(D) 100.25 m

**Q22.** In field astronomy, a star is said to be *circumpolar* (it never sets below the horizon) at a place of latitude $\phi$ when its declination $\delta$ satisfies: **[2 marks]**

(A) $\delta \geq 90^\circ - \phi$

(B) $\delta \leq \phi$

(C) $\delta = 0^\circ$

(D) $\delta \leq 90^\circ - \phi$

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

(A) 120 m

(B) 115.0 m

(C) 100 m

(D) 118.7 m

**Q24.** In the astronomical (PZS) triangle, whose vertices are the celestial pole P, the observer's zenith Z and the star S, the angle measured at the zenith Z is the: **[2 marks]**

(A) azimuth of the star

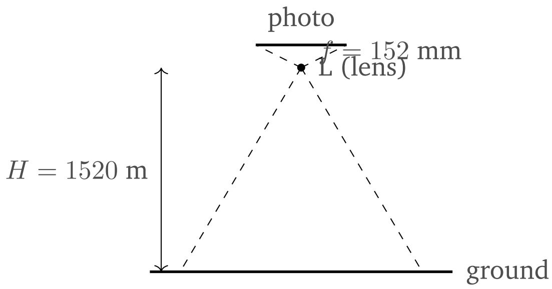
(B) declination of the star

(C) hour angle of the star

(D) altitude of the star

## Photogrammetry

**Q25.** A vertical aerial photograph is taken with a camera of focal length 152 mm from a flying height of 1520 m above flat ground, as shown. The scale of the photograph ($f/H$) is: **[2 marks]**




(A) 1:1000

(B) 1:15,200

(C) 1:10,000

(D) 1:100,000

**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]**

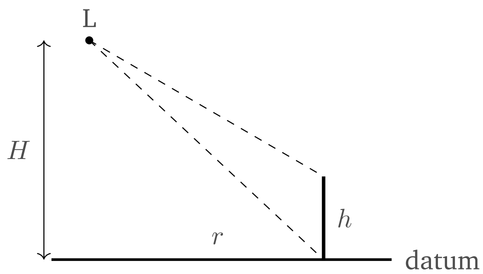
(A) 800 m

(B) 1800 m

(C) 12,000 m

(D) 80,000 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 $r = 100$ mm, object height $h = 150$ m and flying height $H = 3000$ m (see figure), the relief displacement is: **[2 marks]**




(A) 1 mm

(B) 2.5 mm

(C) 10 mm

(D) 5 mm

**Q28.** In digital photogrammetry a Digital Elevation Model (DEM) is derived by measuring the $x$-parallax of conjugate image points on an overlapping stereo pair. For a point on flat, higher terrain compared with a point on lower terrain, the $x$-parallax is directly related to the point's: **[2 marks]**

(A) colour on the print

(B) horizontal position along the flight line only

(C) elevation (height) above the datum

(D) spectral reflectance

**Q29.** A straight boundary appears 60 mm long on a vertical photograph of scale 1:8000. The corresponding ground length of the boundary is: **[2 marks]**

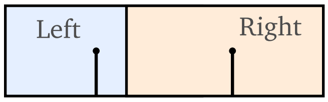
(A) 48 m

(B) 4800 m

(C) 480 m

(D) 80 m

**Q30.** On a stereo pair flown at height $H = 1800$ m the mean photo base (mean parallax) is $b = 90$ mm. The measured difference of parallax between the top and the base of a chimney is $\Delta p = 2$ mm, as sketched. Using $h = \dfrac{H\,\Delta p}{b}$, the height of the chimney is: **[2 marks]**



$\Delta p$ between top and base

(A) 20 m

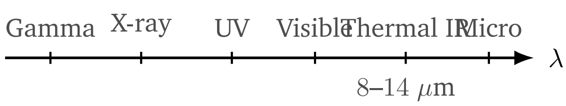
(B) 40 m

(C) 90 m

(D) 4 m

## Remote Sensing

**Q31.** Electromagnetic radiation of frequency $3 \times 10^{13}$ Hz travels in vacuum at $c = 3 \times 10^{8}$ m/s. Its wavelength ($\lambda = c/f$), located on the spectrum below, falls in the thermal-infrared band and equals: **[2 marks]**




(A) 1 $\mu$m

(B) 100 $\mu$m

(C) 10 $\mu$m

(D) 0.1 $\mu$m

**Q32.** The thermal-infrared window most widely used to sense the radiation emitted by the land surface (for land-surface-temperature mapping) lies approximately in the wavelength band: **[2 marks]**

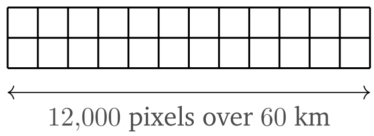
(A) 8–14 $\mu$m

(B) 0.4–0.7 $\mu$m

(C) 0.7–1.3 $\mu$m

(D) 1 mm–1 m

**Q33.** A pushbroom sensor images a ground swath of 60 km using 12,000 detector elements across the line, as sketched. The ground sampling distance (spatial resolution) per pixel is: **[2 marks]**




(A) 12 m

(B) 60 m

(C) 5 m

(D) 0.2 m

**Q34.** Compared with optical (visible/near-infrared) sensors, the principal advantage of active microwave (radar) remote sensing is that microwaves: **[2 marks]**

(A) penetrate cloud cover and haze and can image both by day and by night

(B) always give a finer spatial resolution than optical sensors

(C) require bright sunlight to produce an image

(D) are completely absorbed by dry soil and vegetation

**Q35.** In an active microwave synthetic-aperture-radar (SAR) system, the sensor obtains its imagery by: **[2 marks]**

(A) recording sunlight reflected from the ground

(B) measuring the thermal radiation naturally emitted by the ground

(C) collecting energy only in the visible band

(D) transmitting its own microwave pulses and recording the backscattered return

**Q36.** A satellite sensor records each pixel using 11 bits. The number of discrete grey levels (radiometric resolution) it can represent is: **[2 marks]**

(A) 1024

(B) 2048

(C) 512

(D) 22

## Geographic Information Systems

**Q37.** During the manual digitizing of two adjacent polygons in a GIS, a very thin "sliver" polygon is produced. A sliver is: **[2 marks]**


(A) a correctly closed and labelled polygon

(B) a single raster grid cell

(C) a thin, spurious polygon formed where two boundary lines that should coincide are digitized slightly apart

(D) a point feature carrying an attribute label

**Q38.** Rubber-sheeting, applied when georeferencing a scanned map or aligning two vector layers, is used to: **[2 marks]**

(A) locally stretch and warp the layer so that identified control points move onto their true positions, removing geometric distortion

(B) compress the raster file to save disk space

(C) generate contour lines from spot heights

(D) create a fixed-distance buffer around a road

**Q39.** An "overshoot" created during the digitizing of a line network is best described as: **[2 marks]**

(A) a line digitized past the node where it should have stopped and met another line

(B) a gap left where two lines should have joined but did not

(C) an exact duplicate of an existing polygon

(D) a node that has been correctly snapped to its neighbour

**Q40.** A single-band raster layer has 2000 rows and 2500 columns, with each cell stored as one byte. The uncompressed storage size of the layer is nearest to: **[2 marks]**

(A) 5 KB

(B) 50 MB

(C) 5 MB

(D) 5 GB

**Q41.** In a topologically structured vector GIS, the "topology" that is stored explicitly is: **[2 marks]**

(A) only the display colour and symbol of each feature

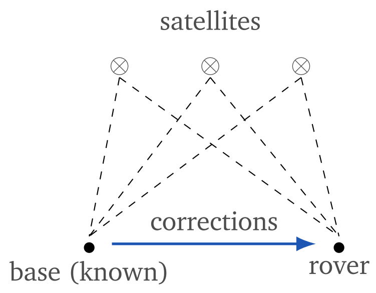
(B) the connectivity, adjacency and containment relationships among the features

(C) the map projection parameters alone

(D) the brightness value of each pixel

## GNSS, Cartography and Map Projections

**Q42.** Differential GPS (DGPS) improves positioning accuracy chiefly by (see the base-and-rover geometry): **[2 marks]**




(A) using a reference receiver at a precisely known point to compute and broadcast corrections that cancel the spatially correlated errors at the rover

(B) raising the orbital height of the satellites

(C) computing the position from a single satellite only

(D) switching off all ionospheric and tropospheric modelling

**Q43.** A GNSS signal takes $0.065$ s to travel from a satellite to a ground receiver. Taking the speed of light as $3 \times 10^8$ m/s, the (approximate) pseudorange to the satellite is: **[2 marks]**

(A) $1950$ km

(B) $19{,}500$ km

(C) $195{,}000$ km

(D) $650$ km

**Q44.** Observing a GNSS signal on two carrier frequencies (for example L1 and L2) and combining them is used mainly to remove or greatly reduce which error source? **[2 marks]**

(A) multipath at the antenna

(B) the receiver clock offset

(C) tropospheric (dry-air) delay

(D) ionospheric propagation delay

**Q45.** A low value of the Geometric Dilution of Precision (GDOP) computed from the tracked satellites indicates: **[2 marks]**

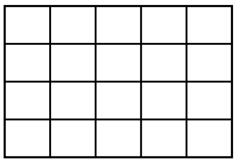
(A) a clustered, poor satellite geometry that degrades accuracy

(B) that fewer than four satellites are being tracked

(C) a large uncorrected receiver clock error

(D) a favourable, widely-spread satellite geometry that improves the positioning accuracy

**Q46.** A map projection on which the ratio of any mapped area to the corresponding true ground area is kept constant everywhere (graticule shown) is classified as: **[2 marks]**



equal-area graticule cells

(A) a conformal (orthomorphic) projection

(B) an equal-area (equivalent) projection

(C) an azimuthal projection only

(D) a gnomonic projection

# Detailed Solutions

## Q1.

**Solution**

**Concept – ground length from representative fraction:** The RF is the ratio of a map distance to the ground distance in the same unit, so ground distance = map distance × scale denominator.

**Step 1 – write the scale denominator:** $\text{denominator} = 25{,}000$

**Step 2 – multiply the map length by the denominator:** $\text{ground} = 4\ \text{cm} \times 25{,}000$

$\text{ground} = 100{,}000\ \text{cm}$

**Step 3 – convert centimetres to metres:** $100{,}000\ \text{cm} = 1000\ \text{m}$

**Step 4 – convert to kilometres:** $1000\ \text{m} = 1\ \text{km}$

**Final Answer:** $1\ \text{km} \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q1

## Q2.

**Solution**

**Concept – most probable value of equally reliable observations:** The most probable value is simply the arithmetic mean of the readings.

**Step 1 – add the readings two at a time:** $250.10 + 250.14 = 500.24$

$500.24 + 250.12 = 750.36$

$750.36 + 250.16 = 1000.52$

$1000.52 + 250.08 = 1250.60$

**Step 2 – divide the total by the number of readings:** $\bar{x} = \dfrac{1250.60}{5}$

**Step 3 – evaluate:** $\bar{x} = 250.12\ \text{m}$

**Final Answer:** $\bar{x} = 250.12\ \text{m} \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q2

## Q3.

### Solution

**Concept – propagation of error in a sum:** For independent parts the standard errors add in quadrature: $\sigma = \sqrt{\sigma_1^2 + \sigma_2^2}$.

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

$\sigma_2^2 = 8^2 = 64$

**Step 2 – add the squares:** $36 + 64 = 100$

**Step 3 – take the square root:** $\sigma = \sqrt{100}$

$\sigma = 10$ mm

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

Answer: (A) Go Back to Q3

## Q4.

### Solution

**Concept – laws of accidental error:** The probability theory of errors rests on a few observed facts about accidental errors.

**Step 1 – recall the first law:** Small errors are more frequent than large errors.

**Step 2 – recall the second law:** Positive and negative errors of the same magnitude are equally likely, so they tend to cancel.

**Step 3 – recall the third law:** Very large errors effectively do not occur (they are treated as blunders).

**Why the other options are wrong:**

- A: large errors are in fact rarer than small ones.
- C: accidental errors take both signs, not one fixed sign.
- D: the errors are bounded, not unbounded.

**Final Answer:** small errors more frequent, equal-size $\pm$ errors equally likely $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q4

## Q5.

**Solution**

**Concept – weighted mean:** With weights $w_i$, the weighted mean is $\bar{x} = \dfrac{\sum w_i x_i}{\sum w_i}$. Work with the seconds part above the common $60°30'$.

**Step 1 – list the seconds and weights:** $x_1 = 12''\,(w_1 = 1)$, $x_2 = 18''\,(w_2 = 2)$, $x_3 = 24''\,(w_3 = 3)$.

**Step 2 – form each product $w_i x_i$:** $w_1 x_1 = 1 \times 12 = 12$

$w_2 x_2 = 2 \times 18 = 36$

$w_3 x_3 = 3 \times 24 = 72$

**Step 3 – add the products:** $12 + 36 + 72 = 120$

**Step 4 – add the weights:** $1 + 2 + 3 = 6$

**Step 5 – divide:** $\bar{x} = \dfrac{120}{6} = 20''$

**Step 6 – add back the common part:** $60°30'20''$

**Final Answer:** $60°30'20'' \Rightarrow \boxed{\text{C}}$

**Answer: (C)** Go Back to Q5

## Q6.

**Solution**

**Concept – classifying an observing error:** An error that changes sign unpredictably from reading to reading, is small, and tends to cancel over many readings is an accidental (random) error.

**Step 1 – describe the source:** Judging the fraction of the smallest staff division is a matter of the observer's estimate, which is slightly different each time.

**Step 2 – note its behaviour:** The estimate is sometimes a little high, sometimes a little low, with no fixed sign.

**Step 3 – name the class:** An unpredictable, small, self-cancelling error is an accidental (random) error.

**Why the other options are wrong:**

- A and D: systematic/constant errors keep the same sign and accumulate.
- C: a blunder is a gross isolated mistake, not this fine estimation scatter.

**Final Answer:** accidental (random) error $\Rightarrow \boxed{\text{B}}$

**Answer: (B)** Go Back to Q6

## Q7.

**Solution**

**Concept – temperature correction to a tape:** $C_t = \alpha\,(T_m - T_0)\,L$, positive when the field temperature exceeds the standard temperature.

**Step 1 – find the temperature change:** $T_m - T_0 = 35 - 20 = 15\ ^\circ\text{C}$

**Step 2 – multiply $\alpha$ by the temperature change:** $\alpha\,(T_m - T_0) = 11.7 \times 10^{-6} \times 15$

$\alpha\,(T_m - T_0) = 175.5 \times 10^{-6}$

**Step 3 – multiply by the tape length:** $C_t = 175.5 \times 10^{-6} \times 50$

$C_t = 8775 \times 10^{-6}$ m

**Step 4 – convert to millimetres:** $C_t = 8.775 \times 10^{-3}$ m $= 8.775$ mm

**Step 5 – fix the sign:** The tape is warmer than standard, so it has lengthened and the correction is added: $C_t \approx +8.8$ mm.

**Final Answer:** $C_t \approx +8.8 \text{ mm} \Rightarrow \boxed{\text{D}}$

**Answer: (D)** Go Back to Q7

## Q8.

**Solution**

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

**Step 1 – square the height difference:** $h^2 = 8^2 = 64$

**Step 2 – form the denominator:** $2L = 2 \times 100 = 200$

**Step 3 – divide:** $\dfrac{h^2}{2L} = \dfrac{64}{200}$

$\dfrac{h^2}{2L} = 0.32$

**Step 4 – apply the negative sign:** $C_s = -0.32$ m

**Final Answer:** $C_s = -0.32 \text{ m} \Rightarrow \boxed{\text{B}}$

**Answer: (B)** Go Back to Q8

## Q9.

**Solution**

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

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

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

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

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

**Answer: (B)** Go Back to Q9

## Q10.

**Solution**

**Concept – height of instrument (collimation) method:** $\text{RL of point} = \text{HI} - \text{staff reading}$.

**Step 1 – write the height of instrument:** $\text{HI} = 320.500$ m

**Step 2 – subtract the staff reading:** $\text{RL} = 320.500 - 2.750$

**Step 3 – evaluate:** $\text{RL} = 317.750$ m

**Final Answer:** $\text{RL} = 317.750 \text{ m} \Rightarrow \boxed{\text{C}}$

**Answer: (C)** Go Back to Q10

## Q11.

**Solution**

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

**Step 1 – total rise from A to B:** $90.0 - 85.0 = 5.0$ m

**Step 2 – rise from A up to the contour:** $86.0 - 85.0 = 1.0$ m

**Step 3 – form the proportion of the total distance:** $\dfrac{1.0}{5.0} = 0.20$

**Step 4 – multiply by the horizontal distance AB:** $d = 0.20 \times 25$

$d = 5$ m

**Final Answer:** $d = 5 \text{ m from A} \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q11

## Q12.

**Solution**

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

**Step 1 – convert the map spacing to a ground distance using the scale:** $10\ \text{mm} \times 5000 = 50{,}000\ \text{mm}$

**Step 2 – convert to metres:** $50{,}000\ \text{mm} = 50\ \text{m}$

**Step 3 – form the slope ratio:** slope $= \dfrac{2\ \text{m}}{50\ \text{m}}$

**Step 4 – reduce to 1 in $n$:** $\dfrac{2}{50} = \dfrac{1}{25}$

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

Answer: (C) Go Back to Q12

## Q13.

**Solution**

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

**Step 1 – note the fore bearing:** $\text{FB} = 120°30'$

**Step 2 – since it is less than $180°$, add $180°$:** $\text{BB} = 120°30' + 180°$

**Step 3 – evaluate:** $\text{BB} = 300°30'$

**Final Answer:** $\text{BB} = 300°30' \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q13

## Q14.

**Solution**

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

**Step 1 – identify the quadrant:** $300°$ is between $270°$ and $360°$, i.e. the NW quadrant.

**Step 2 – subtract from $360°$:** $360° - 300° = 60°$

**Step 3 – attach the quadrant letters:** Measured from north towards west, the bearing is N60°W.

**Final Answer:** N60°W $\Rightarrow \boxed{\text{D}}$

**Answer: (D)** 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), $\theta$ measured from north.

**Step 1 – compute the latitude:** Lat $= 200\cos 45°$

Lat $= 200 \times 0.7071$

Lat $= 141.4$ m (northerly)

**Step 2 – compute the departure:** Dep $= 200\sin 45°$

Dep $= 200 \times 0.7071$

Dep $= 141.4$ m (easterly)

**Step 3 – note the symmetry:** Because $\theta = 45°$, $\cos\theta = \sin\theta$, so latitude and departure are equal.

**Final Answer:** $141.4$ m N, $141.4$ m E $\Rightarrow \boxed{\text{B}}$

**Answer: (B)** Go Back to Q15

## Q16.

**Solution**

**Concept – linear closing error of a traverse:** $e = \sqrt{(\sum L)^2 + (\sum D)^2}$, where $\sum L$ and $\sum D$ are 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:** $e = \sqrt{1.00}$

$e = 1.0$ m

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

**Answer: (A)** Go Back to Q16

## Q17.

**Solution**

**Concept – the three-point problem (resection):** Resection fixes the surveyor's own occupied station by observing the directions (angles) to three points whose coordinates are already known.

**Step 1 – state what is known and unknown:** Known: three visible control stations. Unknown: the position of the instrument station.

**Step 2 – state the method's output:** By the angles subtended at the instrument between those three stations, the instrument position is computed (e.g. by Tienstra's or the graphical Bessel method).

**Why the other options are wrong:**

- A: the area of a triangle is a mensuration task, not resection.
- B: balancing a traverse is done by Bowditch's or the transit rule.
- C: curve setting-out is a separate field procedure.

**Final Answer:** locate an unknown station from directions to three known stations $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q17

## Q18.

**Solution**

**Concept – well-conditioned triangle:** In a triangle the side lengths are found from the sine rule, in which a computed side is proportional to the sine of an angle. Errors in very small or very large angles blow up when propagated.

**Step 1 – recall the sensitivity:** Near $0°$ or $180°$ the sine changes rapidly, so a small angular error produces a large error in the computed side.

**Step 2 – state the safe range:** Keeping all angles between about $30°$ and $120°$ keeps this sensitivity low.

**Step 3 – conclude:** Hence a well-conditioned triangle minimizes the propagation of angular error into the computed sides.

**Why the other options are wrong:**

- B: conditioning is about geometry quality, not station count.
- C: the base length is fixed by the survey plan, not by conditioning.
- D: angles must still be observed.

**Final Answer:** minimizes error propagation into computed sides $\Rightarrow \boxed{\text{A}}$

$\boxed{\textbf{Answer: (A)}}$ Go Back to Q18

## Q19.

### Solution

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

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

**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:** $T = 250$ m $\Rightarrow \boxed{\text{A}}$

$\boxed{\textbf{Answer: (A)}}$ Go Back to Q19

## Q20.

### Solution

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

**Step 1 – form the ratio $\Delta/180^\circ$:** $\frac{60^\circ}{180^\circ} = \frac{1}{3}$

**Step 2 – multiply by $\pi R$:** $L = \pi \times 300 \times \frac{1}{3}$

**Step 3 – simplify:** $L = 100\pi$

**Step 4 – evaluate with $\pi = 3.1416$:** $L = 314.16$ m $\approx 314.2$ m

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

$\boxed{\textbf{Answer: (D)}}$ 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

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

**Answer: (C)** Go Back to Q21

## Q22.

### Solution

**Concept – circumpolar star condition:** A star never sets when, at its lowest point (lower culmination), it still stays above the horizon. This requires its polar distance to be no greater than the latitude.

**Step 1 – write the lower-culmination altitude:** At lower culmination the altitude is alt $= \phi - (90^\circ - \delta)$, taking the pole altitude as $\phi$.

**Step 2 – impose "never sets" (altitude $\geq 0$):** $\phi - (90^\circ - \delta) \geq 0$

**Step 3 – rearrange for $\delta$:** $\delta \geq 90^\circ - \phi$

**Step 4 – interpret:** A star with declination of at least the co-latitude $(90^\circ - \phi)$, and of the same name as the latitude, stays permanently above the horizon.

**Why the other options are wrong:**

- B, $\delta \leq \phi$: is not the circumpolar test.
- C, $\delta = 0$: is a star on the celestial equator, which does rise and set.
- D, $\delta \leq 90^\circ - \phi$: is the reverse inequality (stars that do rise and set).

**Final Answer:** $\delta \geq 90^\circ - \phi \Rightarrow \boxed{\text{A}}$

**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:** $k\,s = 100 \times 1.200 = 120$

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

**Step 3 – square it:** $\cos^2 6^\circ = (0.99452)^2 = 0.98907$

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

$D = 118.69 \text{ m} \approx 118.7 \text{ m}$

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

Answer: (D) Go Back to Q23

## Q24.

### Solution

**Concept – the astronomical (PZS) triangle:** The spherical triangle joining the pole P, the zenith Z and the star S has a standard identification for each of its three angles.

**Step 1 – name the angle at the pole P:** The angle at P is the hour angle of the star.

**Step 2 – name the angle at the zenith Z:** The angle at Z, between the observer's meridian and the vertical circle through the star, is the azimuth of the star.

**Step 3 – confirm the remaining parts:** The side PZ is the co-latitude, PS is the polar distance $(90° - \delta)$ and ZS is the zenith distance $(90° - \text{altitude})$.

**Why the other options are wrong:**

- B and D: declination and altitude are related to the *sides* of the triangle, not the angle at Z.
- C: the hour angle is the angle at the pole P, not at the zenith.

**Final Answer:** azimuth of the star $\Rightarrow \boxed{\text{A}}$

Answer: (A) 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, 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 $= \dfrac{0.152}{1520}$

**Step 3 – simplify:** Scale $= \dfrac{1}{10{,}000}$

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

Answer: (C) 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:** $f = 150$ mm $= 0.150$ m

**Step 2 – multiply by the scale denominator:** $H = 0.150 \times 12{,}000$

**Step 3 – evaluate:** $H = 1800$ m

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

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.

**Step 1 – multiply the radial distance by the object height:** $r\,h = 100 \times 150$

$r\,h = 15{,}000$

**Step 2 – divide by the flying height:** $d = \dfrac{15{,}000}{3000}$

**Step 3 – evaluate (units of $r$, i.e. mm):** $d = 5$ mm

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

Answer: (D) Go Back to Q27

**Q28.**

**Solution**

**Concept – parallax and elevation in digital photogrammetry:** On a stereo pair the $x$-parallax of a conjugate point increases with the point's height above the datum: $p = \dfrac{B\,f}{H-h}$, so larger $h$ gives larger $p$.

**Step 1 – read the relationship:** As the ground height $h$ increases, the denominator $(H - h)$ shrinks and the parallax $p$ grows.

**Step 2 – state the DEM principle:** Because parallax carries the height information, measuring parallax across the overlap lets the software compute an elevation for every point, building the DEM.

**Why the other options are wrong:**

- A and D: colour and reflectance are radiometric, not geometric, quantities.
- B: horizontal position is recovered from image coordinates, but it is the *elevation* that parallax specifically encodes.

**Final Answer:** the point's elevation above the datum $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q28

## Q29.

### Solution

**Concept – ground length from photo length:** ground length $= \dfrac{\text{photo length}}{\text{scale}} =$ photo length $\times$ (scale denominator).

**Step 1 – multiply the photo length by the scale denominator:** ground $= 60\ \text{mm} \times 8000$

**Step 2 – evaluate in millimetres:** ground $= 480{,}000\ \text{mm}$

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

**Final Answer:** $480\ \text{m} \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q29

## Q30.

### Solution

**Concept – object height from parallax difference:** $h = \dfrac{H\,\Delta p}{b}$, where $b$ is the mean photo base (mean parallax) and $\Delta p$ the parallax difference between the top and base of the object.

**Step 1 – multiply the flying height by the parallax difference:** $H\,\Delta p = 1800 \times 2$

$H\,\Delta p = 3600$

**Step 2 – divide by the mean photo base:** $h = \dfrac{3600}{90}$

**Step 3 – evaluate:** $h = 40\ \text{m}$

**Final Answer:** $h = 40\ \text{m} \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q30

## Q31.

**Solution**

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

**Step 1 – substitute the values:** $\lambda = \dfrac{3 \times 10^{8}}{3 \times 10^{13}}$

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

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

**Step 4 – combine:** $\lambda = 1 \times 10^{-5}$ m

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

**Step 6 – place it on the spectrum:** $10\ \mu$m lies in the thermal-infrared window, consistent with the figure.

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

Answer: (C) Go Back to Q31

## Q32.

**Solution**

**Concept – thermal-infrared atmospheric window:** Emitted terrestrial radiation peaks in the thermal infrared, and the atmosphere is transparent over a specific band there.

**Step 1 – recall the emitted-radiation region:** Earth-surface temperatures ($\sim 300$ K) radiate most strongly near $9$–$10\ \mu$m.

**Step 2 – match to the atmospheric window:** The clear thermal window used for land-surface-temperature sensing is about $8$–$14\ \mu$m.

**Why the other options are wrong:**

- B, $0.4$–$0.7\ \mu$m: is the visible band (reflected, not emitted).
- C, $0.7$–$1.3\ \mu$m: is the near infrared (still reflected sunlight).
- D, $1$ mm–$1$ m: is the microwave region.

**Final Answer:** $8$–$14\ \mu\text{m} \Rightarrow \boxed{\text{A}}$

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:** $60 \text{ km} = 60{,}000 \text{ m}$

**Step 2 – divide by the pixel count:** $\text{GSD} = \dfrac{60{,}000}{12{,}000}$

**Step 3 – evaluate:** $\text{GSD} = 5 \text{ m}$

**Final Answer:** $\text{GSD} = 5 \text{ m} \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q33

## Q34.

**Solution**

**Concept – advantage of active microwave remote sensing:** Microwave wavelengths (mm to cm) are long enough to pass through clouds, and because the radar carries its own energy source it does not need sunlight.

**Step 1 – cloud penetration:** At microwave wavelengths atmospheric scattering by cloud droplets is small, so the signal passes through cloud and haze.

**Step 2 – day-and-night capability:** Being an active system that supplies its own illumination, radar images equally well in darkness.

**Why the other options are wrong:**

- B: microwave resolution is generally coarser, not always finer, than optical.
- C: radar does *not* need sunlight (that is the whole advantage).
- D: microwaves are backscattered by the surface, not wholly absorbed; they can even penetrate dry soil a little.

**Final Answer:** penetrate cloud and work day and night $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q34

## Q35.

**Solution**

**Concept – active versus passive sensors:** An active sensor provides its own source of energy; a passive sensor relies on natural energy (sunlight or emitted heat).

**Step 1 – classify SAR:** Synthetic-aperture radar is an active microwave system.

**Step 2 – describe its operation:** It transmits microwave pulses towards the ground and records the portion of energy that is scattered back (the backscatter), timing the returns to build the image.

**Why the other options are wrong:**

- A: relying on reflected sunlight describes a passive optical sensor.
- B: sensing emitted heat describes a passive thermal sensor.
- C: SAR works in the microwave band, not the visible.

**Final Answer:** it transmits its own microwave pulses and records the backscatter $\Rightarrow \boxed{\text{D}}$

**Answer: (D)** 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 $b = 11$:** levels $= 2^{11}$

**Step 2 – expand the power step by step:** $2^{10} = 1024$

$2^{11} = 2 \times 1024 = 2048$

**Final Answer:** $2048$ grey levels $\Rightarrow \boxed{\text{B}}$

**Answer: (B)** Go Back to Q36

## Q37.

**Solution**

**Concept – sliver polygons in digitizing:** When a boundary shared by two polygons is digitized twice (once for each polygon), the two traced lines never fall exactly on top of one another, leaving a long, extremely thin false polygon between them.

**Step 1 – identify the cause:** Two lines meant to coincide are captured a fraction of a millimetre apart.

**Step 2 – describe the result:** The narrow strip enclosed between them is a spurious "sliver" polygon with negligible width.

**Step 3 – note the remedy:** Slivers are removed by snapping/tolerance settings or by a minimum-area clean operation.

**Why the other options are wrong:**

- A: a sliver is an *error*, not a correctly closed polygon.
- B: a sliver is a vector polygon, not a raster cell.
- D: it is an area feature, not a point.

**Final Answer:** a thin spurious polygon from two mismatched boundary lines $\Rightarrow$ $\boxed{\text{C}}$

**Answer: (C)** Go Back to Q37

## Q38.

### Solution

**Concept – rubber-sheeting:** Rubber-sheeting is a geometric transformation that locally stretches (warps) a layer, like pulling an elastic sheet, so that a set of "from" control points land exactly on their known "to" positions.

**Step 1 – state the aim:** It forces identified control points onto their true coordinates.

**Step 2 – describe the effect between control points:** The space in between is stretched or compressed smoothly, removing local geometric distortion left after a simple affine fit.

**Why the other options are wrong:**

- B: file compression is a storage operation, unrelated to geometry.
- C: contour generation is a surface-interpolation task.
- D: buffering creates distance zones, not a warp.

**Final Answer:** locally warp the layer so control points reach their true positions $\Rightarrow$ $\boxed{\text{A}}$

**Answer: (A)** Go Back to Q38

## Q39.

**Solution**

**Concept – digitizing errors at nodes:** When capturing a line network, the drawn line may stop short of, or run past, the junction it should meet.

**Step 1 – define the overshoot:** An overshoot is a line digitized *beyond* the node where it should have ended, leaving a small dangling tail past the intersection.

**Step 2 – contrast with the undershoot:** An undershoot is the opposite: the line stops *short*, leaving a gap.

**Why the other options are wrong:**

- B: a gap where lines fail to meet is an undershoot.
- C: a repeated polygon is a duplicate, not an overshoot.
- D: a correctly snapped node is not an error at all.

**Final Answer:** a line digitized past the node it should have met $\Rightarrow \boxed{\text{A}}$

**Answer: (A)** Go Back to Q39

## Q40.

**Solution**

**Concept – raster storage size:** size $=$ rows $\times$ columns $\times$ bytes per cell.

**Step 1 – multiply rows by columns:** $2000 \times 2500 = 5{,}000{,}000$ cells

**Step 2 – multiply by bytes per cell:** $5{,}000{,}000 \times 1 = 5{,}000{,}000$ bytes

**Step 3 – convert to megabytes (1 MB $\approx 10^6$ bytes):** $5{,}000{,}000$ bytes $\approx 5$ MB

**Final Answer:** about 5 MB $\Rightarrow \boxed{\text{C}}$

**Answer: (C)** Go Back to Q40

## Q41.

**Solution**

**Concept – topology in a vector GIS:** Topology records how features relate in space, independently of their exact coordinates.

**Step 1 – list the stored relationships:** Connectivity (which arcs meet at which nodes), adjacency (which polygons share a boundary) and containment (which features lie inside which).

**Step 2 – state its use:** These stored relationships let the GIS trace networks, find neighbours and run overlays without recomputing geometry each time.

**Why the other options are wrong:**

- A: colour and symbology are display properties, not topology.
- C: projection parameters belong to the coordinate reference system.
- D: pixel brightness is a raster attribute.

**Final Answer:** connectivity, adjacency and containment among features $\Rightarrow \boxed{\text{B}}$

**Answer: (B)** Go Back to Q41

## Q42.

### Solution

**Concept – differential GPS:** A reference (base) receiver sits on a point of accurately known coordinates. Because it knows where it is, it can find the error in each satellite's range and pass those corrections to nearby rovers.

**Step 1 – form the corrections at the base:** The base compares its measured pseudoranges with the true ranges to compute a correction per satellite.

**Step 2 – apply them at the rover:** Rovers close to the base experience almost the same satellite-orbit, ionospheric and tropospheric errors, so applying the base's corrections cancels these spatially correlated errors.

**Step 3 – state the outcome:** Positioning accuracy improves from several metres to the decimetre level (or better with carrier-phase DGPS).

**Why the other options are wrong:**

- B: satellite orbits are fixed; DGPS does not alter them.
- C: a fix still needs at least four satellites.
- D: DGPS supplements, not disables, atmospheric modelling.

**Final Answer:** broadcasting known-point corrections that cancel correlated errors $\Rightarrow \boxed{\text{A}}$

**Answer: (A)** Go Back to Q42

## Q43.

### Solution

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

**Step 1 – substitute the values:** $\rho = (3 \times 10^8) \times (0.065)$

**Step 2 – multiply the mantissas:** $3 \times 0.065 = 0.195$

**Step 3 – write with the power of ten:** $\rho = 0.195 \times 10^8$ m

**Step 4 – normalise:** $\rho = 1.95 \times 10^7$ m

**Step 5 – convert to kilometres:** $\rho = 1.95 \times 10^4$ km $= 19{,}500$ km

**Final Answer:** $\rho \approx 19{,}500$ km $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q43

## Q44.

### Solution

**Concept – dual-frequency ionospheric correction:** The ionosphere is dispersive: its delay depends on frequency ($\propto 1/f^2$). Observing the same signal on two frequencies lets the delay be solved for and removed.

**Step 1 – note the frequency dependence:** Because L1 and L2 are delayed by different amounts through the same ionosphere, comparing them isolates the ionospheric term.

**Step 2 – form the corrected observable:** A linear combination of the two measurements (the "ion-free" combination) cancels the first-order ionospheric delay.

**Why the other options are wrong:**

- A: multipath depends on the local reflecting environment, not on frequency in this simple way.
- B: the receiver clock offset is handled by solving for it with a fourth satellite.
- C: tropospheric delay is non-dispersive (nearly frequency-independent), so dual frequency does not remove it; it is modelled instead.

**Final Answer:** the ionospheric propagation delay $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q44

## Q45.

**Solution**

**Concept – Geometric Dilution of Precision:** GDOP is a pure number that scales the measurement (ranging) errors into position errors; it depends only on the geometry of the tracked satellites.

**Step 1 – read the meaning of a low GDOP:** A small GDOP means the satellites are well spread across the sky (wide angular separation, including high and low elevations).

**Step 2 – state the effect on accuracy:** Good spread makes the intersecting range spheres cut at strong angles, so the same ranging error yields a smaller position error, i.e. better accuracy.

**Why the other options are wrong:**

- A: clustered (poor) geometry gives a *high* GDOP, not low.
- B: the number of satellites (as long as $\geq 4$) is separate from the geometry value.
- C: GDOP describes geometry, not the size of the clock error.

**Final Answer:** a favourable, widely-spread satellite geometry improving accuracy $\Rightarrow \boxed{\text{D}}$

$\boxed{\textbf{Answer: (D)}}$ Go Back to Q45

## Q46.

**Solution**

**Concept – classifying map projections by the property preserved:** Projections are named for the metric property they keep true.

**Step 1 – match the stated property:** Keeping the ratio of mapped area to true ground area constant everywhere is the defining property of an equal-area (equivalent) projection.

**Step 2 – note the trade-off:** Preserving area means shapes and angles are distorted, so no equal-area map is also conformal.

**Why the other options are wrong:**

- A, conformal: preserves local angles/shapes, not area (e.g. Mercator exaggerates polar areas).
- C, azimuthal: names the developable surface/aspect, not the area property.

- D, gnomonic: is an azimuthal projection on which great circles plot straight; it is neither equal-area nor conformal.

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

**Answer: (B)** **Go Back to Q46**

# Answer Key

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