
🟦 Exercise 1 – Free-Air Correction (Medium Elevation)

A gravity measurement is made at a station with:

- Observed gravity: $g_{\text{obs}} = 979\,620\ \text{mGal}$
- Elevation above sea level: $h = 800\ \text{m}$

Use the free-air correction formula:

$$\Delta g_{FA} = 0.3086\, h \quad (\text{mGal})$$

✅ Solution

$$\Delta g_{FA} = 0.3086 \times 800 = 246.88\ \text{mGal}$$

Free-air corrected gravity:

$$g_{\text{FA}} = g_{\text{obs}} + \Delta g_{FA} = 979620 + 246.8 = \boxed{979866.88\ \text{mGal} \approx 979866.9\ \text{mGal}}$$

🟦 Exercise 2 – Free-Air Correction (Lower Elevation)

A station is at elevation $h = 450\ \text{m}$, and the observed gravity is:

- $g_{\text{obs}} = 979\,300\ \text{mGal}$

Compute the free-air correction and the corrected gravity.

✅ Solution

$$\Delta g_{FA} = 0.3086 \times 450 = 138.87\ \text{mGal}$$

$$g_{\text{FA}} = 979300 + 138.87 = \boxed{979438.87\ \text{mGal}}$$

🟦 Exercise 3 – Bouguer Correction (Standard Rock)

Use:

$$\Delta g_B = 0.04193\, \rho\, h$$

Given:

- Elevation: $h = 800\ \text{m}$
- Density: $\rho = 2.67\ \text{g/cm}^3$

✅ Solution

$$\Delta g_B = 0.04193 \times 2.67 \times 800$$

$$= 0.04193 \times 2136 = 89.56248\ \text{mGal} \approx \boxed{89.6\ \text{mGal}}$$

(Remember: Bouguer correction is **subtracted** from gravity.)

Exercise 6 – Simple Latitude Correction

At a certain latitude, the theoretical (normal) gravity is slightly higher than at the equator. Suppose:

- Observed gravity: $g_{\text{obs}} = 979\,500\ \text{mGal}$
- Latitude correction: $\Delta g_{\text{lat}} = +10.3\ \text{mGal}$

Compute the latitude-corrected gravity.

Solution

$$g_{\text{lat}} = g_{\text{obs}} + \Delta g_{\text{lat}} = 979500 + 10.3 = \boxed{979510.3\ \text{mGal}}$$

Compute the Bouguer anomaly.

Exercise 7 – Drift Correction (Single Station)

A gravimeter is read at a base station:

- 08:00 → 1000.35 mGal
- 12:00 → 1000.75 mGal

Assume linear drift.

A field station is measured at 10:00 with:

- Raw reading: 982.60 mGal

Find the drift correction at 10:00 and the corrected reading.

Solution

Total drift from 08:00 to 12:00 (4 hours):

$$\Delta_{\text{total}} = 1000.75 - 1000.35 = 0.40\ \text{mGal}$$

Drift rate:

$$\text{drift per hour} = \frac{0.40}{4} = 0.10\ \text{mGal/hr}$$

10:00 is 2 hours after 08:00 → drift:

$$\Delta_{\text{drift at 10:00}} = 0.10 \times 2 = 0.20\ \text{mGal}$$

Since the instrument reading has increased over time, the field reading is too large by 0.20 mGal → we subtract:

$$g_{\text{corr}} = 982.60 - 0.20 = \boxed{982.40\ \text{mGal}}$$