Solutions

2.1

- `course → title` – the course determines the title from part of the key (student, course) ✓.

2.2

- The delete anomaly – the fact rides on the last row carrying it ✓.

2.3

- 2NF and 3NF (BCNF implies both) ✓.

3.1

- FDs: `(proj_id, member) → hours`; `proj_id → dept`; `dept → dept_head` ✓.
- Part-key: `proj_id → dept` (dept depends on half the key); transitive: `proj_id → dept → dept_head` ✓.
- 3NF split into three tables ✓: `Project(proj_id, dept)`; `Dept(dept, dept_head)`; `Work(proj_id, member, hours)`.
- The splits remove the update anomaly (department facts stored once) and the insert anomaly (a department with no project becomes insertable) ✓.
- Original form: 1NF only (it violates 2NF) ✓.

3.2

- Derivable: `order_total` (sum over lines) ✓.
- Anomaly: update anomaly – one line changes and every stored total must change with it; miss one and the report lies ✓.
- 3NF treatment: drop the column; compute the total per read with an aggregation – the cost is a GROUP BY over the order's lines ✓.
- Keep it when the report is read far more often than lines change and the aggregation is measurably too slow – maintained by a trigger (or materialised-view refresh), the mechanism that keeps it honest ✓.