**FB1:** Suppose that is a surjective function. Define the following relation on *A*:

Show that this is an equivalence relation. Denote by the set of equivalence classes of . Prove that

The relation on *A* is **reflexive** because ; thus,

Furthermore, the relation is **symmetric** because implies that ; thus,

Finally, the relation is **transitive** because, if for an element there is a relation , then the condition applies, which combined with implies that ; thus,

By surjectivity, each element in B is a distinct value , where Since the relation partitions the set *A* into distinct subsets (each containing a distinct collection of ), each equivalence class corresponds to exactly one element in B. Thus,

**FB2:** Suppose that *G* is a group with identity element *e*. Let be arbitrary. Prove the following statements.

1. implies .
2. implies .

(i)

implies that either or If , then

Because of associativity, ; thus, also implies Therefore, implies .

(ii)

Using the law of inverses and ‘multiplying’ on the left both sides of the equation by ,

where or . By associativity, any other case is equivalent. In either case, they can swapped to find

Therefore, implies .

**FB3:** A parametric curve is described by the following equations

and passes through when. By solving the ODE for , or otherwise, find an expression for in terms of and use this to write the space curve as a vector function. Hence, find the unit tangent to the curve at the point .

To solve the separable differential equation, the variables need to be separated into

Then by integrating both sides one gets

Since the curve passes through when , the constant *C* is found by

Thus,

for all

The parametric curve is written as a vector function by

The tangent to the curve at *t* is

Hence, when ,