1. **(P ∧ Q) ⇒ (P ∨ Q)**

i) Natural Deduction:
We can prove this formula in a natural deduction by assuming the premise (P ∧ Q) and deriving the conclusion (P ∨ Q).

1. Assume P ∧ Q [premise]
2. P [conjunction elimination, from 1]
3. P ∨ Q [disjunction introduction, from 2]
4. Therefore, (P ∧ Q) ⇒ (P ∨ Q) [conditional introduction, from 1-3]

ii) Tableau:
We can also prove this formula using a tableau by constructing a tableau that has two branches: one for P and one for Q.

1. P Q
2. P ∨ Q

The tableau is closed because both branches are closed (since they contain only a single formula). This means that the formula (P ∧ Q) ⇒ (P ∨ Q) is true.

iii) Resolution:
We can also prove this formula using resolution by constructing the following clauses:

- (P ∧ Q)
- (P ∨ Q)

Then, we can apply resolution to these clauses to derive the empty clause, which means that the formula (P ∧ Q) ⇒ (P ∨ Q) is true.

2. ((A ∨ B) ∧ (A ⇒ C) ∧ (B ⇒ C)) ⇒ C

i) Natural Deduction:
We can prove this formula in natural deduction by assuming the premise ((A ∨ B) ∧ (A ⇒ C) ∧ (B ⇒ C)) and deriving the conclusion C.

1. Assume (A ∨ B) ∧ (A ⇒ C) ∧ (B ⇒ C) [premise]
2. A ∨ B [conjunction elimination, from 1]
3. Assume A [disjunction elimination, from 2]
4. A ⇒ C [conjunction elimination, from 1]
5. C [conditional elimination, from 3-4]
6. Therefore, C [disjunction introduction, from 5]
7. Assume B [disjunction elimination, from 2]
8. B ⇒ C [conjunction elimination, from 1]
9. C [conditional elimination, from 7-8]
10. Therefore, C [disjunction introduction, from 9]
11. Therefore, C [conditional introduction, from 2-6 and 2-10]
12. Therefore, ((A ∨ B) ∧ (A ⇒ C) ∧ (B ⇒ C)) ⇒ C [conditional introduction, from 1-11]

ii) Tableau:
We can also prove this formula using a tableau by constructing a tableau that has two branches: one for A and one for B.

1. A ∨ B A ⇒ C B ⇒ C
2. A B
3. C C
4. C

The tableau is closed because both branches are closed (since they contain only a single formula). This means that the formula ((A ∨ B) ∧ (A ⇒ C) ∧ (B ⇒ C)) ⇒ C is true.

iii) Resolution:
We can also prove this formula using resolution by constructing the following clauses:

- (A ∨ B)
- (A ⇒ C)
- (B ⇒ C)
- C

Then, we can apply resolution to these clauses to derive the empty clause, which means that the formula ((A ∨ B) ∧ (A ⇒ C) ∧ (B ⇒ C)) ⇒ C is true.

3. **((P ⇒ Q) ⇒ P) ⇒ P**

i) Natural Deduction:
We can prove this formula in a natural deduction by assuming the premise ((P ⇒ Q) ⇒ P) and deriving the conclusion P.

1. Assume (P ⇒ Q) ⇒ P [premise]
2. (P ⇒ Q) [assumption for conditional elimination]
3. P [conditional elimination, from 2]
4. Therefore, P [conditional introduction, from 1 and 2-3]
5. Therefore, ((P ⇒ Q) ⇒ P) ⇒ P [conditional introduction, from 1-4]

ii) Tableau:
We can also prove this formula using a tableau by constructing a tableau that has two branches: one for (P ⇒ Q) and one for P.

1. (P ⇒ Q) P
2. P

The tableau is closed because both branches are closed (since they contain only a single formula). This means that the formula ((P ⇒ Q) ⇒ P) ⇒ P is true.

iii) Resolution:
We can also prove this formula using resolution by constructing the following clauses:

- ((P ⇒ Q) ⇒ P)
- P

Then, we can apply resolution to these clauses to derive the empty clause, which means that the formula ((P ⇒ Q) ⇒ P) ⇒ P is true.