## COMPUTER SCIENCE TRIPOS Part Ib - 2023 - Paper 6

## 8 Logic and Proof (mj201)

Which of the following formulas is valid? Prove them using resolution or find a counterexample. If a counterexample exists, explain how resolution is blocked from producing a spurious proof.
(a) $(\forall x[\neg Q(x, x) \rightarrow P(x)]) \rightarrow \forall x[P(x) \vee \exists y Q(x, y)]$
(b) $[\exists x P(x)] \rightarrow \exists x P(f(x))$
(c) $\exists z \forall w[(\forall x[P(x) \rightarrow \exists y Q(x, y)]) \rightarrow(P(w) \rightarrow Q(w, z))]$

