# IN-CLASS ACTIVITIES FOR APPENDIX A: REVIEW OF BASIC PROOF TECHNIQUES

**Problem 1.** *Answer the following questions*

(1) *Write down an example of a false implication and write down a negation of the given implication.*
(2) *Write down an example of a implication and its converse. Is it true that an implication and its converse must have the same truth value? Justify your answer.*
(3) *Negate the following statement: There exists* $x, y, a \in \mathbb{R}$ *such that if* $x \in A$ *then* $x < a$ *and* $x \leq y$.

**Problem 2.** *Give a direct proof of each mathematical statement*

(1) *The square of a rational number is rational.*
(2) *Suppose that* $a, b$ *and* $c$ *are integers. If* $a^2$ *divides* $b$ *and* $b^3$ *divides* $c$ *then* $a^6$ *divides* $c$.

**Problem 3.** *Give a proof by* ***contradiction*** *of each mathematical statement.*

(1) *If* $n$ *is natural number then* $\frac{n}{n+1} > \frac{n}{n+2}$.
(2) *Prove by contradiction that if* $0 < x < \frac{\pi}{2}$ *then* $\sin x + \cos x > 1$.

**Problem 4.** *Use the method of* ***contrapositive*** *proof to prove the following statements.*

(1) *If* $x^2 + 5x < 0$ *then* $x$ *must be negative.*
(2) *If* $x^2 (y + 3)$ *is even, then* $x$ *is even or* $y$ *is odd.*

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