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Begins
1 Let n be a positive int that isn't a perfect square,
ends
Thus n has an even number of factors; which of the following inference for quantifiers is such a proof using: universal instantiation, universal generalization, existential instantiation, or existential generalization.

$\forall n$ Universal generalization.

2

$p \to q$
$q \to r$
$(q \wedge r) \to s$
p
---
s

1	p	premise
2	$p \to q$	premise
3	q	Modus ponens 1 and 2
4	$q \to r$	premise
5	r	Modus ponens 3 and 4
6	$(q \wedge r)$	Conjunction 3 4 and 5
7	$(q \wedge r) \to s$	premise
8	s	premise

If it is cloudy out, then it will rain. If it rains then there will be lightning. If there is rain and lightning, then we must stay inside. Therefore our conclution is that we should stay inside.

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3 using proof by cases, show that for all int n, $n(n+1)$ is even

$\forall n \mid n(n+1)$ is even

n is odd	n is even
$n = 2c+1$	$n = 2c$
$n(n+1) = (2c+1)(2c+2)$	$2c(2c+1)$
$2(2c+1)(c+1)$	all values will be even
$\rightarrow$ even	$\rightarrow$ even

4 proof by contradiction

show $n(n+1)$ is even

we assume $\forall n \mid n(n+1)$ is odd

n is odd

$n = 2c+1$

$n(n+1) = (2c+1)(2c+2)$

$2(2c+1)(c+1)$

$=$ even $\neq$ odd

proof by contradiction shows that all values will be even.

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Prove the Pathagorean theorem

5 The area of the square

$(a^2+b^2)-c^2$ or $4(\frac{1}{2}ab)$

for the areas of the triangles.

$a^2+2ab+b^2-c^2 = 4(\frac{1}{2}ab)$

$= a^2+2ab+b^2-2c^2 = 2ab$

$\equiv a^2+b^2-2c^2 = 0$

therefore $a^2+b^2 = c^2$

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6 Geometric mean: the central number in a geometric progression. Calulates as the n^{th} root of a product on n numbers.

Harmonic mean: To find a harmonic mean of a set of n numbers, add the reciprocals of the numbers in the set, divide the sum by n, then take the reciprocal of the result.

geometric:

$a = 8 \qquad b = 8$

$8 \times 8 = 64$

$\sqrt{64} = \boxed{8}$

harmonic:

$a = 8 \qquad b = 8$

$\frac{1}{8} + \frac{1}{8} = \frac{2}{8} = \frac{1}{4}$

$\frac{2}{\frac{1}{8} + \frac{1}{8}} = \frac{2}{\frac{1}{4}} = \boxed{8}$

$\subseteq \rightarrow$ "subset or"
a set of which all elements are contained in another

7 Prove the following propositions about arbitrary sets
if $A \cup B \subseteq C$ and $C \subseteq D \cap E$ then
$A \subseteq D \wedge A \subseteq E$.

assume $\exists x \mid x \in A \cup B \subseteq C$
$A \cup B$
C being a subset of $A \cup B$ means
that $\forall x \mid x \in A \cup B \equiv \forall x \mid x \in C$

are equivalent by rule of intersection
if
$C \subseteq D \cap E$
$\forall x \mid x \in D \cap E \equiv \forall x \mid x \in C$

therefore
$A \subseteq D \wedge A \subseteq E$

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8 Disprove the following proposition
if $A \cap B \subseteq C$ and $C \subseteq D \cup E$
then $A \subseteq D \vee A \subseteq E$

if $A \cap B \subseteq C$
$C\, x \mid x \in A \cap B \qquad x \in C$
C is a subset of A intersect B
So it only contains values in Both
if $C \subseteq D \cup E$
$x \mid x \in D \cup E \qquad x \notin C$
x is not nessecarily a value in the set C.
therefore
$A \subseteq D \vee A \subseteq E$ is false.

9 List the elements of the Powerset
$P(\emptyset)$
$P(\emptyset) = \{\emptyset\}$
$2^{\emptyset} = \{x \mid x \subseteq \emptyset\} = \{\emptyset\}$

10 Cartesian Product of $A \times B$
A = { chicken sandwich, Burger }
B = { fries, Chips, salad }
$A \times B$ = { chicken sandwich, Fries }
{ burger, fries }
{ chicken sandwich, chips }
{ burger, chips }
{ Chicken Sandwich, Salad }
{ burger, Salad }