Steven Clontz

mathematician, professor, programmer, puzzler

steven.clontz@gmail.com http://clontz.org

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Theorem: An integer is a
multiple of nine iff the sum
of its digits is a multiple of
nine.
Proof: Express the inte-
ger in terms of its digits:
d_0 + 10d_1 + 100d_2 +
\ldots + 10^n d_n. This may be
grouped into the sum of its
digits d_0 + d_1 + \ldots + d_n
plus the sum 9d_1 + 99d_2 +
... + (10^n - 1)d_n. Since
each 10^i - 1 is divisible by
the result follows. □
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