What Makes a Number Divisible by 4?*

Ms. Harris is working with her class on divisibility rules. She tells her class that:

A number is divisible by 4 if and only if the last two digits of the number are divisible by 4.

The students spend a little time verifying the truth of this statement by checking several examples (e.g., 924, 723, 12564, 3999 etc.). Then, one of the students, Student X, asks why this rule works. Ms Harris asks the other students if they can come up with a reason, and several possible reasons are proposed.

Student A: Four is an even number, and odd numbers are not divisible by even numbers.

Student B: The number 100 is divisible by 4 (and also 1000, 10,000, etc.).

Student C: Every other even number is divisible by 4, for example, 24 and 28 but not 26.

Student D: It only works when the sum of the last two digits is an even number.

Now imagine you are the teacher of this class.

1. Which of the following statements comes closest to explaining the reason for the divisibility rule for 4? Please choose ONE statement only.
2. Explain why you made this choice.
3. In your view, how should Ms Harris respond to the statements from each one of Students A, B, C and D?
4. In your view, how should Ms Harris continue and conclude the discussion initiated by the question of Student X?

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* Based on activities and examination questions designed by Elena Nardi (e.nardi@uea.ac.uk) for use in UEA's BA Education Year 3 module *Children, teachers and mathematics: Changing public discourses about mathematics* between 2012 and 2016. Inspired by the Mathematical Knowledge for Teaching (MKT) activities of Deborah Ball's, and colleagues', work, as in, e.g.,
Ball, D. L., Thames, M. H., & Phelps, G. (2008). Content knowledge for teaching: What makes it special? *Journal of Teacher Education, 59*(5), 389-407.