14. Modular Arithmetic

Exercises

September 19, 2016

Very interesting patterns arise from calculating the powers of numbers using modular arithmetic, let's see what we can find out.

Exercises

1. In mod five arithmetic calculate the following powers: in other words $\equiv$ ______$(mod\,5)$
   (a) $2, 2^2, 2^3, 2^4, 2^5, 2^6$
   (b) $3, 3^2, 3^3, 3^4, 3^5, 3^6$
   (c) $4, 4^2, 4^3, 4^4, 4^5, 4^6$
2. Now let's switch to $(mod\,7)$ instead
   (a) $2, 2^2, 2^3, 2^4, 2^5, 2^6, 2^7$
   (b) $3, 3^2, 3^3, 3^4, 3^5, 3^6, 3^7$
   (c) $4, 4^2, 4^3, 4^4, 4^5, 4^6, 4^7$
   (d) $5, 5^2, 5^3, 5^4, 5^5, 5^6, 5^7$
   (e) $6, 6^2, 6^3, 6^4, 6^5, 6^6, 6^7$
3. Now let's switch to doing $(mod\,9)$
   (a) $2, 2^2, 2^3, 2^4, 2^5, 2^6, 2^7$
   (b) $3, 3^2, 3^3, 3^4, 3^5, 3^6, 3^7$
   (c) $4, 4^2, 4^3, 4^4, 4^5, 4^6, 4^7$
   (d) $5, 5^2, 5^3, 5^4, 5^5, 5^6, 5^7$
   (e) $6, 6^2, 6^3, 6^4, 6^5, 6^6, 6^7$
4. Last let's do $(mod\,11)$
   (a) $3, 3^2, 3^3, 3^4, 3^5, 3^6, 3^7$
   (b) $4, 4^2, 4^3, 4^4, 4^5, 4^6, 4^7$
   (c) $5, 5^2, 5^3, 5^4, 5^5, 5^6, 5^7$

14. Mod 5 Arithmetic Answers

1. In $(mod\, 5)$
   (a) $2, 4, 3, 1, 2, 4, \ldots$
   (b) $3, 4, 2, 1, 3, 3, \ldots$
   (c) $4, 1, 4, 1, 4, 1, \ldots$
2. In $(mod\, 7)$
   (a) $2, 4, 1, 2, 4, 1, 2, \ldots$
   (b) $3, 2, 6, 4, 5, 1, 3, \ldots$
   (c) $4, 2, 1, 4, 2, 1, 4, \ldots$
   (d) $5, 4, 6, 2, 3, 1, 5, \ldots$
   (e) $6, 1, 6, 1, 6, 1, 6, \ldots$
3. In $(mod\, 11)$
   (a) $3, 9, 5, 4, 1, 3, \ldots$
   (b) $4, 5, 9, 3, 1, 3, \ldots$
   (c) $5, 3, 4, 9, 1, 3, \ldots$