Mathematics 446 — third assignment — due Monday, October 6

Exercise 1. *Locate through the UBC library and JSTOR the article 'Of the theory of circulating decimal fractions' by John Robertson in the 1768 voilume of Philosophical Transactions. Summarize what it says in 300 words or less, includng some calculation examples.*

Exercise 2. *Write down and prove* **by mathematical induction** *the formula for the finite geometric sum*

$$1 + q + q^2 + \cdots + q^n \ .$$

Exercise 3. *Prove by mathematical induction the binomial theorem*

$$(x+1)^n = x^n + nx^{n-1} + \frac{n(n-1)}{2}\, x^{n-2} + \cdots + nx + 1$$

where n is an arbitrary positive integer and the coefficient of x^k is

$$\frac{n(n-1)\cdots(n-(r-1))}{1\cdot 2\cdot 3\cdots r}$$

Exercise 4. *Find a such that*

$$a \equiv 14 \text{ modulo } 71$$
$$a \equiv 17 \text{ modulo } 91$$

Exercise 5. *Write down a* **complete** *proof that $\sqrt{3}$ is not a fraction.*

Exercise 6. *Write an essay of 100 words explaining why the Chinese Remainder Theorem is called what it is.*

Exercise 7. *Find all the powers of 60 modulo 37. Use this to find the repeating fraction for $1/37$ in base 60.*

Exercise 8. *What is the length of the repeating fraction $1/91$ in base 60?*

Exercise 9. *Read Book VII.Proposition 1 of Euclid's Elements (on line at Joyce's site). Restate the Proposition and rewrite the proof in your own words, using modern algebraic notation.*

Exercise 10. *Find the continued fraction expansion of (a) $\sqrt{5}$; (b) $\sqrt{3}$; (c) $\sqrt{19}$.*