> Having investigated the practical impact of inaccuracy and error I can use my knowledge of tolerance when choosing the required degree of accuracy to make real-life calculations.
> MNU 4-01b
> I can apply my knowledge and understanding of measure to everyday problems and tasks and appreciate the practical importance of accuracy when making calculations
> MNU 4-11a

Error Checking: ISBN Algorithm

Just as credit cards have an error-checking algorithm, so do books. It's called the International Standard Book Number (ISBN). Each book will typically have a 10–digit ISBN or 13-digit ISBN which provides information about the book and prevents switches of digits or single errors with a high degree of accuracy. The code consists of 10 symbols for ISBN-10 and 13 symbols for ISBN-13 (either numerical digits or the letter X which represents 10). Often the ISBN will be split up with hyphens to make it easier to use.
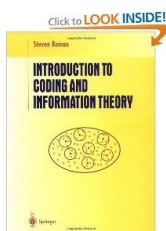
For example, the book "Introduction to Coding and Information Theory" has an ISBN-10 which looks like 0-38-794704-3 where:

0:	English
38:	Springer (publisher)
794704:	Book Number
3:	Check Digit

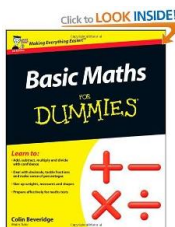Since January 2007, ISBN-13 has been the preferred option, but books before this date could have either code.

The system for **ISBN-10** works like this:

Step 1: Take the first 9 digits.
Step 2: Multiply the first digit by 1, the second digit by 2, the third digit by 3 and so on….
Step 3: Add all your answers from Step 2.
Step 4: The 10th digit in the ISBN is whatever you'd need to **subtract** from your total to make a multiple of 11.

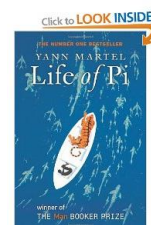**Example:**   Double check that these are valid ISBN-10 codes!

ISBN-10: 1119974526

(*Basic Maths for Dummies* by Colin Beveridge)

Step 1	First 9 digits:
	111997452
Step 2	Multiply the 1st digit by 1 , 2nd by 2, 3rd by 3 etc
	1x1= 1, 2x1=2, 3x1=3, 4x9=36, 5x9=45, 6x7=42, 7x4=28, 8x5=40, 9x2=18
Step 3	Add your answers to Step 2
	1+2+3+36+45+42+28+40+18 = 215
Step 4	What would you subtract to get to a multiple of 11?
	It should be a **6**

Given the first 9 digits, the tenth should be a 6! It is!

ISBN-10: 184195392X

(*The Life of Pi* by Yann Martel)

Step 1	First 9 digits:
	184195392
Step 2	Multiply the 1st digit by 1 , 2nd by 2, 3rd by 3 etc
	1x1= 1, 2x8=16, 3x4=12, 4x1=4, 5x9=45, 6x5=30, 7x3=21, 8x9=72, 9x2=18
Step 3	Add your answers to Step 2
	1+16+12+4+45+30+21+72+18 = 219
Step 4	What would you subtract to get to a multiple of 11?
	It should be a **10**

Given the first 9 digits, the tenth should be an X! It is!

Exercise 1:
Find the check digit for the following books given the first nine digits of their ISBN-10 code.

a) Harry Potter and the Philosopher's Stone (2001)　　　　**ISBN-10:** 074755819☐

b) The Witches (2007)　　　　**ISBN-10:** 014132264☐

c) The Merchant of Venice (2000)　　　　**ISBN-10:** 184022431☐

d) 1089 and all that (2010)　　　　**ISBN-10:** 019959002☐

e) Twilight: Breaking Dawn (2010)　　　　**ISBN-10:** 075286619☐

f) Asterix in Britain (2005)　　　　**ISBN-10:** 190741035☐

The system for **ISBN-13** works like this:

Step 1: Take the first 12 digits.
Step 2: Add all the digits in odd positions.
Step 3: Add all the digits in even positions and then triple your answer.
Step 4: Add your answers to Step 2 and Step 3.
Step 5: The 13th digit in the ISBN is whatever you'd need to **add** to your total to make a multiple of 10.

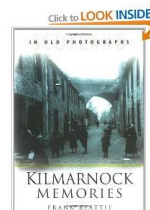**Example:**　　　Double check that these are valid ISBN-13 codes!

ISBN-13: 978-0516299181

(*Hot Numbers, Cool Math*
by Brian Sargent)
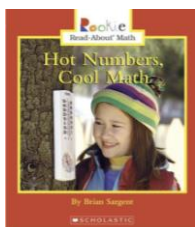
ISBN-13: 978-0750932363

(*Kilmarnock Memories*
by Frank Beattie)

Step 1	First 12 digits: 978051629918	*Step 1*	First 12 digits: 978075093236
Step 2	Add all odd position digits. 9+8+5+6+9+1=**38**	*Step 2*	Add all odd position digits. 9+8+7+0+3+3=**30**
Step 3	Add all even position digits and triple answer. 7+0+1+2+9+8=27 27x3 = **81**	*Step 3*	Add all even position digits and triple answer. 7+0+5+9+2+6=39 39x3 = **117**
Step 4	Add the answers to Step 2 and Step 3: 38+81 = **119**	*Step 4*	Add the answers to Step 2 and Step 3: 30+117 = **147**
Step 5	What would you add to get to a multiple of 10? It should be a **1**	*Step 5*	What would you add to get to a multiple of 10? It should be a **3**

Given the first 12 digits, the 13th should be a 1! It is!　　**Given the first 12 digits, the 13th should be a 3! It is!**

Exercise 2:
Find the check digit for the following books given the first twelve digits of their ISBN-13 code.

a) Music of the Primes (2003)　　　　**ISBN-13:** 978006621070☐

b) Harry Hill's Bumper Book of Bloopers (2001)　　　　**ISBN-13:** 978057128174☐

c) Scottish Ceilidh Dancing (1996)　　　　**ISBN-13:** 978185158845☐

d) As Easy as Pi (2009)　　　　**ISBN-13:** 978184317355☐

e) The Bible (2011)　　　　**ISBN-13:** 978144470161☐

f) Oxford French Mini Dictionary (2011)　　　　**ISBN-13:** 978019969264☐

Secure Exercise:
a) What are your 5 favourite books? Check their ISBN codes are Mathematically valid.
b) Research to find any other codes (apart from Credit Cards and ISBN) which have Mathematical algorithms.

Error Checking: ISBN Algorithm

Answers:

Exercise 1

    a) Harry Potter and the Philosopher's Stone (2001)   **ISBN-10:** 0747558191

    b) The Witches (2007)   **ISBN-10:** 0141322640

    c) The Merchant of Venice (2000)   **ISBN-10:** 1840224312

    d) 1089 and all that (2010)   **ISBN-10:** 0199590028

    e) Twilight: Breaking Dawn (2010)   **ISBN-10:** 0752866192

    f) Asterix in Britain (2005)   **ISBN-10:** 190741035X

Exercise 2

    a) Music of the Primes (2003)   **ISBN-13:** 9780066210704

    b) Harry Hill's Bumper Book of Bloopers (2001)   **ISBN-13:** 978-0571281749

    c) Scottish Ceilidh Dancing (1996)   **ISBN-13:** 978-1851588459

    d) As Easy as Pi (2009)   **ISBN-13:** 978-1843173557

    e) The Bible (2011)   **ISBN-13:** 978-1444701616

    f) Oxford French Mini Dictionary (2011)   **ISBN-13:** 978-0199692644

Secure Exercise:

a) Proofs.

b) Most electronic codes do! Barcodes, EAN etc etc.