Outcome 3 – Changing number bases

Worked Example:

Express 468_7 in base 11.

1. Express in base 10 first.

$$8 \times 7^0 + 6 \times 7^1 + 4 \times 7^2$$

$$468_7 = 246_{10} = 2\,0\,4_{11}$$

2. Now repeatedly divide by the required base.

$$246 = 22 \times 11 + 4$$

$$22 = 2 \times 11 + 0$$

$$2 = 0 \times 11 + 2$$

3. Write the remainders in reverse order.

Key Facts/Formulae:

Our number system works on base ten, where all digits are based on powers of ten.

e.g. $527 = 527_{10}$ consists of

$$7 \times 10^0 + 2 \times 10^1 + 5 \times 10^2$$

Numbers that work on base 2 have all digits based on the power of 2.

Numbers that work on base 7 have all digits based on the power of 7.

Etc!

We can change a base 10 number into another base easily by repeatedly dividing by that number.

To change from one base (other than 10) to another, we need to change to base 10 first.

Questions...

1. Express 153_{10} in base 7.
2. Express 3425_{10} in base 9.
3. Express 6890_{10} in base 6.
4. Express 4286_3 in base 8.
5. Express 987_6 in base 4.
6. Express 629_8 in base 2.

Answers

1 $153_{10} = 306_7$

2 $3425_{10} = 4625_9$

3 $6890_{10} = 51\,478_6$

4 $4286_3 = 156_{10} = 234_8$

5 $987_6 = 379_{10} = 11\,323_4$

6 $629_8 = 409_{10} = 110\,011\,001_2$