

MATHEMATICS: SPECIALIST 3AB

EXTENDED PIECE OF WORK 1

MINDARIE SENIOR COLLEGE WHERE YOUR FUTURE BEGINS NOW

PART B

Different Number Bases

Time Allowed = 60 minutes

Marks Available = 40 marks

Students may bring a graphic calculator and any notes into the Validation Test.

1. [2, 2, 2 marks]

Convert the following numbers into base 10:

(a)
$$24151_6$$

 $2 \times 6^4 + 4 \times 6^3 + 1 \times 6^2 + 5 \times 6 + 1$
= 3523

(b)
$$120012_3$$

 $1 \times 3^5 + 2 \times 3^7 + 1 \times 3 + 2$
 $= 410$

(c)
$$38a5b_{12}$$
 (where $a = 10$ and $b = 11$)
 $3 \times 12^{4} + 8 \times 12^{3} + 10 \times 12^{2} + 5 \times 12 + 11$

$$= 77543$$

2. [3, 3 marks]

Convert the indicated numbers to the given base:

1331 121 11 1

base 11

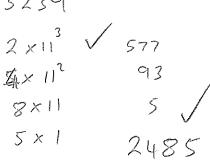
(a)
$$2371_9$$
 to base 5
 $615 \cdot 125 \cdot 25 \cdot 51$
 $2 \times 9^3 + 3 \times 9^2 + 7 \times 9 + 9$
 1765
 2×625
 4×125
 0×25
 3×5

24030

(b) (using a to represent 10) 3x45 + 2x43+2x42 + 1x4+7 3239

to

3022134



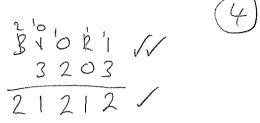
3. [3, 3, 3, 3 marks]

Perform the following operations in the given base. Do NOT convert to base 10. Show ALL working

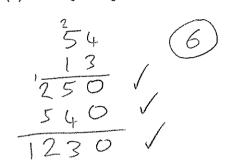
(a)
$$20112_3 + 222_3$$

$$\frac{20112}{21111} \sqrt{3}$$

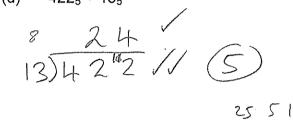
(b)
$$31021_4 - 3203_4$$



(c)
$$54_6 \times 13_6$$



(d)
$$422_5 \div 13_5$$



Convert to base 10:
$$12.32_5$$

$$5+2+\frac{3}{5}+\frac{2}{25}=7\frac{17}{25}$$

(b) Convert to base 4:
$$33.24_5$$

$$15+3+\frac{2}{5}+\frac{4}{25}=18\frac{14}{25}$$

$$= 18.56$$
4 1 0.25 0.0625 0.01562F

Evaluate exactly, giving your answer in base 6: $24 \cdot 3_6 + 1 \cdot 25_6 + 345 \cdot 403_6$ (c)

Modulo Arithmetic

Modulo arithmetic is closely related to number bases. A major difference is that we only worry about the units digit.

If we were to count (from zero) in base 3 it would look like:

If we were to count (from zero) in modulo 3 it would look like:

An addition table in modulo 3 would look like:

+	0	1	2
0	0	1	2
1	1	2	0
2	2	0	1

[2 marks] 5.

Complete the following addition table in modulo 4.

+	0	1	2	3
0	0	ţ	2	3
1	Ĺ	Š	3	0
2	ک	S)	O	1
3	ک	0		2



6. [3 marks]

Complete the following multiplication table in modulo 4.

Х	0	1	2	3
0	\circ	0	0	0
7	\circ		2	3
2	0	2	0	2
3	U	3	2	

7. [1, 2 marks]

> The following calculations have been performed in modulo arithmetic. Determine what base has been used in each case.

(a)
$$5+4=1$$

(b)
$$5 \times 4 = 2$$

base = 8 / base = 6, 9, 18 MM Merror