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| EGC_Black | **YEAR 11 MATHEMATICS: SPECIALIST**  **EXTENDED PIECE OF WORK 1**  **PART B** |

**Different Number Bases**

Time Allowed = 60 minutes Marks Available = 37 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) 241516 (b) 1200123

(c) 38a5b12

(where a = 10 and b = 11)

**2.** [2, 2 marks]

Convert the indicated numbers to the given base:

(a) 1765 to base 5 (b) 3239 to base 11

(using a to represent 10)

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

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

(a) 201123 + 2223 (b) 310214 – 32034

(c) 546 x 136 (d) 4225 ÷ 135

**4.** [3, 3 marks]

(a) Convert to base 10: 12⋅325

(b) Evaluate exactly, giving your answer in base 6: 24⋅36 + 1⋅256 + 345⋅4036

**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:

0, 1, 2, 10, 11, 12, 20, 21, 22, 100, …

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

0, 1, 2, 0, 1, 2, 0, 1, 2, …

An addition table in modulo 3 would look like:

|  |  |  |  |
| --- | --- | --- | --- |
| + | 0 | 1 | 2 |
| 0 | 0 | 1 | 2 |
| 1 | 1 | 2 | 0 |
| 2 | 2 | 0 | 1 |

**5.** [2 marks]

Complete the following addition table in modulo 4.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| + | 0 | 1 | 2 | 3 |
| 0 |  |  |  |  |
| 1 |  |  |  |  |
| 2 |  |  |  |  |
| 3 |  |  |  |  |

**6.** [3 marks]

Complete the following *multiplication* table in modulo 4.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| x | 0 | 1 | 2 | 3 |
| 0 |  |  |  |  |
| 1 |  |  |  |  |
| 2 |  |  |  |  |
| 3 |  |  |  |  |

**7.** [1, 3 marks]

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

(a) 5 + 4 = 1 base =

(b) 5 x 4 = 2 base =