Rocky Brdenekat 109480099

1.B $(1011)_2$ $\boxed{\text{1011 already in Binary form}}$

- Decimal

$(1011)_2 = (1\times2^3)+(0\times2^2)+(1\times2^1)+(1\times2^0) = \boxed{(11)_{10}}$

- Octal dec divide by 8 til quotient = 0

11 ÷	Remainder
11 ÷ 8 = 1	3
1 ÷ 8 = 0	1

$= \boxed{(13)_8}$

- Hexadecimal decimal form divide by 16

	Remainder
11 ÷ 16 = 0	11

$\boxed{(B)_{16}}$

C. $(47)_{10}$ $\boxed{\text{47 already in decimal form}}$

- Octal

	Remainder
47 ÷ 8 = 5	7
5 ÷ 8 = 0	5

$\boxed{(57)_8}$

- Hexadecimal

	Remainder
47 ÷ 16 = 2	15
2 ÷ 16 = 0	2

15 > 12 $(2E)_{16}$

C. Binary $(47)_{10}$

	Remainder
$47 \div 2 = 23$	1
$23 \div 2 = 11$	1
$11 \div 2 = 5$	1
$5 \div 2 = 2$	1
$2 \div 2 = 1$	0
$1 \div 2 = 0$	1

$\boxed{(101111)_2}$

D. $(3EAC)_{16}$ $\boxed{\text{3EAC already in hex form.}}$

· decimal

$$(3EAC)_{16} = (3 \cdot 16^3) + (14 \cdot 16^2) + (10 \cdot 16^1) + (12 \cdot 16^0)$$

$$= \boxed{(16044)_{10}}$$

· Octal

	Remainder
$16044 \div 8 = 2005$	4
$2005 \div 8 = 250$	5
$250 \div 8 = 31$	2
$31 \div 8 = 3$	7
$3 \div 8 = 0$	3

$\boxed{(37254)_8}$

2. $\text{Lcm}(a,b) = 44452800$

$\text{GCD}(a,b) = 63$

$a \cdot b = \gcd(a,b) \cdot \text{lcm}(a,b)$

$= 63 \cdot 44452800$

b is odd

63 = odd   44452800 = Even

odd · Even = Even

Smallest number A can be if b is odd

$\boxed{A = 2}$

3. A 773 $\sqrt{773} = 27.80$

Prime # ≤ 27 = $\cancel{2}$, 3, $\cancel{5}$, 7, 11, 13, 17, 19, 23,

not 2 or 5, 3 != even or 0 or 5

$773 \div 3 = 257.6$

$773 \div 7 = 110.4$

$773 \div 11 = 70.\overline{27}$

$773 \div 13 = 59.4$

$773 \div 17 = 45.4$

$773 \div 19 = 40.6$

$773 \div 23 = 33.6$

$\boxed{\text{Prime}}$

B 733 $\sqrt{733} = 27.07$

Prime # ≤ 27 = $\cancel{2}$, 3, $\cancel{5}$, 7, 11, 13, 17, 19, 23

$733 \div 3 = 257.6$ $733 \div 17 = 45.4$

$733 \div 7 = 110.4$ $733 \div 19 = 40.6$

$733 \div 11 = 70.2$ $733 \div 23 = 33.6$

$733 \div 13 = 59.4$

$\boxed{\text{Prime}}$

3.c 377 $\sqrt{377} = 19.4$

Prime # $\leq 19.4 = \cancel{2}, 3, \cancel{5}, 7, 11, 13, 17, 19$

$377 \div 3 = 125.6$

$377 \div 7 = 53.8$

$377 \div 11 = 34.27$

$\boxed{377 \div 13 = 29}$

$\boxed{\text{Not Prime}}$

4. 678 mod 2970

GCD(678, 2970) = 2 Euclidean Algo

$678A + 2970B = 2$

A = inverse of 678 mod 2970

$2970 = 4 \cdot 678 + 258$

$678 = 2 \cdot 258 + 162$

$258 = 1 \cdot 162 + 96$

$162 = 1 \cdot 96 + 66$

$96 = 1 \cdot 66 + 30$

$66 = 2 \cdot 30 + 6$

$30 = 5 \cdot 6 + 0 \leftarrow$

GCD(678, 2970) = 6

$6 = 66 - 2 \cdot 30$ Betals coeff

$= 66 - 2 \cdot (96 - 66 \cdot 1) = -2 \cdot 30 + 1 \cdot 66$

$= -2 \cdot 30 + 1(162 - 96 \cdot 1) = 1 \cdot 162 -$

4. B $GCD(137, 2350) = 1$ because 137 is prime, therefore, no inverse

5. $a^{p-1} \equiv 1 \pmod{p}$ Fermat's little theorem

A. $123^{1001} \pmod{101}$

$$123^{100 \cdot 10 + 1} = \left(123^{100}\right)^{10} \cdot 123^{1}$$

$$123^{100} \equiv \underline{1} \bmod 101$$

$$(1)^{10} \bmod 101 \cdot 123^{1} \bmod 101 = \boxed{22}$$

B. $17^{123} \bmod 13$

$$17^{12 \cdot 10 + 3} = \left(17^{12}\right)^{10} \cdot 17^{3}$$

$$17^{12} \equiv 1 \bmod 12$$

$$(1)^{10} \bmod 13 \cdot 17^{3} \bmod 13$$

$$= 1 \cdot 12 = \boxed{12}$$