1. (1 point) The equation $(3+2)+4=(2+3)+4$ is an example of which one of the following properties of whole numbers?

   (a) identity property for addition
   (b) closure property for addition
   (c) commutative property for addition
   (d) associative property for addition
   (e) distributive property for multiplication over addition
   (f) parenthetical property for addition

2. (1 point) Which one of the following sets is not closed for the given operation?

   (a) The set of even whole numbers for multiplication
   (b) The set of odd whole numbers for multiplication
   (c) The set of even whole numbers for addition
   (d) The set of odd whole numbers for addition
   (e) The set $\{0,1\}$ for multiplication

For instance, $1+3=4$ which is not an odd whole number.

Note: $\{0,1\}$ is closed under multiplication since

$0\times 0=0$
$0\times 1=0$
$1\times 0=0$
$1\times 1=1$

the result is always an element of the set $\{0,1\}$

3. (1 point) To make subtraction easier, Abby performs some subtraction as follows:

$$97 - 28 = (97 + 2) - (28 + 2) = 99 - 30 = 69$$

Demonstrate that you can use Abby's method to find the value of 123456789 – 2999999.

$123456789 - 2999999$

$= (123456789 + 1) - (2999999 + 1)$

$= 123456790 - 3000000$

$= 120456790$

4. (1 point) Convert the base ten number 26 to base two.

$26 = 16 + 8 + 2$

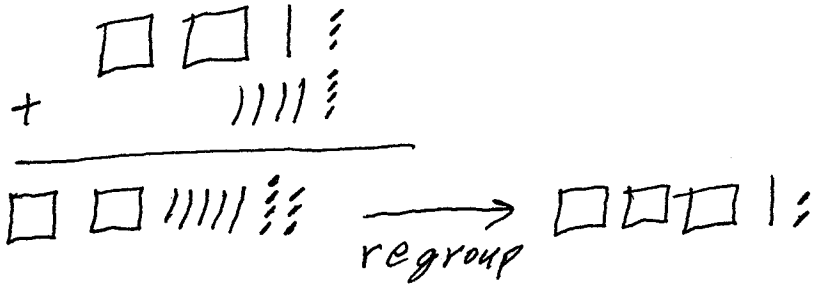
$26 = 1 \times 2^4 + 1 \times 2^3 + 0 \times 2^2 + 1 \times 2^1 + 0 \times 2^0$

$26_{ten} = 11010_{two}$

5. (2 points each) Demonstrate that you can evaluate the following quantities using the bases shown. You should not convert back and forth between base ten and the given base.

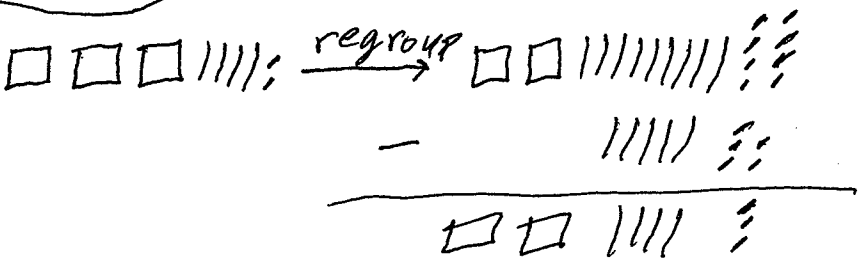
(a) $213_{five} + 44_{five} = 312_{five}$

$$\begin{array}{r} {\scriptstyle 1\ 1} \\ 213 \\ +\ \ 44 \\ \hline 312 \end{array}$$



(b) $342_{six} - 55_{six} = 243_{six}$

$$\begin{array}{r} {\scriptstyle 2\ 13} \\ 3\not{4}{\scriptstyle 1}2 \\ -\ \ 55 \\ \hline 243 \end{array}$$



(c) $23_{five} \times 12_{five} = 331_{five}$

$$\begin{array}{r} {\scriptstyle 1} \\ 23 \\ \times\ 12 \\ \hline 101 \\ 23 \\ \hline 331 \end{array}$$