***NUMBER BASES***

***Summary:***

***1.*** *Number bases**are different ways of writing down numbers.*

***2.*** *The most common base system is base* ***10.***

***3.*** *The**digits of a number in any base are less than the base itself*

***4.*** *The digits* ***10*** *and* ***11*** *are represented by* ***t*** *and* ***e*** *respectively in number bases*

***NOTE:***

***(i****) Base 10 is called* ***decimal base***

***(ii****) Base 2 is called* ***binary base***

***(iii****) Base 3 is called* ***trinary base***

***(iv****) Base 8 is called* ***octal base***

***EXAMPLES:***

***1.*** *Convert the following to base ten*

***(i****)*  ***(ii****)*  ***(iii****)* 

***(iv****)*  ***(v)***   ***(vi****)* 

***solution***





***CONVERTING FROM BASE TEN TO OTHER BASES***

***Summary:***

***(i)*** *Divide the number repeatedly by the required bases*

***(ii)*** *The remainder in reverse order gives the required number*

***EXAMPLES:***

***1.*** *Convert*  *to base three*

|  |  |  |
| --- | --- | --- |
| ***3*** | ***64*** | ***R*** |
| ***3*** | ***21*** | ***1*** |
| ***3*** | ***7*** | ***0*** |
|  | ***2*** | ***1*** |



***2.*** *Convert*  *to base five*

***3.*** *Convert*  *to base seven*

***Hint:*** *First convert*  *to base ten*



|  |  |  |
| --- | --- | --- |
| ***7*** | ***64*** | ***R*** |
| ***7*** | ***9*** | ***1*** |
|  | ***1*** | ***2*** |



***5.*** *Find the value of* ***n*** *in the following equations****:***

***(i)*** ***(ii)******(iii)***

***(iv)******(v)*** 

***OPERATIONS WITH ANY BASE OTHER THAN 10***

***ADDITION:***

*If the sum of the digits exceeds the base, divide that sum by the base then write down the remainder and carry the whole number.*

***EXAMPLES:***

***1.***  *Workout the following leaving your answer in the base indicated*

***(i)*** 

***(ii)***

***(iii)*** 

***Solution:***







***2.*** *Workout*  *giving your answer in base five*

***Hint:*** *First convert*  *and*   *to base ten and then finally express the answer in the required base*







|  |  |  |
| --- | --- | --- |
| ***5*** | ***256*** | ***R*** |
| ***5*** | ***51*** | ***1*** |
| ***5*** | ***10*** | ***1*** |
|  | ***2*** | ***0*** |



***SUBTRACTION:***

*In case of borrowing the new value is the sum of the base and the digit which was small.*

***EXAMPLES:***

***1.***  *Workout the following leaving your answer in the base indicated*

***(i)*** 

***(ii)***

***(iii)*** 

***Solution:***







***2.*** *Workout*  *giving your answer in base four*

***Hint:*** *First convert*  *and*   *to base ten and then finally express the answer in the required base*







|  |  |  |
| --- | --- | --- |
| ***4*** | ***20*** | ***R*** |
| ***4*** | ***4*** | ***0*** |
|  | ***1*** | ***1*** |



***MULTIPLICATION AND DIVISION***

***EXAMPLES:***

***1.***  *Workout the following leaving your answer in the base indicated*

***(i)*** 

***(ii)***

***(iii)*** 

***Solution:***







***2.*** *Workout*  *giving your answer in binary base*

***Hint:*** *First convert*  *and*   *to base ten and then finally express the answer in the required base*







|  |  |  |
| --- | --- | --- |
| ***2*** | ***55*** | ***R*** |
| ***2*** | ***27*** | ***1*** |
| ***2*** | ***13*** | ***1*** |
| ***2*** | ***6*** | ***1*** |
| ***2*** | ***3*** | ***0*** |
|  | ***1*** | ***1*** |



***3.***  *Workout the following leaving your answer in the base indicated*

***(i)*** 

***(ii)***

***Solution:***

***(i) Hint:*** *First convert*  *and*   *to base ten and then finally express the answer in the required base*







|  |  |  |
| --- | --- | --- |
| ***3*** | ***11*** | ***R*** |
| ***3*** | ***3*** | ***2*** |
|  | ***1*** | ***0*** |



 



|  |  |  |
| --- | --- | --- |
| ***2*** | ***11*** | ***R*** |
| ***2*** | ***5*** | ***1*** |
| ***2*** | ***2*** | ***1*** |
|  | ***1*** | ***0*** |



***EER:***

***1.***  *Convert the following to base ten*

***(i****)*  ***(ii****)*  ***(iii****)* 

***2.*** *Express*  *as a fraction in base ten*

***3.*** *Express*  *in base ten using point notation*

***4.*** *Find the value of* ***n*** *if* 

***5.*** *Find the value of* ***n*** *if* 

***6.***  *Convert*  *to binary base*

***7.*** *Workout the following leaving your answer in the base indicated*

***(i)*** 

***(ii)***

***(iii)*** 

***8.*** *Arrange the following numbers*  *and*   *in ascending order*