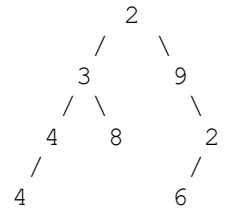
Node at distance K in C++

```
#include <iostream>
#include <queue>
using namespace std;

// Definition of a binary tree node
struct Node {
    int data;
    Node* left;
    Node* right;

    Node(int item) {
        data = item;
        left = nullptr;
        right = nullptr;
    }
};

// Function declaration
void printNodesDown(Node* root, int k);

// Function to print nodes at distance k from the given node
int nodesAtDistanceKWithRootDistance(Node* root, int node, int k) {
    if (root == nullptr) {
        return -1;
    }

    // If the current node is the target node, print nodes at distance k from it
    if (root->data == node) {

printNodesDown(root, k);
        return 0;
    }

    // Recursively search in left subtree
    int leftHeight = nodesAtDistanceKWithRootDistance(root->left, node, k);
    if (leftHeight != -1) {
        // If the target node is found in the left subtree
        if (leftHeight + 1 == k) {
            cout << root->data << endl;
        } else {
            // Print nodes at distance k from the right subtree
```

Binary Tree Structure:



Objective:

Print all nodes that are **exactly `k=2` distance** away from node with value `3`.

Dry Run Table:

Step	Function Call	Current Node	Action	Output	Return Value
1	`nodesAtDistanceK(root=2, node=3, k=2)`	2	Call `nodesAtDistanceKWithRootDistance`		
2	`nodesAtDistanceKWithRootDistance(root=2, node=3, k=2)`	2	Not target → search left and right		
3	`nodesAtDistanceKWithRootDistance(root=3, node=3, k=2)`	3	🎯 Target found! Call `printNodesDown(3, 2)`		0
4	`printNodesDown(root=3, k=2)`	3	Go down to distance 2		
5	`printNodesDown(root=4, k=1)`	4	Recurse to left → node 4		
6	`printNodesDown(root=4, k=0)`	4 (leaf)	✅ Distance 0 → print 4	4	
7	`printNodesDown(root=8, k=1)`	8	No children		
8	Back to step 2, leftHeight = 0		Check if root (2) is at k=2? No → Call `printNodesDown(right, k-2)`		
9	`printNodesDown(root=9, k=0)`	9	✅ Distance 0 → print 9	9	
10	All done		Final output = `4, 9`		

```
printNodesDown(root->right, k - leftHeight - 2);
        }
        return leftHeight + 1;
    }

    // Recursively search in right subtree
    int rightHeight = nodesAtDistanceKWithRootDistance(root->right, node, k);
    if (rightHeight != -1) {
        // If the target node is found in the right subtree
        if (rightHeight + 1 == k) {
            cout << root->data << endl;
        } else {
            // Print nodes at distance k from the left subtree

printNodesDown(root->left, k - rightHeight - 2);
        }
        return rightHeight + 1;
    }

    // If the target node is not found in either subtree
    return -1;
}

// Function to print nodes at distance k from a given node downwards
void printNodesDown(Node* root, int k) {
    if (root == nullptr || k < 0) {
        return;
    }

    // If reached the required distance, print the node
    if (k == 0) {
        cout << root->data << endl;
        return;
    }

    // Recursively print nodes at distance k in both subtrees
    printNodesDown(root->left, k - 1);
```

✅ Final Output:

```
4
9
```

```
    printNodesDown(root->right, k - 1);
}

// Function to initiate printing nodes at distance k from a given node value
void nodesAtDistanceK(Node* root, int node, int k) {

nodesAtDistanceKWithRootDistance(root, node, k);
}

int main() {
    // Hardcoded tree construction
    Node* root = new Node(2);
    root->left = new Node(3);
    root->left->left = new Node(4);
    root->left->right = new Node(8);
    root->left->left->left = new Node(4);
    root->right = new Node(9);
    root->right->right = new Node(2);
    root->right->right->left = new Node(6);

    // Call function to print nodes at distance k from node with value 3
    nodesAtDistanceK(root, 3, 2);

    // Clean up dynamically allocated memory
    delete root->right->right->left;
    delete root->right->right;
    delete root->right;
    delete root->left->left->left;
    delete root->left->left;
    delete root->left->right;
    delete root->left;
    delete root;

    return 0;
}
```

```
4
9
```