DHAKA COLLEGE

DEPT. OF PYSICS

Honours 3rd Year

Incourse — 2020

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Ans to the Q.N. 2

Newton raphson method:

$$f(x) = x^2 - 3x + 2$$

$$\Rightarrow f'(x) = 2x - 3$$

$$X_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$$

$$= \frac{2x_n^2 - 3x_n - x_n^2 + 3x_n - 2}{(2x_n - 3)}$$

$$\therefore X_{n+1} = \frac{(x_n^2 - 2)}{(2x_n - 3)}$$

$x_0 = 0,$

$x_1 = 0.667$

$x_2 = 0.9334$

$x_3 = 0.996$

$x_4 = 0.999$

$x_5 = 0.999$

Hence the required root is 0.999

Ans

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Solving with C++ :

```
# include <bits/stdc++.h>

# define EPSILON 0.001

// The fuction is x^2 - 3x+2
double func (double x)
{
    return x*x - 3*x +2
}

// Derivative of the above function which
is 2*x - 3
double derivfunc (double x)
{
    return 2*x -3
}

// Function to find the root
void newton Raphson (double x)
{ double h= func (x) / deriv Func (x) ;
while (abs(h) >= EPSILON)
{
    h= func (x) / deriv Func (x);
```

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```
// x(i+1) = x(i) - f(x)/f'(x)
      x = x-h;
   }
  count << "The value of the root is:" << x;
}

// Driver program to test above

  int main()
{
 double x0=0; // Initial values assumed
 Newton Raphson (x0);
 return 0;
}
```

<u>output</u>:

The value of root is: 0.999

Ans

Ans to the q.n. 3

Simpson's (1/3) method:

let, $y = f(x) = 2x$

Here, $a=0$, $b=1$, We shall divide the interval into six equal parts.

Hence, $h = \frac{b-a}{n} = \frac{1}{6}$

Now,

$x_0 = 0 \longrightarrow y_0 = 0$

$x_1 = x_0 + h = \frac{1}{6} \longrightarrow y_1 = \frac{1}{3}$

$x_2 = \frac{1}{3} \longrightarrow y_2 = \frac{2}{3}$

$x_3 = \frac{1}{2} \longrightarrow y_3 = 1$

$x_4 = \frac{2}{3} \longrightarrow y_4 = \frac{4}{3}$

$x_5 = \frac{5}{6} \longrightarrow y_5 = \frac{5}{3}$

$x_6 = b = 1 \longrightarrow y_6 = 2$

From,

Simpson's (1/3) rule is,

$$\int_0^1 2x\,dx = h/3 \left[\{y_0 + y_6\} + 4(y_1 + y_3 + y_5) + 2(y_2 + y_4)\right]$$

$$= \frac{1}{18}(2 + 12 + 4)$$

$$\therefore \int_0^1 2x\,dx = 1 \quad \text{(Ans)}.$$

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Solving with C++:

```
# include <iostream>
# include <math.h>

// Function to calculate f(x)
float func (float x)
{
  return log(x);
}

// Function for approximate integral
float simpsons_ (float ll, float ul, int n)
{
  // calculating the value of h
  float h = (ul - ll)/n;

  // Array for storing value of x and f(x)
  float x[10], fx[10];

  // calculating values of x and f(x)
  for (int i=0; i<=n; i++)
  {
    x[i] = ll + i*h;
    fx[i] = func (x[i]);
  }
```

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```
// Calculating result
  float res =0;
for (int i=0; i<=n; i++)
{
   if (i==0 || i==n)
     res += fx[i];
   else if(i%2 !=0)
      res += 4*fx[i];
   else
      res +=2*fx[i];
}
  res = res * (h/3);
  return res;
}
// Driver program
  int main()
{ float lower-limit = 0;
 float upper-limit = 1;
  int n=6;
 cout << simpsons-(lower-limit, upper-limit, n);
 return 0;
}
```

Output: The root is $\boxed{.1}$

Ans

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