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**Computer Oriented Numerical
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Prepared by



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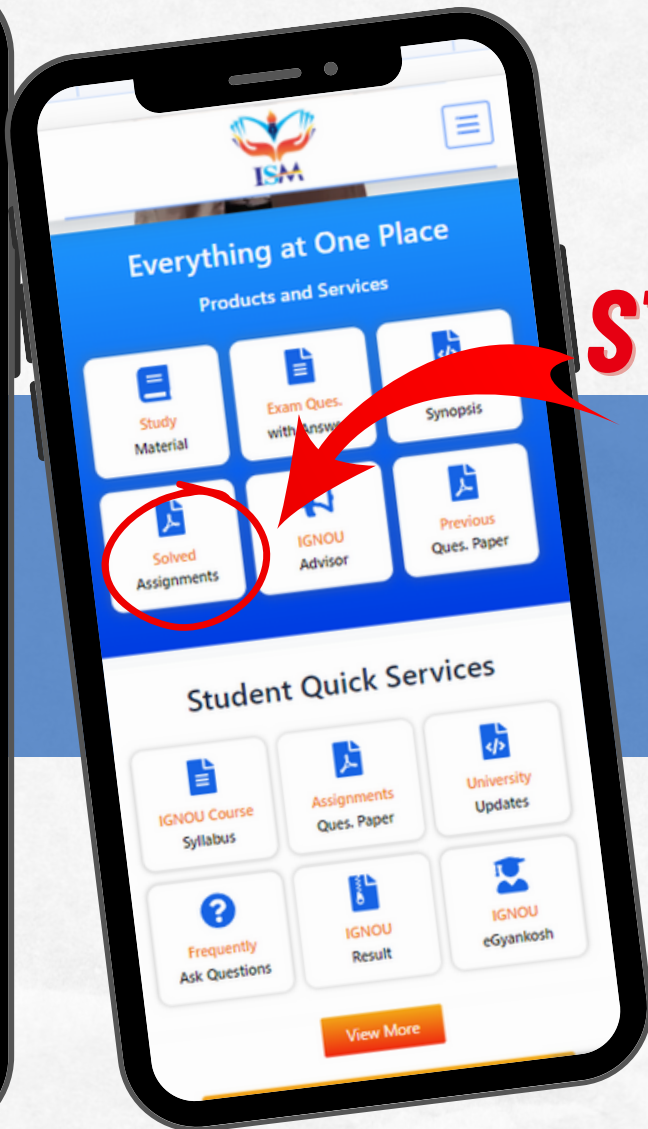
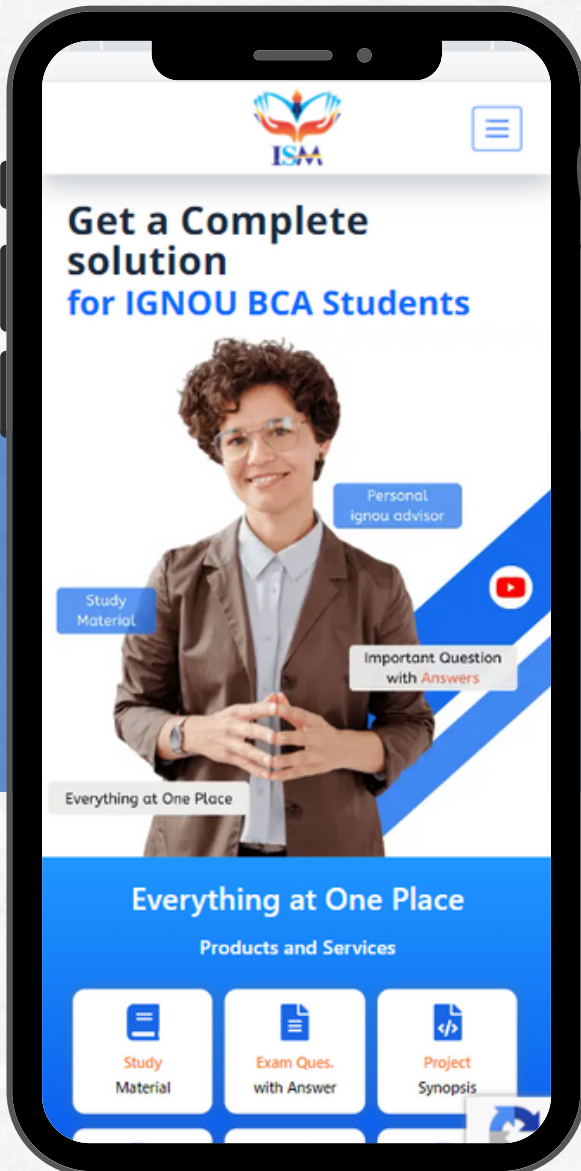


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Ques.6 Write a program in C/C++ to calculate the value of “cos x” by using the series expansion given below: $\text{Cos } x = 1 - x^2/2! + x^4/4! + x^6/6! + \dots$

Note:

- Evaluate cos x only up to first three terms.
- Also, find the value of cos x by using the inbuilt function.
- Compare the results i.e., the result produced by your program and that produced by the inbuilt function. Based on comparison, determine error.

Sol. #include <stdio.h>

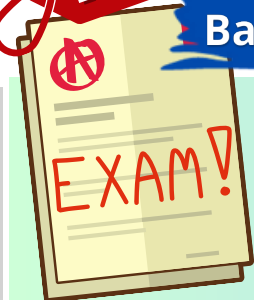
```
double cos_series(double x, int n) {  
double sum = 1;  
double factorial = 1;
```

```
for (int i = 1; i <= n; i++)  
factorial *= i;  
sum += (-1) * pow(x, 2 * i) / factorial;  
}
```

```
return sum;  
}
```



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```
int main() {
double x = 3.14159;
int n = 10;

double cos_x = cos_series(x.n);

printf("The value of cos(%f) is: %f \n", x, cos_x);

return 0;
}
```

Ques.7 Write a program in C/C++ to find the value of $\sin(\pi/6)$ by using Lagrange's Interpolation, the related data is given below

x:	0	$\pi/4$	$\pi/2$
y = Sin(x):	0	0.70711	1.0

Sol. #include <stdio.h>

```
double lagrange_interpolation(double x, double x_data[], double y_data[], int n){
double p=0;
```

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```
for (int i = 0; i < n; i++) {  
    double prod = 1;  
    for (int j = 0; j < n; j++) {  
        if (i != j) {  
            prod *= (x - x_data[j]) / (x_data[i] - x_data[j]);  
        }  
    }  
    p += prod * y_data[i];  
}  
  
return p;  
}  
  
int main() {  
    double x = 1.0 / 6.0 * 3.14159;  
    double x_data[] = {0, 1.0 / 4.0 * 3.14159, 1.0 / 2.0 * 3.14159};  
    double y_data[] = {0, 0.70711, 1.0};  
    int n = 3;  
  
    double sin_x = lagrange_interpolation(x, x_data, y_data, n);  
  
    printf("The value of sin(%f) is: %f\n", x, sin_x);  
  
    return 0;  
}
```

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Ques.8 Write a program that approximates the value of a definite integral $\int f(x)$ using Simpson 1/3 Rule, with M sample points. Find an approximate value of the integral of $2x^3/2$ using the program with 8 intervals over the interval [1, 9]

Ans. #include <stdio.h>

```
double simpson_1_3_rule(double a, double b, double f(double x), int M) {
```

```
double h = (b - a) / M;
double integral = f(a) + f(b);
```

```
for (int i = 1; i < M; i += 2) {
    integral += 4 * f(a + i * h);
}
```

```
for (int i = 2; i < M - 1; i += 2) {
    integral += 2 * f(a + i * h);
}
```

```
return h * integral / 3;
}
```

```
int main() {
    double a = 1;
    double b = 9;
```



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```
double f(double x) {  
    return 2 * pow(x, 3.0 / 2.0);  
}  
  
int M = 8;  
  
double integral = simpson_1_3_rule(a, b, f, M);  
  
printf("The approximate value of the integral is: %f\n", integral);  
  
return 0;  
}
```

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