Questions

1. What is the sum of the numbers between 1 and 20 inclusive ? (using formula)
2. What is the sum of this sequence: {4, 10, 16, 22, 28, 34, 40} ? (using formula)
3. What is the sum of this geometric series: 1 3 9 27 81 243 729 ? (using formula)
4. Compute the permutation and combination where n = 5 and r = 3 ?
5. What is the output of this code?

a.

```
#include<iostream>
#include <cmath>
 using namespace std;
 int main() {
     cout << log(2.7182818) << ' ' << log10(100) << ' ' << log2(8) << endl;
     return 0;
 }
```

b.

```
#include<iostream>
#include <cmath>
 using namespace std;
 int main(){
     cout << pow(4, 3) << ' ' << sqrt(16) << ' ' << cbrt(64) << endl;
     return 0;
 }
```

c.

```cpp
#include<iostream>
#include <cmath>
using namespace std;
int main()
{
    cout << round(3.467) << ' ' << round(3.567) <<endl ;
    cout<< floor(3.567) << ' ' << ceil(3.467);
    return 0;
}
```

6. How to distribute the modulus in these calculations?
   a) (2 + 8 + 20) % 7
   b) (2 - 8 - 20) % 7
   c) (2 * 8 * 20) % 7

7. What are the results of these calculations?
   a. 5 & 7
   b. 5 | 7
   c. 5 ^ 7

8. Write a c++ program that can determine that the number is prime or not and print all divisors of this number.

9. What is the angle of 60 degrees in radians?

10. What is the angle 3.142 radian in degrees?

11. Write the output of the following:

```
#include<iostream>
#include <cmath>
 using namespace std;
 int main()
 {
    double PI=acos(-1);
    cout<<sin(PI / 2)<<' '<<cos(PI / 2)<<' '<<asin(1)<<' '<<acos(0)<<' '<<atan(1);
     return 0;
 }
```

- Note : $PI/2 = 1.5708$, $PI/4 = 0.785398$
- What do you notice?

12. What is the area of a triangle with sides 3, 4, 6? Give the result and write code to do that.

13. Prove that the given sides can or can't make a triangle?
    a) 3 4 8
    b) 5 6 10

14. Find the slope of the line connecting the two points: a(0, 0), b(2, 2), Find the distance between a,b, and Find the midpoint.

15. Given points in space and a circle. Determine the relative position of the point (i.e. in the circle, on the boundary or outside the circle).
    The center of the circle = (1, 3), radius = 2, Points:
    a) (1, 4)
    b) (5, 7)
    c) (3, 3)

16. What is the greatest common divisor and least common multiple of 36,42?

17. Given a main circle and a set of circles in the format {Center, Radius}. Determine if each circle in the set doesn't intersect in a point externally, intersects in two points with the main circle, intersects in a point internally, or if it is inside the main circle or if they are concentric (have the same center). Main Circle = {(0,0),4}, Circles:

    1) (10, 7), 2
    2) (0, 7), 3
    3) (5,0),3
    4) (2, 0), 2
    5) (1,1),2
    6) (0,0),3

Answers

1. $sum = \frac{firstNumber+lastNumber}{2} \times numberOfNumber = \frac{1+20}{2} \times 20 = 210$

2. $sum = \frac{firstNumber+lastNumber}{2} \times numberOfNumber = \frac{4+40}{2} \times 7 = 154$

3. $sum = firstNum \times \frac{base^{numberOfnumbers}-1}{base-1} = 1 \times \frac{3^7-1}{3-1} = 1093$

4. nPr(5, 3) = 5! / (5 - 3)! = 5 * 4 * 3 * 2 * 1 / (2 * 1) = 60
   nCr(5, 3) = 5! / (3! * (5 - 3)!) = 5 * 4 * 3 * 2 * 1 / ((3 * 2 * 1) * (2 * 1)) = 10

5.

   a) 1 2 3

   b) 64 4 4

   c) 3 4
      3 4

6.

   a) ((2 % 7 + 8 % 7) % 7 + 20 % 7) % 7 = 2
   b) (((2 % 7 - 8 % 7) % 7 - 20 % 7) % 7 + 7) % 7 = 2
   c) (((2 % 7) * (8 % 7))%7 * (20 % 7))%7 = 5

7. a) 5
   b) 7
   c) 2

8. https://ideone.com/MivyRV

9. 60 degrees = 60 * PI / 180 = PI / 3 radians

10. 3.142 radians = PI * 180 / PI = 180 degrees

11. 1 0 1.5708 1.5708 0.785398
    I notice that sin(asin(1))=sin(PI/2)
    And atan(1)=PI/4 radian =45 degree.

12. Heron's rule states that $A = \sqrt{s(s-a)(s-b)(s-c)}$, such that $s = \frac{a+b+c}{2}$.
so $A = \sqrt{6.5 * (6.5 - 3) * (6.5 - 4) * (6.5 - 6)} = 5.33268$

13. a) is a triangle .
    b) is not a triangle.
    - This is because the sum of the two smallest sides should be greater than the other side.

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14. Slope = $(y2 - y1) / (x2 - x1) = (2 - 0) / (2 - 0) = 1$

Distance = $\sqrt{((y2 - y1) * (y2 - y1) + (x2 - x1) * (x2 - x1))}$
$= 2 * \sqrt{2}$
Midpoint = $((x1 + x2) / 2, (y1 + y2) / 2) = (1, 1)$

15. - Distance between the center and the point < Radius : in the circle
    - Distance between the center and the point = Radius : on the boundary of the circle
    - Distance between the center and the point > Radius : outside the circle

16. since $36 \% 6 = 0$ *and* $42 \% 6 = 0$ and there is no greater number satisfying the same conditions then gcd(36, 42) = 6,
and since $lcm(x, y) = x * y / gcd(x, y)$then
$lcm(36, 42) = 36 * 42 / 6 = 242.$

17. R1 = Radius of the main circle, R2 = Radius of the circles in the set
By comparing the distance between the centers and the the sum of two radius:
    1. Doesn't intersect: $distance > R1 + R2$
    2. Intersect in one point externally: $distance = R1 + R2$
    3. Intersect in two points:
    $R1 - R2 < distance < R1 + R2$
    4. Intersect in one point internally: $distance = R1 - R2$
    5. Inside the main circle: $0 < distance < R1 - R2$
    6. Concentric: $distance = 0$