

**Entrance Exam Into Year I, First Cycle TTTTC Bambili****Department: Fundamental Sciences****Time Allowed: 3 Hours****Option: All Technical / Industrial Series****Exercise**

Given the complex numbers:  $z_1 = 3(-\frac{1}{2} + i\frac{\sqrt{3}}{2})$  and  $z_2 = 3(\frac{\sqrt{2}}{2} + i\frac{\sqrt{2}}{2})$ .

1. Give the trigonometric form of the following complex numbers:  $z_1$ ,  $z_2$  and  $z = \frac{z_1}{z_2}$ .
2. Prove that for all  $n$  intergers,  $z^{12n}$  is a real number.
3. What are the exact values of  $\cos \frac{5\pi}{12}$  and  $\sin \frac{5\pi}{12}$ ?

**Exercise**

Find the particular solution of the differential equation:  $4f''(x) - 4f'(x) + f(x) = 0$  such that  $f(0) = 4$  and the tangent to the curve of  $f$  at the point with  $x = 2$  is horizontal.

**Exercise**

Solve for  $(x; y)$  the following system in the set of the real numbers:

$$\begin{cases} x^2 + y^2 = 145 \\ \ln x + \ln y = \ln 72 \end{cases}$$

**Exercise**

Given the line  $L : y = 2x + 4$  and the circle:  $x^2 + y^2 - 4x - 6y - 12 = 0$ .

1. The points of intersection of the line and the circle are:
  - a)  $A(-2; 0); B(2; 8)$
  - b)  $A(2; 0); B(-2; 8)$
  - c)  $A(-2; 8); B(0; 8)$
  - d)  $A(0; -2); B(8; 2)$ .
2. The length of the cord cut off is:
  - a)  $4\sqrt{5}$
  - b)  $5\sqrt{4}$
  - c)  $\sqrt{68}$
  - d) 8

**Exercise**

Given the function  $f(x) = (2x^2 - 7x + 7)e^x$ . Choose the correct answers:

1.  $\lim_{x \rightarrow -\infty} f(x) = 0$ ;  $\lim_{x \rightarrow +\infty} f(x) = +\infty$ ;  $f(-\frac{1}{2}) = \frac{9}{\sqrt{e}}$ .
2.  $\lim_{x \rightarrow -\infty} f(x) = -\infty$ ;  $\lim_{x \rightarrow +\infty} f(x) = 0$ ;  $f(-\frac{1}{2}) = \frac{9}{\sqrt{e}}$ .
3. The function  $f$  is positive and increasing in  $]-\infty; -\frac{1}{2}]$ .

4. The function  $f$  is negative and increasing in  $]2; +\infty]$ .
5. The minimum of the function  $f$  is 0.
6.  $f(x) \geq -e^2$  for all real number  $x$ .

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