ADVANCED MATHEMATICS - SET 1

1. Use a scientific calculator to perform the following Expressions giving your answers correct to three decimal places.

   a) $[\frac{\tan 124^0 + e^2}{\sqrt{32 \ln 36}}]^2$

   b) Find θ, if $\tan\theta = \frac{14.32 \tan 16^0 24'}{76.9}$

2. Given set A = { $x \epsilon R$; x>3} and B = { $x \epsilon R$; x>3} and $x \leq 4$ C = { $x \epsilon R$; -1 $\leq x < 3$} Represent on a real number line, the following sets a) $A \cap B$ b) $(A \cup B)'$

3. There are 12 pupils in a class. 10 of them play football. 15 play volleyball and 6 play both. Find the number of pupils who play;
   a) Either football or volleyball
   b) Neither football or volleyball

4. Draw a truth table for the compound statement $[p \quad (p \quad q)] \leftrightarrow p$

5. Simplify the statement $\sim[p \quad (\sim p \quad q)]$ by using the laws of algebra of propositions.

6. Find the angles between the following lines
   a) y = 2x + 5 and 3x + y = 7
   b) 3x – y + 7 = 0 and x – 3y + 8 = 0

7. Find the perpendicular distance of the points; a) (2, -1) b) (1, 1) from the straight line 3x - 4y – 6 = 0.

8. If the points A and B are (3,0) and (2,4) respectively, find the locus of the point such that
   a) $\overline{PA} = \overline{PB}$
   b) $\overline{PA} = 4\,\overline{PB}$

9. Find the coordinates of the point which divides the line segment that joins R(-2,5) and S(4,2) in the ratio 2:1
   a) Internally
   b) Externally

10. Find the coordinates of the center and radius of the equation of a circle given by $12x^2 + 12y^2 + 12x - 8y + 3 = 0$.

ADVANCED MATHEMATICS – SET2

1. Find the equations of the tangent and normal to the circle given by the equations $(X-1)^2 + (Y-2)^2 = 2$ at the point (2, 1).
2. Given that f(x) = $2X^2$-1 and g(x) = $\sqrt{X}$. Find a) fog(x) b) gof (x)
3. Find the composite function fog(x) given that f = {(1,6), (4,7), (5,0)} and f ={(1,6), (4,7), (5,0)}
4. Simplify the Expressions
   a) $\frac{a^2-b^2}{a^2-2ab+b^2}$
   b) a^2-2ab + b^2
5. Solve simultaneously the system of the equations $log_{10}(x+y) = 0$
   $2log_{10}$ X = $log_{10}(y+1)$
6. Express the following sum as series of the terms.
   a) $\sum_{k=1}^{n} \frac{k+1}{k(k+1)}$
   b) $\sum_{k=1}^{4} 2^k$
7. Differentiate the following
   a) Y = sec(x^2+ 2x +1)
   b) y = $\frac{x^2}{\sqrt{cosx}}$
8. Two fruit producers, A and B with 50 tonnes and 45 tonnes of fruits respectively are required to supply fruits to three food processing industries, namely P, Q and R demanding 30 tonnes, 25 tonnes and 40 tonnes of fruits respectively. The transportation costs (in TZS) from the sources to the demanding sites are tabulated.

From / to	A	B
P	30,000	25,000
Q	45,000	30,000
R	20,000	40,000

Formulate a mathematical model representing the given transportation.

9. Find the maximum and minimum points and values of the function. $y=x^3-3x^2-9x+27$.
10. If $Z = x^2 - y^2 + 2xy^2 + x^2y - 3x + y$. Find a) $\frac{\partial Z}{\partial X}$ b) $\frac{\partial Z}{\partial Y}$