Group 'A'

1. A man can send 3 of lissons to 6 different colleges in the to.
   a) 12 ways b) 18 ways c) 120 ways d) 720 ways

2. $P(n, n-r) =$
   a) $n!$ b) $(n-r)!$ c) $\frac{n!}{(n-r)!}$ d) $\frac{n!}{r!}$

3. In triangle ABC, $a \sin A - b \sin B$ is equal to
   a) $c \sin(A-B)$ b) $c \cos(A-B)$
   c) $a^2 + b^2$ d) $a^2 - b^2$

4. For any triangle ABC, $\frac{b+c}{a} \sin\frac{A}{2}$ is equal to
   a) $\cos\frac{B+C}{2}$ b) $\sin\frac{B+C}{2}$ c) $\sin\frac{B-C}{2}$ d) $\cos\frac{B-C}{2}$

5. Euler's form of the complex no. $\frac{1}{i}$ is
   a) $e^{\pi/4i}$ b) $e^{3\pi/2i}$ c) $e^{\pi/2i}$ d) $e^{\pi i}$

6. If f is continuous function on [a, b] and ϕ is an antiderivatives of f, then $\int_a^b f(x)\,dx$ is equal to
   a) $\phi(x) - \phi(a)$ b) $\phi(b) - \phi(a)$ c) $\phi(a) - \phi(b)$ d) $\phi(b) - \phi(a)+c$

7. If $f'(x) = x + \frac{1}{x}$ then the value of $f(x)$ is
   a) $x^2 + \log x + c$ b) $\frac{x^2}{2} + \log x + c$
   c) $\frac{x}{2} + \log x + c$ d) $\frac{x^2}{2} - \frac{1}{x^2} + c$

8. Which one of the following is not correct?
   a) $\int \frac{1}{a^2 + x^2}\,dx = \frac{1}{a}\sin^{-1}\frac{x}{a} + c$

b) $\int \frac{1}{\sqrt{x^2+a^2}} = \log\left(x+\sqrt{x^2+a^2}\right)+c$

c) $\int \frac{1}{\sqrt{x^2+a^2}}\,dx = \cos h^{-1}\frac{x}{a}+c$

d) $\int \frac{1}{x^2-a^2}\,dx = \frac{1}{2a}\log\frac{x-a}{x+a}+c$

Group 'B'

9. a) A person want to buy a car. There are two brands of car available in the market and each brand has 3 variant models and each model comes in five different colours. In how many ways a person can choose a car to buy? [2]

b) Evaluate $\frac{n!}{r!\,(n-r)!}$ when for any n with r = 3? [1]

c) If $\frac{1}{7!}+\frac{1}{8!}=\frac{A}{9!}$ then find the value of A. [2]

Prove that ${}^nP_r = {}^{n-1}P_r + r \times {}^{n-1}P_{r-1}$ [3]

10. a) Define cosine law. [2]

b) In any triangle, prove that

$$\frac{\cos A}{a}+\frac{a}{bc}=\frac{\cos B}{b}+\frac{b}{ca}=\frac{\cos C}{c}+\frac{c}{ab}.$$ [3]

Prove that:

$$4\left(bc\cos^2\frac{A}{2}+ca\cos^2\frac{B}{2}+ab\cos^2\frac{C}{2}\right)=(a+b+c)^2.$$ [3]

11. a) Find the product of two complex numbers $z_1 = r_1(\cos\theta_1 + i\sin\theta_1)$ and $z_2 = r_2(\cos\theta_2 + i\sin\theta_2)$. [2]

b) Express $(\sqrt{3}+i)$ in polar form and Euler form. [2+1]

c) State De-moivre's theorem. Using De-moivre's theorem, evaluate $(1-\sqrt{3}\,i)^6$. [1+2]

12. a) Evaluate:

$$\int \frac{1}{x^2-a^2}\,dx$$ [2]

b) Evaluate: $\int \frac{1}{1+x-x^2}\,dx$ [3]

c) Evaluate: $\int \frac{(2x+2)}{3+2x-x^2}\,dx$ [3]

Best of Luck