1. Let $f : R \to R$ be a function such that $f(x+y) = f(x) + f(y)$ and $f'(0) = 2$, then
   (a) $y = f(x)$ is an increasing function
   (b) $f'(x) = 0$ has two roots in $(0, 2)$
   (c) $f'(x) = 0$ has exactly two root
   (d) $f'(2) = 5$ and $f'(5) = 2$

2. $f : R - \{0\} \to [0, \infty)$ and $f(x) = |1 + \frac{1}{x}|$, then f is
   (a) injective and surjective
   (b) injective but not surjective
   (c) not injective and not surjective
   (d) not injective but surjective

3. Let $\int \sqrt{cotx}dx = \frac{1}{\sqrt{2}}sin^{-1}(-f'(x)) + \frac{1}{\sqrt{2}}ln|f(x) + \sqrt{1-(f'(x))^2}| + c$. then $f(x) - f'(x)$ at $x = \frac{\pi}{2}$ is (where c is an arbitrary constant)
   (a) 1
   (b) -1
   (c) 2
   (d) -3

4. If $\int |x|ln|x|dx = \frac{f(x)}{4}(h(x) - 1) + c$ then $f(h(e^{-2}))$ is equal to
   (a) e^{-2}
   (b) e^4
   (c) -4
   (d) -16

5. $\int_0^1 |2x - [3x]|dx$ is equal to (where [.] is the greatest integer function)
   (a) $\frac{3}{19}$
   (b) $\frac{5}{18}$
   (c) $\frac{7}{24}$
   (d) $\frac{1}{16}$

6. The value of the integral $\int_{-1}^{2}[x^2 - 2x + 3]dx$ is equal to (where [.] is the greatest integer function)
   (a) $11 - \sqrt{3} - \sqrt{2}$
   (b) $10 - 2\sqrt{2} + \sqrt{2}$

(c) $13 - 2\sqrt{2} + \sqrt{2}$
(d) $10 + \sqrt{2}$

7. If $P = \lim_{n\to\infty}\left(\frac{\Pi_{r=1}^{n}(n^4+r^4)}{n^{4n}}\right)^{\frac{1}{n}}$, $Q = \int_0^1 \frac{dx}{1+x^4}$ and $lnp = lna + bQ + c$ then $a+b+c$ is
   (a) 1
   (b) 2
   (c) 3
   (d) none of these

8. Let $f(x) = x^3 + 2x + 1$ and $g(x)$ is the inverse of it. Then the area bounded by $g(x)$, the x-axis , ordinate $x = -2$ and $x = 4$ is
   (a) 3.5
   (b) 0.5
   (c) 7.5
   (d) 2

9. $cos^3\left(\frac{\pi}{12}\right) cos\left(\frac{5\pi}{12}\right) + sin^3\left(\frac{\pi}{12}\right) sin\left(\frac{5\pi}{12}\right)$ is
   (a) 0
   (b) $\frac{1}{2}$
   (c) $\frac{1}{4}$
   (d) none of these

10. Let θ_1 and θ_2 be least and greatest value of $\theta \in (0,\pi) - \{\frac{\pi}{2}\}$ which satisfy the equation $sec^2\theta - \frac{\sqrt{3}+1}{cot\theta} + \sqrt{3} - 1 = 0$. Then the value of $\int_{\theta_1}^{\theta_2} sin^2 2\theta d\theta$ is
    (a) 0
    (b) $\frac{\pi}{24} + \frac{\sqrt{3}}{16}$
    (c) 2
    (d) 3

11. If θ represents the acute angle between the curves $y = 14 - x^2$ and $y = 6 + x^2$ at their point of intersection then $15|tan\theta|$ is
    (a) 8
    (b) 120
    (c) 1
    (d) 0

12. The gradient of the curve passing through $(3,0)$ is given by : $\frac{dy}{dx} - \frac{y}{x} + \frac{3x}{(x+1)(x-2)} = 0$. If point $(5, lna)$ lies on the curve , then a is exactly

(a) 0.03

(b) 0.01

(c) 0.04

(d) 0.29

13. The gradient of the curve through $(0,1)$ is given by : $\frac{dy}{dx} + xy = y^2 e^{\frac{x^2}{2}} sinx$. Then $[ln(-y(\pi)]$ is equal to ([.] is the greatest integer function)

(a) -5

(b) -4

(c) 2

(d) 4